

BIO-ACOUSTIC SIMULATORS

MODEL BA-202

USER MANUAL



Bio-Acoustic Simulator Models:

- BA-202 Bio-Acoustic Simulator User Manual
- BA-202-25 includes Octave Monitor with OSHA Requirements

Table of Contents

Bio-Acoustic Simulator Models	2
General Description	2
BA-202 Model Explained	3
BA-202-25 Model Explained	3
Operating Procedure	4
Operation Outside of the Audiometric Room	4
Operation Inside of the Audiometric Room	4
Microphone Location (BA-202-25).....	5
Battery Test (Battery Operation Only) ..	5
General Operational Considerations	5
Testing a Manual Audiometer	6
Testing an Automatic Audiometer	6
Testing Audiometric Room Noise (BA-202-25).....	7
Testing Audiometric Room Notes:.....	8
Specifications	8
Bio-Acoustic Simulator (BA-202 model).....	8
BA-202-25 (model) Octave Monitor (OSHA version).....	9
General Features	10

Figures

Figure 1: Model BA-202 Bio-Acoustic Simulator.....	2
Figure 2: Model BA-202-25 Bio-Acoustic Simulator & Octave Monitor (OSHA)	3

Tables

Table 1: Typical HL Values for Various Earphones on Audiometer with 5 dB Attenuator Steps. These levels are just for reference to see if the audiometer is relatively correct the first time that it is tested.....	7
---	---

Controls (See Figures 1, 2, and 3)	10
Principles of Operation	11
Bio-Acoustic Simulator Models	
Block Diagram	12
Response Output Jack and Wiring	13
Wiring	14
Battery Replacement.....	14
Volt Power Adapter.....	15
Maintenance and Calibration.....	15
Headphone Calibration Check (Left/Right Earphone)	15
Octave Monitor Calibration	16
Microphone Care	16
Preamplifier Care.....	17
Recommendations.....	17
Contact/Service information	18
Technical Support Contacts	18
Service Contact Information	18
Returning for Service	19
Calibration	19
Warranty	20

Figure 3: Block Diagram, Models BA-202 and BA-202-25	12
Figure 4: Response Jack Wiring	13

Table 2: Allowable Room Noise Specified by Various Regulations....	8
--	---

Bio-Acoustic Simulator Models

Model	Description
BA-202	Bio-Acoustic Simulator
BA-202-25	Bio-Acoustic Simulator & Octave Monitor OSHA Requirements for Octave Levels (Type 2 accuracy)

General Description

The Bio-Acoustic Simulator Model BA-202 (Figure 1) is a high-quality measuring device used to fulfill the requirements for daily biological tests of audiometers. The Bio-Acoustic Simulator Model BA-202-25 also provides the capability to continuously monitor room noise in octaves during an actual hearing test. This ensures compliance to either the OSHA or ANSI allowable background noise limits for audiometric test rooms.

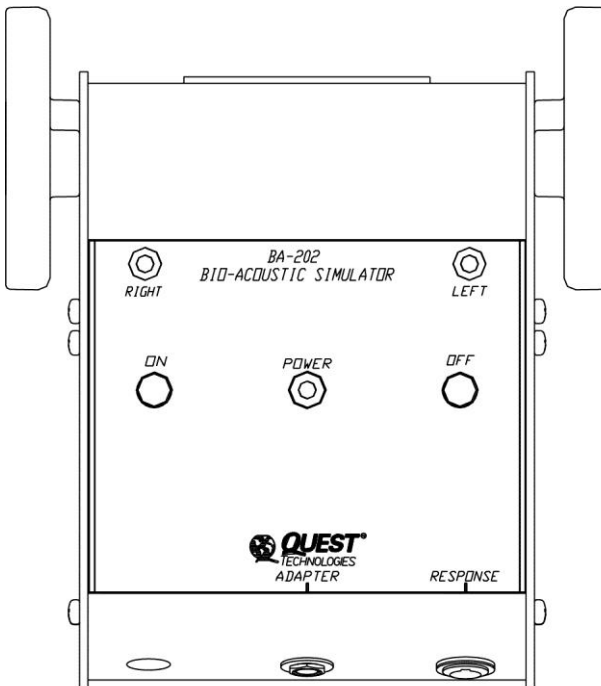


Figure 1: Model BA-202 Bio-Acoustic Simulator

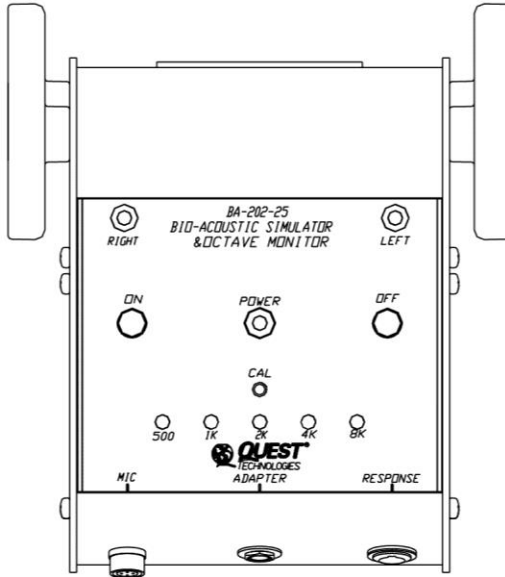


Figure 2: Model BA-202-25 Bio-Acoustic Simulator & Octave Monitor (OSHA)

BA-202 Model Explained

The BA-202 series simulator is simply substituted for a human test subject, thus eliminating the need to use the same person with a known hearing threshold level. The Bio-Acoustic Simulator's performance is consistent every day. This eliminates the variables that can be present when using a human test subject whose hearing can be affected by such things as a head cold, allergy, recreational noise exposure, etc. Either model will provide a reference audiogram when the simulator is connected to a manual or automatic audiometer.

BA-202-25 Model Explained

Audiometric room background noise can easily be monitored during the audiogram by using the Octave Monitor capability of the BA-202-25 (OSHA levels). Other factory-set octave levels can be special ordered if requested by the purchaser.

Operating Procedure

Operation Outside of the Audiometric Room

The unit is intended to be wall-mounted in an audiometer test room. However, the unit can be operated as a table-top unit outside of the test room if desired. When used in this manner, the four rubber feet (sticky adhesive backing, provided) will need to be installed on the back four corners of the unit. When performing the biological check, the headphones have to be unplugged from the room connection jacks, brought to the location of the audiometer and simulator, and reconnected to the audiometer jacks. Also, for the BA-202-25, the microphone cable must also go from the unit to the inside of the audiometric room and must hang down from the ceiling (with only 10 feet of microphone cable provided). Considering these inconveniences, it is much easier to use the unit when mounted inside of the audiometric room on the wall as follows.

Operation Inside of the Audiometric Room

All models have been designed to be mounted on an inside wall of an audiometric room with two screws (pan head style, not provided) and a Velcro® brand fastener (provided). A suggested location would be on the inside of the test room on the wall opposite the operator's viewing window. It should also be located where the subject's head will not interfere with the viewing of the indicator lights. When a good location is determined, fasten the unit as follows:

1. Locate the long slot on the back of the chassis. This slot is intended to slide onto the screw heads. The four rubber feet are not used when wall-mounting the unit.
2. Mark the location for the two mounting screws, approximately 3½ inches apart.
3. If necessary, make two small "starting" holes in the room wall for the screws.
4. Screw the two screws into the wall. Let the screw heads protrude just far enough so that the long slot on back of the unit will slide onto them. Test to be sure that the unit slides onto the screw heads.
5. There are two Velcro® brand fasteners on the back of the unit. The "hook" patch is fastened to the unit; the "loop" patch is stuck onto the "hook" patch. Peel the backing from the "loop" patch.
6. Slide the unit onto the screw heads while holding the sticky Velcro® brand fastener surface away from the wall.
7. Once the unit is centered on the screw heads, press the bottom of the unit firmly against the wall so that the patch sticks to the wall.

® Velcro is a registered trademark of Velcro Companies.

8. The unit is now fastened securely. The Velcro® brand fastener holds the unit from sliding sideways off of the screws.

To remove the unit from the wall, pull the bottom away from the wall to separate the Velcro® brand fastener. Then slide the unit to the side.

After sticking the unit's patch to the wall, you may want to remove the unit from the wall and firmly press the Velcro® brand fastener to the wall to ensure proper bonding.

Microphone Location (BA-202-25)

The model BA-202-25 requires the use of a cable-mounted microphone to operate the octave band filters. It is recommended that the microphone be suspended by its cable close to the ceiling of the audiometric room. Also locate it in the best position so that the test subject's head will not interfere with it when entering and leaving the room. Be sure to attach the cable in such a fashion so that it can be easily removed from the ceiling mount for periodic calibration. The use of a "screw-type" hook is one way to attach it. Since room ceiling material varies, use the best method for that type of material.

Battery Test (Battery Operation Only)

Press the **ON** button to turn the power on. The **POWER** indicator lamp will flash, indicating that the battery voltage is sufficient. If this light does not flash, the battery is too low to operate the unit. When the battery weakens and approaches the end of its useful life, the intensity of the flashing will lessen and finally disappear.

General Operational Considerations

The Bio-Acoustic Simulator section checks the audiometer earphones in the 45 dB HL to 75 dB HL range. Therefore, it is important to have a relatively quiet background when performing the HL tests. All tests should be performed within an audiometric room for best results.

An original **BIOLOGICAL LOG** should always be made when the audiometer has just come back from having an exhaustive calibration. Every successive **BIOLOGICAL LOG** should then be compared against the original. By doing this, as long as the new HL values are within ± 5 dB of the original **BIOLOGICAL LOG**, the audiometer accuracy is acceptable to begin testing of patients. See Table 1, for typical HL values for audiometers with 5 dB HL steps.

Table 1 requires that you know the model of headphone that your audiometer uses. Refer to the audiometer instruction manual. If you cannot find what you

need from the manual, you will need to disassemble one earphone (removing either the red or blue cup) to read the model of the headphone.

Testing a Manual Audiometer

A typical test procedure would be as follows:

1. Switch the audiometer on and allow it to stabilize per manufacturer's specifications.
2. Place the earphones onto the Bio-Acoustic Simulator.
3. Turn the Bio-Acoustic Simulator on.
4. Starting at 125 Hz (or the lowest frequency) and 40dB HL on the Left (Blue) earphone, increase the HL value until the **LEFT** indicator light appears. Repeat a few times to be confident of the HL value. Record the HL value. Repeat this step for all frequencies on the audiometer.
5. Repeat step 4 with the Right (Red) earphone.
6. Keep a **BIOLOGICAL LOG** of this data. Always compare the new HL values to the original **BIOLOGICAL LOG** that was established early in the present calibration interval of the audiometer. All data should compare within ± 5 dB of the original **BIOLOGICAL LOG**. See Table 1 for HL value ranges.

Testing an Automatic Audiometer

A typical test procedure would be as follows:

1. Switch the audiometer on and allow it to stabilize per manufacturer's specifications.
2. Connect the **RESPONSE CABLE** (059-995) between the patient response jack of the audiometer and the **RESPONSE** jack of the Bio-Acoustic Simulator.
3. Place the earphones onto the Bio-Acoustic Simulator.
4. Turn the Bio-Acoustic Simulator on.
5. Run the audiometer through its normal testing sequence. An audiogram will be produced.
6. Keep a **BIOLOGICAL LOG** of this data. Always compare the new HL values to the original **BIOLOGICAL LOG** that was established early in the present calibration interval of the audiometer. All data should compare within ± 5 dB of the original **BIOLOGICAL LOG**. See Table 1 for typical HL values.

Frequency	TDH-39	TDH-49 TDH-50	Telex 1470	Insert Earphone
125	55 to 70	50 to 65	55 to 70	55 to 70
250	60 to 70	60 to 70	60 to 70	55 to 70
500	60 to 70	60 to 70	60 to 70	55 to 70
750	60 to 70	60 to 70	60 to 70	55 to 70
1K	55 to 65	55 to 65	60 to 70	55 to 70
1.5K	55 to 65	55 to 65	55 to 65	55 to 70
2K	55 to 65	50 to 60	60 to 70	55 to 70
3K	50 to 60	50 to 60	55 to 65	55 to 70
4K	50 to 65	50 to 65	55 to 70	55 to 70
6K	45 to 60	50 to 65	55 to 70	55 to 70
8K	55 to 70	55 to 70	60 to 75	55 to 70

Table 1: Typical HL Values for Various Earphones on Audiometer with 5 dB Attenuator Steps. These levels are just for reference to see if the audiometer is relatively correct the first time that it is tested.

Testing Audiometric Room Noise (BA-202-25)

Room noise within an audiometric room can be tested either continuously or periodically depending on various conditions that are producing the noise. However, TSI recommends that this test be performed continuously while test subjects are being evaluated. Testing is performed as follows:

1. Hang the microphone from the ceiling slightly above the test subject's head.
2. Turn the BA-202-25 on.
3. With the door closed, occasionally view the frequency indicator lights on the monitor. They should not be on. If the frequency lights are activating at random, these frequencies are in violation and the subject's test should be halted. The offending sound source(s) should then be located and eliminated. If elimination is not possible, either the audiometric booth should be moved to a quieter location or the test should be scheduled for a more quiet time. See Table 2 for the allowable values.

Frequency (in Hz)	OSHA Values 8-Mar-83 *	ANSI Values S3.1, 1999 **	Values on Special Order ***
125	-----	35 dB	dB
250	-----	25 dB	dB
500	40 dB	21 dB	dB
1K	40 dB	26 dB	dB
2K	47 dB	34 dB	dB
4K	57 dB	37 dB	dB
8K	62 dB	37 dB	dB

Table 2: Allowable Room Noise Specified by Various Regulations

Testing Audiometric Room Notes:

* The BA-202-25 is set at these values unless otherwise indicated.

*** Contact TSI (See Customer Service section) for special room noise limits that can be ordered for the BA-202-25. TSI can also modify values for other special requirements.

NOTE: There is a charge for this modification. Write special values here for reference if you want to do so.

Specifications

Bio-Acoustic Simulator (BA-202 model)

Test Frequencies	125 Hz to 8 kHz
Calibration	60 HL \pm 1 dB at 1 kHz continuous tone with TDH-39, TDH-49, or TDH-50 earphones.
Accuracy	Repeatable to within 2 dB when using an audiometer with a continuously variable HL control. When using automatic audiometers, the BA-202 will be repeatable within the HL step increments of the audiometer (usually 5 dB).
Hysteresis	10 dB \pm 1 dB between ON and OFF indication for the LEFT/RIGHT headphone indicators when used with continuous tone input. This means once activated, the LEFT/RIGHT headphone signal must be lowered by at least 10 dB to deactivate the Indicator Light and Relay.
Indicators	3 LEDs— RIGHT , LEFT , and POWER .
Transducers	Two independent Electret Microphones.

Response Output	Normally open and normally closed relay contacts. (SPDT 3-wire output).
Response Relay Specifications	250 mA, 30 VDC. 20 million operations.
Application	For use with manual or automatic audiometers using either pulsed or continuous tones. Will measure all earphones equipped with either MX-41/AR cushions or Telephonics Model 51 cushions, with or without Audiocups or similar earmuffs.

BA-202-25 (model) Octave Monitor (OSHA version)

Test Octaves (Hz) and Activation Levels	Federal Register dated Tuesday, March 8, 1983. 500 Hz – 40 dB 1 kHz – 40 dB 2 kHz – 47 dB 4 kHz – 57 dB 8 kHz – 62 dB
Indicators	5 LEDs—One for each monitored frequency.
Microphone/Amplifier	ANSI S1.4—1983 & S1.4A - 1985, Type 2
Octave Filters	ANSI S1.11 - 1986, Class II
Preamp	Cable-mounted FET type for electret microphone.
Microphone	TSI Quest QE7052 (1/2") Type 2 electret.
Calibration	Requires 114 dB, 1 kHz acoustical calibrator (such as the TSI Quest AC-300)

General Features

Power and Battery Life	9 volt alkaline battery. Uses flashing LED as “Good Battery Indicator”. Battery life will vary depending on how many LEDs are on and for what length of time. If battery life is not adequate in your application, use one of the following optional power adapters (battery eliminators): 015-910 120 VAC to 9 VDC, unregulated 015-680 220 VAC to 9 VDC, unregulated NOTE: Center terminal is "+”.
Size	173 mm x 165 mm x 107 mm (6.8 in. x 6.5 in. x 4.2 in.)
Weight	Each model is approximately 740 g (1.6 lb.) not including the remote microphone of the BA-202-25.
Construction	Rugged aluminum housing with molded ABS polycarbonate ear cups.

Controls (See Figures 1, 2, and 3)

ON/OFF Pushbuttons	Press the ON pushbutton to turn the power on. The unit will remain on until the OFF pushbutton is pressed.
POWER Indicator Light	This light will flash when the power is on. When the power is supplied with the internal 9-volt battery, the light will flash when the battery is good. If the light does not flash, the battery is low and requires replacement.
RIGHT/LEFT Indicator Lights	One light will activate when either the Right (Red) or Left (Blue) earphone output exceeds an internally set dB level. Once lit, the signal must be reduced approximately 10 dB (called “hysteresis”) to cause the light to go out.
RESPONSE Output Jack	This output is intended to replace the Patient Response Switch that normally plugs into the audiometer. When either the RIGHT or LEFT indicator lamp is on, the internal relay contact is operated to simulate the test subject pressing the Patient Response Switch. The relay contact (RESPONSE CABLE) output can be wired for normally open, normally closed, or single pole double throw configurations (see Figure 4).
MIC. Input Connector	This connector appears only on the BA-202-25. It allows the external preamp and microphone system to be connected for making audiometric room background noise measurements in octave bands.

500, 1K, 2K, 4K, 8K Indicator Lights	Each individual light will activate if the room noise in the corresponding octave band exceeds the internal preset level.
ADAPTER Input Jack	Optional. Allows the unit to be powered by a 9 VDC power cube. TSI Part Numbers: 015-910 120 VAC to 9 VDC, unregulated 015-680 220 VAC to 9 VDC, unregulated Note: Center terminal is "+".
CAL. Adjustment	This adjustment appears only on the BA-202-25. It allows you to calibrate the 1 K octave band with a 1 kHz, 114 dB acoustic calibrator (such as the TSI Quest AC-300 calibrator). When the 1K filter is calibrated, all other octave bands are automatically within calibration.

Principles of Operation

The Models BA-202 and BA-202-25 use two independent microphones to convert earphone signals to AC voltages. (See Figure 3) These voltages are then amplified and sent to rectifiers for AC to DC conversion. The DC voltage enters its respective detector. When sufficient signal is present at the earphone coupler, the appropriate indicator light (**RIGHT** or **LEFT**) will light and the response relay will activate. Once this occurs, the earphone signal must be decreased by at least 10 dB (hysteresis) to deactivate the indicator light and the response relay.

The power supply is turned on by pressing the **ON** button. This causes the "flip-flop" circuit to change state and hold the power supply on. The power supply divides the 9-volt supply to produce the +V and -V supplies needed to operate all remaining circuitry. The **POWER** indicator light flashes during operation and also serves as a "low battery" indicator when used on internal battery power. When the battery is low, the flashing light will become less intense and will finally disappear. Pressing the **OFF** button simply turns the unit off.

The Model BA-202-25 contains the extra circuitry shown within the dotted lines. A microphone system and amplifier are used to condition the acoustic signal and then present this signal to resistive voltage dividers. These dividers allow the filter inputs to have various sensitivities.

Bio-Acoustic Simulator Models Block Diagram

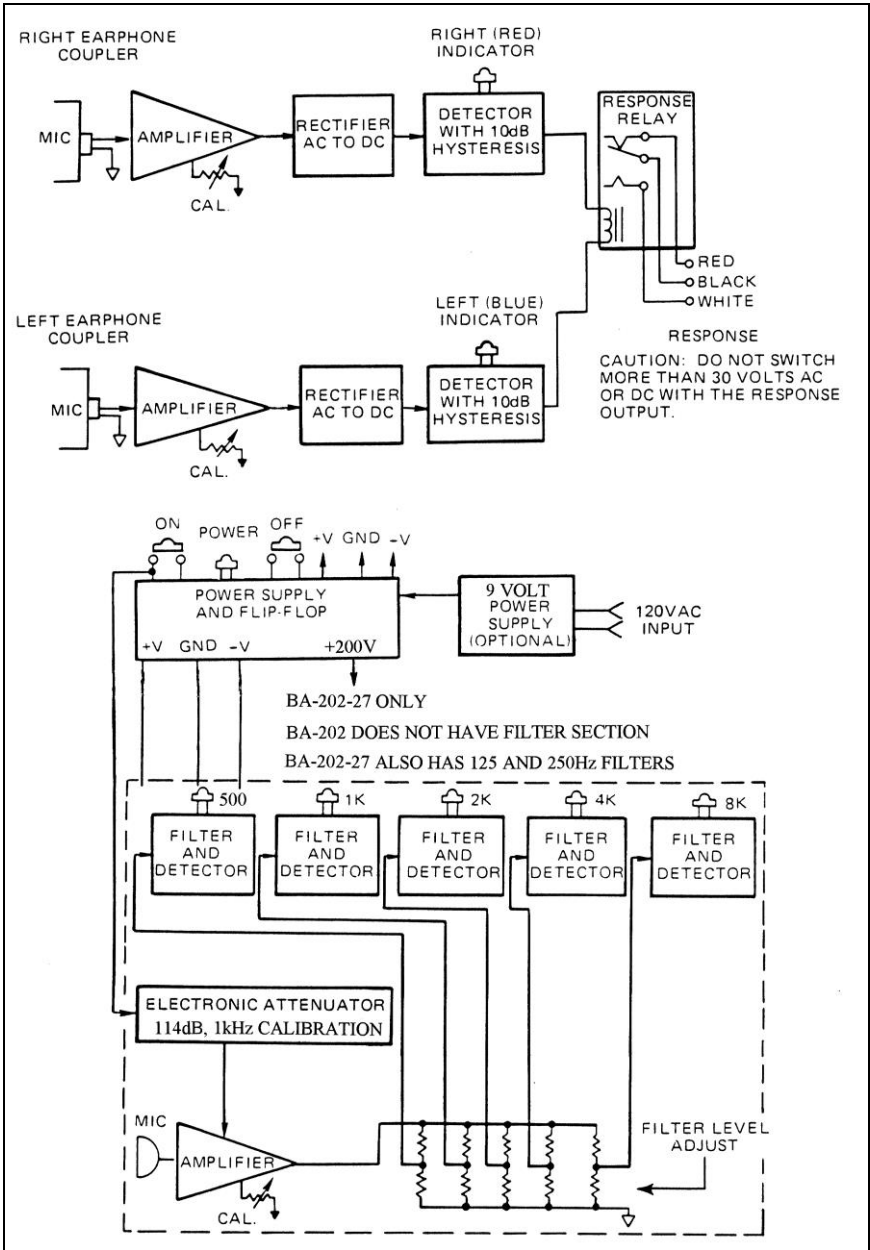


Figure 3: Block Diagram, Models BA-202 and BA-202-25

The filter and detector circuits select and detect various frequency components within the room noise spectrum. If the room noise is intense enough within a given octave band, it will activate the respective indicator light.

Various resistor dividers can be installed by TSI to allow different levels to be detected. Contact TSI for special orders.

Response Output Jack and Wiring

This feature is designed to take the place of a patient pressing the response switch when a tone is heard. When the tone is loud enough to activate the indicator light, a relay contact is closed, opened, or both, depending on the requirement for the particular automatic audiometer being used. This relay actuation will cause the audiometer attenuator to decrease its HL output until the relay is deactivated. When deactivated, the audiometer attenuator will increase the HL output until the relay is again activated, etc.

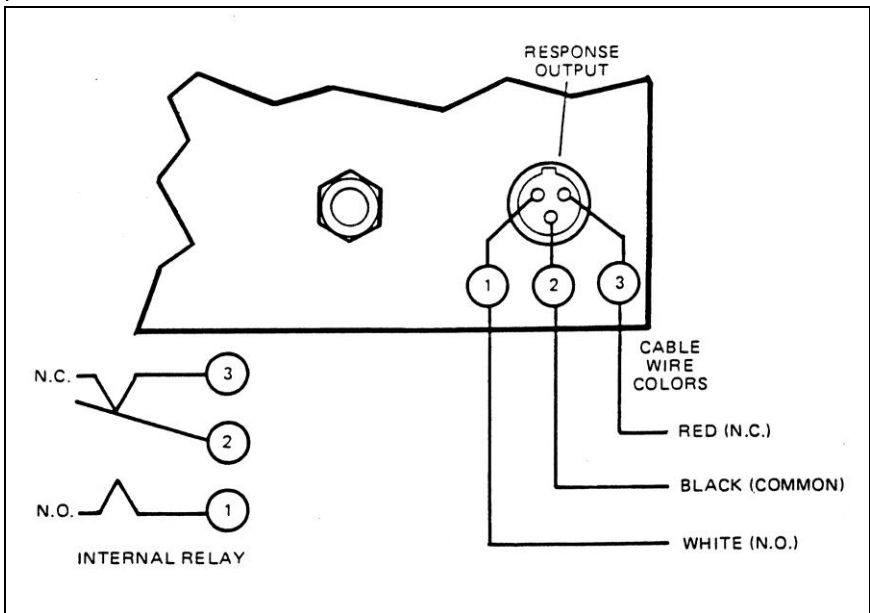


Figure 4: Response Jack Wiring

Wiring

Wiring of the connector will require some technical expertise using an ohm meter and a soldering iron. Wire as follows:

1. Obtain a plug that is similar to the one that is on the end of the patient response hand switch.
2. Wire it to the **RESPONSE CABLE** so that the relay function of the Bio-Acoustic Simulator mimics the hand switch.

NOTE: Refer to Figure 4. If the patient response switch of the audiometer is normally open, use the **WHITE** and **BLACK** wires of the **RESPONSE CABLE**. If the patient response switch of the audiometer is normally closed, use the **RED** and **BLACK** wires. If a single pole double throw contact arrangement is required, use the **BLACK** wire as the common, the **WHITE** wire as normally open, and the **RED** wire as normally closed.

3. Be sure to provide ample strain relief to the plug so that the cord does not accidentally pull out of the plug too easily.
4. If help is needed to determine the wiring, TSI can help you with this.

Battery Replacement

The battery compartment is located on the top side of the unit. Replace the battery as follows:

1. Open the battery compartment by lifting the side of the battery door that has the four long bumps on it.
2. Lift the battery out of the compartment.
3. Remove the old battery from the battery snap.
4. Replace with a new 9-volt "alkaline" battery.

NOTE: The battery **MUST** be of the alkaline variety!

Volt Power Adapter

If the battery life is not adequate in your application, an optional power adapter is available to save on battery consumption. The 9 volt adapter is simply plugged into the **ADAPTER** jack on the unit. Battery power is automatically disconnected from the circuit whenever the adapter is connected. The following adapters are available from TSI:

Part No.	Description
015-910	120 VAC to 9 VDC, unregulated
015-680	220 VAC to 9 VDC, unregulated

NOTE: Center terminal is "+".

Maintenance and Calibration

The Bio-Acoustic Simulator section should maintain its accurate calibration for many months of use. Since both the LEFT and RIGHT test circuits are identical, the following procedure can be used to verify that the Bio-Acoustic Simulator section is functioning properly.

Headphone Calibration Check (Left/Right Earphone)

Turn the unit on.

Place the headphones onto the simulator with the Right (Red) earphone in the coupler on the side marked RIGHT. Test and record the HL values in 5dB increments (45, 50, 55, etc.) at all frequencies.

Remove the headphones, turn them around, and place the same Right (Red) earphone in the other coupler on the side marked **LEFT**. Again, test and record the HL values in 5dB increments (45, 50, 55, etc.) at all frequencies.

Compare both sets of data. If the difference between both sets of data is 5 dB or less at each frequency, the Bio-Acoustic Simulator is functioning properly. If it is more than 5 dB at any frequency, the unit should be sent in for calibration/repair. (See TSI Service and Warranty policies.)

Octave Monitor Calibration

The Octave Monitor section should maintain its accuracy for many months of use. However, to insure consistently accurate operation, it is recommended that the 1K filter be tested and calibrated weekly or at least monthly. Calibration of the 1 K filter requires a 1 kHz, 114 dB acoustic calibrator capable of adapting to the microphone diameter. TSI | Quest Calibrators meeting this requirement are the AC-300 (1 kHz / 250 Hz, 114 dB / 94 dB).

1. Switch the calibrator on.

NOTE: If other settings are available, make sure that they are set to produce a 1 kHz tone at 114 dB.

2. Place the microphone into the calibrator.
 - When using the ½-inch microphone, use the ½ inch to 1-inch adapter between the calibrator and the microphone.
 - When using the 1-inch microphone, an adapter is not required.
3. Turn the BA-202-25 on.
4. While holding the **ON** button in, observe the 1 kHz light while slowly turning the **CAL** adjustment with a screwdriver. Adjust it until the light appears to glow at approximately one-half intensity.
5. Release the **ON** button. All octave filters are now in calibration.

Microphone Care

The Octave Monitor Microphone is a delicate and expensive component. Therefore, it should be treated with care to avoid costly replacement due to physical damage. Reading and adhering to the following information will help avoid damage to the microphone:

NEVER unscrew and remove the microphone grid unless great care is taken. Removing it will expose the very delicate microphone diaphragm to possible physical damage.

If the grid is removed for inspection of the diaphragm, **NEVER** touch the diaphragm. Cleaning should only be performed by a TSI service technician if it is ever needed.

Preamplifier Care

The Octave Monitor Preamplifier is somewhat delicate. Reading and adhering to the following information will help avoid damage to the preamplifier.

Recommendations

- **DO NOT** flatten the cable between tight door joints.
- **DO NOT** kink the cable sharply since this may cause wire breakage.

NOTE: ALWAYS connect and disconnect the connector from the BA-202-25 model by screwing and unscrewing only the "knurled" shiny part of the connector. **NEVER** try to unscrew the black rubber "strain relief". If the "strain relief" is forcefully unscrewed, it will destroy the connector and will twist and break all of the wire connections within the connector.

Contact/Service information

This section gives directions for contacting TSI Incorporated for technical information and directions for returning the WIBGET WB-300 Heat Stress Monitor for service.

Technical Support Contacts

If you have any difficulty setting or operating the instrument, or if you have technical or application questions about this system, contact TSI's Technical Support.

North America and Asia Pacific	Europe, Middle East, and Africa
Telephone: 1-800-680-1220 (USA); +1 651-490-2860 (Outside USA)	Telephone: +49 241-52303-0
Fax: +1 651-490-3824	Fax: +49 241 52303-49
E-mail: technical.services@tsi.com	E-mail: tsigmbh@tsi.com

Service Contact Information

If your instrument does not operate properly, or if you are returning the instrument for service, visit our website at <http://rma.tsi.com> for a Return Material Authorization, or contact Customer Service.

North America and Asia Pacific	Europe, Middle East, and Africa
TSI Incorporated 1060 Corporate Center Drive Oconomowoc, WI 53006-4828	TSI Instruments Ltd. Stirling Road Cressex Business Park High Wycombe, Bucks HP12 3ST United Kingdom
Telephone: 1-800-680-1220 (USA); +1 651-490-2860 (Outside USA)	Telephone: +44 (0) 149 4 459200
E-mail: technical.services@tsi.com	E-mail: tsiuk@tsi.com

Returning for Service

Visit our website at <http://rma.tsi.com> and complete the on-line “Return Merchandise Authorization” form or call TSI at 1-800-680-1220 (USA) or (651) 490-2860, or 001 651 490 2860 (International) for specific return instructions.

Customer Service will need the following information:

- The instrument model number
- The instrument serial number
- A purchase order number (unless under warranty)
- A billing address
- A shipping address

Use the original packing material to return the instrument to TSI. If you no longer have the original packing material, seal off any ports to prevent debris from entering the instrument and ensure that the display and the connectors on the instrument front and back panels are protected. This instrument is very fragile and must be packed in a manner appropriate for a precision instrument.

Calibration

The Bio- Acoustic Simulators and TSI field calibrator devices should be examined regularly by the factory. An annual calibration is recommended. (Please see [Service Department](#) above.)

Warranty

(For country-specific terms and conditions outside of the USA, please visit www.tsi.com.)

Seller warrants the goods, excluding software, sold hereunder, under normal use and service as described in the operator's manual, to be free from defects in workmanship and material for **12 months**, or if less, the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. This limited warranty is subject to the following exclusions and exceptions:

- a. Hot-wire or hot-film sensors used with research anemometers, and certain other components when indicated in specifications, are warranted for 90 days from the date of shipment;
- b. Pumps are warranted for hours of operation as set forth in product or operator's manuals;
- c. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment;
- d. Seller does not provide any warranty on finished goods manufactured by others or on any fuses, batteries or other consumable materials. Only the original manufacturer's warranty applies;
- e. This warranty does not cover calibration requirements, and seller warrants only that the instrument or product is properly calibrated at the time of its manufacture. Instruments returned for calibration are not covered by this warranty;
- f. This warranty is **VOID** if the instrument is opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the manual allow an operator to replace consumables or perform recommended cleaning;
- g. This warranty is **VOID** if the product has been misused, neglected, subjected to accidental or intentional damage, or is not properly installed, maintained, or cleaned according to the requirements of the manual. Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, goods which are incorporated into other products or equipment, or which are modified by any person other than Seller.

The foregoing is **IN LIEU OF** all other warranties and is subject to the LIMITATIONS stated herein. **NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE. WITH RESPECT TO SELLER'S BREACH OF THE IMPLIED WARRANTY AGAINST INFRINGEMENT, SAID WARRANTY IS LIMITED TO CLAIMS OF DIRECT INFRINGEMENT AND EXCLUDES CLAIMS OF CONTRIBUTORY OR INDUCED INFRINGEMENTS. BUYER'S EXCLUSIVE REMEDY SHALL BE THE RETURN OF THE PURCHASE PRICE DISCOUNTED FOR REASONABLE WEAR AND TEAR OR AT SELLER'S OPTION REPLACEMENT OF THE GOODS WITH NON-INFRINGEMENTS.**

TO THE EXTENT PERMITTED BY LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF SELLER'S LIABILITY FOR ANY AND ALL LOSSES, INJURIES, OR DAMAGES CONCERNING THE GOODS (INCLUDING CLAIMS BASED ON CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) SHALL BE THE RETURN OF GOODS TO SELLER AND THE REFUND OF THE PURCHASE PRICE, OR, AT THE OPTION OF SELLER, THE REPAIR OR REPLACEMENT OF THE GOODS. IN THE CASE OF SOFTWARE, SELLER WILL REPAIR OR REPLACE DEFECTIVE SOFTWARE OR IF UNABLE TO DO SO, WILL REFUND THE PURCHASE PRICE OF THE SOFTWARE. IN NO EVENT SHALL SELLER BE LIABLE FOR LOST PROFITS, BUSINESS INTERRUPTION, OR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES. SELLER SHALL NOT BE RESPONSIBLE FOR INSTALLATION, DISMANTLING OR REINSTALLATION COSTS OR CHARGES. No Action, regardless of form, may be brought against Seller more than 12 months after a cause of action has accrued. The goods returned under warranty to Seller's factory shall be at Buyer's risk of loss, and will be returned, if at all, at Seller's risk of loss.

Buyer and all users are deemed to have accepted this LIMITATION OF WARRANTY AND LIABILITY, which contains the complete and exclusive limited warranty of Seller. This LIMITATION OF WARRANTY AND LIABILITY may not be amended, modified or its terms waived, except by writing signed by an Officer of Seller.

Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at 1-800-874-2811 (USA) or +001 (651) 490-2811 (International).



TSI Incorporated – Visit our website www.tsi.com for more information.

USA Tel: +1 800 874 2811
UK Tel: +44 149 4 459200
France Tel: +33 1 41 19 21 99
Germany Tel: +49 241 523030

India Tel: +91 80 67877200
China Tel: +86 10 8219 7688
Singapore Tel: +65 6595 6388

