



**BigSound™ Model 97**

## **Steam Installation Guide**

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## Introduction

To you, our much appreciated customer:

Thank you for your purchase of our BigSound™ system! We trust you will enjoy many hours of listening pleasure as you operate your favorite locomotive equipped with Phoenix Sound. If we can be of service to you, please don't hesitate to give us a call.



### CAUTION!

- BEWARE OF STATIC ELECTRICITY, IT IS THE ENEMY!
- BE SURE TO FOLLOW THE WIRING INSTRUCTIONS AND DIAGRAMS.
- ENSURE THE SOUND CHIPS ARE ORIENTED CORRECTLY IN THEIR SOCKETS.
- BE SURE THE BATTERY IS INSTALLED CORRECTLY IN TERMINAL BLOCK P1 AND THAT IT IS FULLY CHARGED.
- DO NOT APPLY VOLTAGE TO THE TERMINAL BLOCK MARKED P2.
- DO NOT EXCEED 24 VOLTS OF INPUT POWER..

EVEN THOUGH YOUR BIGSOUND™ 97 HAS BUILT IN PROTECTION AGAINST INCORRECT WIRING, PREVENT DAMAGE TO THE CPU AND OTHER COMPONENTS BY GUARDING AGAINST STATIC CONDITIONS AND TAKING A MOMENT TO REVIEW THE WIRING DIAGRAM AND INSTALLATION INSTRUCTIONS BEFORE YOU BEGIN WORK.

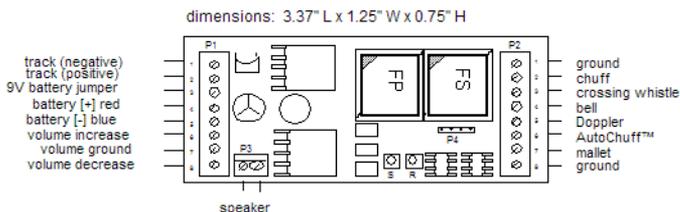
If you need to return your board for any reason, protect it by using the packing box we provided. It has anti-static foam padding that will protect against static electricity and also cushion your unit so that it should arrive at Phoenix Sound without damage. We are not responsible for damage due to inadequate packing.

Our warranty is packed in the box with your system. Our goal is to provide you with outstanding realistic sound for your model railroad; we welcome your comments, suggestions, and even your disappointment – if any.

**HAPPY LISTENING!**

## Section 1: The Sound Board & Its Components

The BigSound™ board for steam is pictured below to help you correctly wire your unit. Be sure to study the appropriate schematic carefully to avoid unwanted results.



On each end of the board is a series of 8 screw terminals numbered 1 through 8. The eight positions on the left side of the board (as pictured above) comprise the P1 Block; the eight positions on the right side of the board comprise the P2 Block. Another small terminal block located next to P1 at the bottom of the board is the P3 (Speaker) Block with terminals marked 1 and 2. Each terminal controls a specific function or feature of the BigSound™. Most of the wire ends of the kit components have been tinned to make sure you get a good contact when you screw the wires into the terminals. For any wires that are not tinned, we suggest twisting the strands together firmly before inserting the wire into the terminal.

### Steam Connections

P1 - Left Side	P2 – Right Side
1 – Track Negative	1 – Trigger Ground
2 – Track Positive	2 – Chuff trigger / Dip switch 1
3 – 9V Battery Jumper	3 – Crossing whistle trigger
4 – Battery positive (red)	4 – Bell trigger
5 – Battery negative (blue)	5 – Doppler trigger
6 – Volume switch, raise	6 – AutoChuff™ jumper / Dip switch 2
7 – Volume switch, ground	7 – Double chuff jumper / Dip switch 3
8 – Volume switch, lower	8 – Ground / Dip switch 4

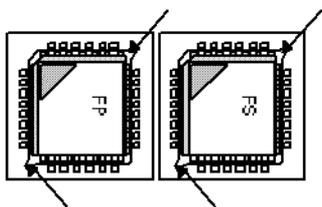
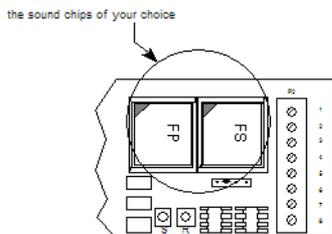
BE SURE THAT YOU ARE USING A TRANSFORMER WITH ENOUGH POWER TO DRIVE YOUR TRAIN WITH THE BIGSOUND™ INSTALLED. WE RECOMMEND A CONTROLLER WITH A MINIMUM OUTPUT OF 2 AMPS (30VA) FOR OPTIMAL PERFORMANCE.

## 1.1: The Sound Chips

When you order a BigSound™ Model 97 system one set of sound chips is installed.

These chips are found next to terminal block P2. Each chip is labeled with the sound code and version number; additionally, one chip is labeled “FS” and the other “FP”. Both chips are required for the system to produce sound. The chips need be removed only if you are changing the system to another sound. A small colored triangle is located on one corner of each chip to help you

orient the chips correctly if and when you do change sets.



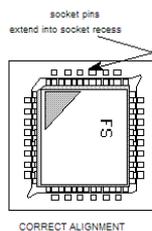
To remove the chips use the small Allen wrench included in your kit. Insert the wrench into the small recesses (noted with arrows in the diagram) and *gently and carefully* pry the chips loose. You do not need to get under the chip, the wrench is simply a lever; pry one side up, switch sides and repeat. One good pry on each corner is usually sufficient to release the chips.

**DO NOT PRY THE BROWN SOCKETS FROM THE BOARD!**

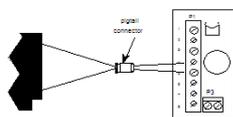
To install the new chips place the sound board on a solid flat surface. Center each chip over its designated socket in the proper position. Seat the chip by pressing downward firmly until the chip locks into place. If the chips are angled the pins along the inside edge of the socket could be irreparably bent or dislodged. The chips are flat and flush with the top of the socket when properly seated.

Your BigSound™ board contains the latest version sound chips, which include the 3 toot reverse signal and the ability to turn off the bell and/or whistle. If you get 3 toots when the locomotive begins to move forward, simply swap the wires in P1 block # 1 & #2.

The bell and whistle features may be disabled by either a jumper wire or on/off switch. Simply connect the correct input to ground on terminal block P2. The bell input is terminal 4 and the whistle is terminal 3; terminals 1 and 8 are both ground. The jumper/switch is connected in place of the reed switch and inhibits trigger activation. This is useful when double heading. Please see steam connections chart for further details on terminal assignments for both P1 and P2.



## 1.2: The Battery



A 6 volt SLA (Sealed Lead Acid, or gel cell) battery is included in your kit to power the board functions. The battery plug connects to the receptacle on the "pigtail," which is installed in your sound board when you receive it. Simply match each color wire on the battery with its color mate on the pigtail and insert the plug. Terminal block P1 position 4 is positive (red) and position 5 is negative (blue). When you want to disconnect the battery, leave the pigtail attached to the board and disconnect the battery from the receptacle.

The battery should read 6.2 volts or more when charged. Batteries discharge slowly during storage so your kit battery may be under the operational threshold. If the charge measures less than 6.2 volts you need to charge the battery. An inadequately charged battery leads to odd, inconsistent operation. For instance, if you hear the sound for awhile and it suddenly stops and starts, the first suspect is a battery with a low charge. During continuous slow speed operation, the system draws current from the battery. If you notice the volume decreasing, this is an indication of a low battery charge. If you increase the track voltage to 8 volts or more and run the train for awhile, the volume will return to the set point as the battery recharges, or you can let your locomotive stand on a side track under power. We recommend charging the battery through the system rather than with a battery charger. A transformer can be wired directly to terminals 1 and 2 on terminal block P1, 10 – 12 volts will suffice.

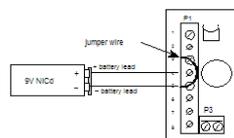


**CAUTION: BE SURE YOU DO NOT APPLY POWER TO TERMINAL BLOCK P2.**

If you do not hear any sound at start up or if you hear a clicking from the speaker, the most likely culprit is a dead or discharged battery. If you plan to store your system for an extended time, we suggest unplugging the battery. A monthly 'maintenance' charge for a between 10 and 20 minutes is also recommended for all stored systems.

A 9V Ni-Cd battery may also be used with a Model 97 system. We prefer the 6V battery included with our kit; like a car battery it can be charged over and over without losing its effectiveness, the same cannot be said for Ni-Cd batteries. To connect the 9V correctly, install the battery leads in positions 4

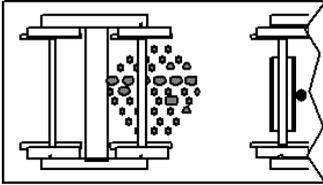
(positive) and 5 (negative) on terminal block P1. A jumper wire must be placed between positions 3 and 5 in order for the 9V Ni-Cd battery to work; a short piece of wire will suffice. Be sure the jumper does not touch the positive battery lead. If you requested a 9-volt battery when you ordered your kit, a jumper is installed.



### 1.3: The Speaker

The speaker has its own terminal block, labeled P3, perpendicular to block P1. Connect the speaker by placing one of the speaker wire leads in each of the speaker terminals.

To prepare your engine or car for installation, you need to locate a place to mount the speaker and

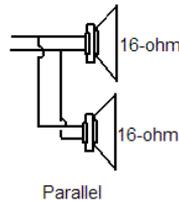
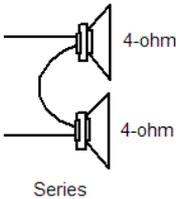


bottom of car

the speaker and drill holes in the floor of the car to allow sound to escape. You might use an arrangement of holes as shown here. Be sure you drill a sufficient number of holes to allow the sound to emit from the car. If in doubt, drill more! Some cars and engines have factory drilled holes or slots for your convenience.

Use silicon adhesive to secure the speaker over the holes in the floor of the car or drill holes for the mounting points (not all speakers have mounting ears) on the speaker and bolt it down. If your car has preexisting holes, you may have to cut off some tabs or ridges on the floor of the car to accommodate the speaker. Example: the tender of an LGB Mogul has a place prepared to accept a 2-3/4" speaker. This area needs to be leveled to accept the larger speaker we ship with the Model 97 kit. It's worth the trouble to adjust for our 3½" speaker.

For most applications one speaker is more than adequate; however, if you decide that you must use more than one speaker with your BigSound™ system, be sure the combined impedance value remains at 8 ohms. If you are using 4 ohm speakers, connect them in series to achieve 8 ohm impedance; if you are using 16 ohm speakers, connect them in parallel to obtain the 8 ohm impedance.



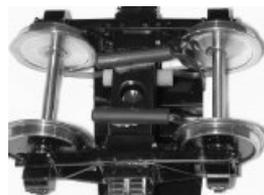
## 1.4: Reed Switches

Your kit contains three brown cylindrical reed switches, each with two long connecting wires. One switch is used to synchronize the chuff rate which shall be covered later in this guide. The other two can be used for feature activation by track magnets if you so choose.

The crossing whistle and bell will sound without a track magnet triggering a reed switch; this is done by increasing the speed of the engine. If you wish to sound the crossing whistle and/or the bell only at specific locations then the reed switches are necessary. Please see the connection chart for wiring points.

The programmed sequence is overridden if you use magnets to trigger the whistle and/or bell. If you wish to return to the programmed sequence, simply remove the magnets from your track, power down, and restart.

Placement of the reed switches is a matter of personal preference but a few things to keep in mind follow. Keep the reed switches away from the speaker magnet and strong motor magnets. Reed switches should ride about ¼” above the rail head and be spaced ½” on either side of center.



For Doppler effect, attach the wire leads from the reed switch to terminal block P2 at positions 1 and 5. To activate Doppler, use two magnets and place them on your layout at different locations. The first magnet triggers the Doppler sound as your train approaches. As the train rushes past your observation point and then past the second magnet, you hear our 3-D Sound™ as the train recedes into the distance. Once past the second magnet, the chuff exhaust returns to its normal state.

## 1.5: Volume Switch

The toggle switch in your kit controls the volume of your BigSound™ board. Connect it to the P1 terminal block in positions 6, 7, and 8 with the switch's center wire in position 7. Simply press the lever in one direction or the other and hold until the volume you hear is what you prefer and then release; the lever returns to center position. Once you set the level to your liking, and as long as your battery has a full charge, the setting will remain each time the system starts. If the volume begins to fade from the set point during operation, it's time to charge the battery.

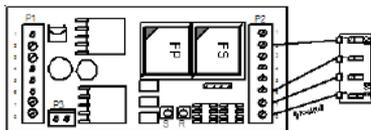
There are as many ways and locations to mount the volume control switch as there are train enthusiasts. The best locations are unobtrusive yet accessible. Typically floors of tenders are boxcars work well. Many models have removable pieces, doors, etc. that work well. The proper hole size is 15/64”.

## 1.6: Dip Switch

A four-position DIP switch is supplied with steam kits so that a number of options can be activated. These options apply to steam only; installation of this switch is not required unless you plan to switch back and forth between options such as demo mode & normal operation or normal & double chuff,

The DIP switch as packed is set for 4-valve chuff: switches 1, 2, and 3 OFF and switch 4 ON. The DIP switch should be connected to the P2 terminal block, as follows:

- Switch 1 to P2 terminal 2
- Switch 2 to P2 terminal 6
- Switch 3 to P2 terminal 7
- Switch 4 to P2 terminal 8



Option	DIP Switch Settings
4-VALVE CHUFFING (normal operation)	ON (up): 4 OFF: 1, 2 & 3
Mallet Mode (Double Chuff)	ON (up): 3 & 4 OFF: 1 & 2
AutoChuff™	ON (up): 2 & 4 OFF: 1 & 3
Demonstration Mode	ON (up): 2, 3 & 4 OFF: 1
Mallet AutoChuff™	ON (up): 1, 2 & 4 OFF: 3
SWITCH 4 (BLACK OR GROUND) IS ALWAYS IN THE ON POSITION, WHICH IS HOW IT IS PACKAGED IN YOUR KIT.	

When you use AutoChuff™ or combined AutoChuff™ and Double Chuff, you must disconnect the chuff reed switch from P2 numbers 1 & 2. When you are ready to return to normal operation reconnect the wire of the chuff reed switch and disable the DIP switch by returning the levers to the default positions: OFF for 1, 2, and 3 and ON for 4.

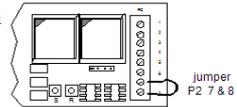
## 1.6.1: Double Chuff / Mallet Mode

THIS FEATURE APPLIES TO ALL STEAM SOUNDS EXCEPT THE SHAY.

When you wish to hear the distinctive 8-chuff exhaust of a mallet type engine or when you are double heading engines and want to hear them move in and out of phase, there are two methods to activate this feature:

1) Begin with track power off. Set switches 1 and 2 to the OFF (down) position and switches 3 and 4 to the ON (up) position. Power up your BigSound™ system and your engine will mimic a mallet engine. In order to return to normal chuff, you must reset the board by powering down, moving switch 3 to the OFF position (leave switch 4 ON), and powering up again.

2) Place a jumper wire in terminal block P2 between positions 7 & 8 without the DIP switch installed. Insert the jumper with the system powered off. Mallet mode will be active when the system powers up with the jumper in place. Shut down, remove the jumper and then restart to return to single chuff mode.



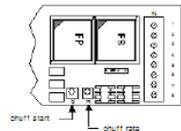
## 1.6.2: AutoChuff™

THIS FEATURE APPLIES TO ALL STEAM SOUNDS.

In some instances the chuff reed switch cannot be installed and the AutoChuff™ feature is used to synchronize the chuff. Set DIP switch levers 2 and 4 ON, and levers 1 and 3 OFF. Make sure no reed switch is installed in positions 1 and 2 of P2.

When you are using AutoChuff™ mode, the chuff start voltage and the chuff rate can be adjusted to synchronize the chuff with the motion of the train. Two small, round silver potentiometers are located at the bottom edge of the board below the sound chips for this adjustment.

The pot on the left (labeled "S") sets the voltage at which the BigSound™ begins to chuff. Set this pot first by using a small screwdriver with a blade width of about 1/10". If the screwdriver is too small, it will not lock in the slots on either side of the turning ring of the pot. The pot moves 360°; continued rotation in one direction will return you to the starting position. The pot on the right (labeled "R") sets the chuff rate. After you set the chuff start voltage, adjust the second pot to get the proper number of chuffs to correspond to the train speed. In order to synchronize the chuff, the above process may have to be repeated after running the train around the track and observing how the chuff rate corresponds to the train movement.



### 1.6.3: Mallet AutoChuff™

THIS FEATURE APPLIES TO ALL STEAM SOUNDS EXCEPT THE SHAY.

Mallet – or double chuff – mode can be activated along with AutoChuff™. Simply move the tiny switches to the positions shown in the chart above.

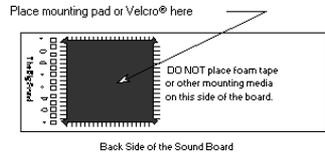
### 1.6.4: Demonstration Mode

To hear a complete sound sequence without the train in motion, set the DIP switches as shown in the chart. This is used to demonstrate a particular train sound. This is particularly useful for stationary displays.

## Section 2: Installation and Mounting Considerations

We recommend installation in a tender, boxcar, or other trailing car rather than in an engine for steam locomotives. It is a much simpler installation than taking the engine apart. A boxcar, water car, or tender all work very well. Small squares of foam tape are enclosed in your kit for mounting the BigSound™ board, battery, and the DIP switch. Mounting foam is available at many hardware stores, hobby shops and general home supply centers. Hook and loop tape (Velcro®) is another popular mounting media that allows easy extraction of the components from the car.

The foam tape is best attached to the bottom of the board on the black square (microprocessor) behind the sound chip sockets. **DO NOT** apply the foam tape on top of other components on the board, this could cause damage to the board. Hook and loop tape can be used, this also should be placed only on the microprocessor.



The DIP switch may be held in place with foam tape or with another adhesive. The important thing is to fasten it securely in a place that's easy to reach so changing DIP switch positions is not difficult. One idea is to mount the DIP switch on the underside of your sound car and drill a hole in the floor for the wires. The DIP switch is easy to get to without taking the top cover off your car.

To avoid speaker vibration at high volume, the thin walls of some cars should be reinforced for added support and rigidity. Thin sheets of stiff foam (such as Styrofoam™) can be used to line the interior walls of the sound car. The use of silicone sealant around the rim of the speaker will help keep vibration noise from becoming a nuisance.

## Section 3: Chuff Synchronization

### 3.1: Normal Chuff

One of the reed switches in your kit is used along with the supplied magnets to regulate the chuff for your system. The key to obtaining the correct chuff response is careful attention to the positioning of the reed switch relative to the axle magnets.

Although it is sometimes challenging to get the correct synchronization using magnets and a reed switch, it is well worth the effort. The reed switch has a long lifetime; once it is correctly positioned, your system should be trouble-free. We strongly recommend taking the time to install the magnets and chuff reed switch.

The chuff reed switch must be connected to the P2 terminal block at positions 1 and 2. The switch should be mounted as far away from the speaker magnet as possible. If it is placed directly beneath the speaker holes, the speaker magnet may cause the chuff to be erratic or even non-existent since the large magnet on the speaker may interfere with the switch response.



You may need to experiment to get reliable triggering from rotating axle magnets. After mounting the magnets on the axle, hold the reed switch in various possible positions and hook something to the reed so you can tell when it's tripping. An ohm meter with a beeper works great. You can point the reed switch directly at the axle/magnets but there will be less tolerance. With the magnets sweeping the side of the reed switch (as shown) a clearance of about 3/16" is usually about right. If you are too close you may get extra closures – one as the magnet approaches, and one as it leaves.

**NOTE:** TO OBTAIN BEST RESULTS, INSTALL MAGNETS ON ONE AXLE 180° APART. THE SWITCH SHOULD BE POSITIONED SO THAT THE TRUCK DOES NOT HIT IT WHEN IT SWIVELING.

There is a way to modify BigSound™ steam systems to obtain four chuffs per revolution. Substitute a lever operated, sub-miniature micro-switch for the reed switch and glue it to the tongue of the truck of the car or tender. Then glue three small-diameter plastic or brass rods to the axle to trip the lever. There is a drawback to this synchronizing method, however – the service life of the switch is much less than that of the reed switch; the micro-switch will need frequent replacement if the train is run for extended periods of time.

### **3.2: Geared Locomotives (Shay)**

For geared engines other than the Bachmann Spectrum® series, you may use either AutoChuff™ or the reed switch and magnets; we prefer the magnets and reed switch for overall performance. Bachmann Spectrum® series geared locomotives include specific installation instructions in their kits, the information in this manual refers to installation in a car trailing a geared engine.

The Shay will chuff once the first time a magnet passes the reed switch. As the second magnet passes the reed switch, you will hear several chuffs. The BigSound™ microprocessor detects the rotation time and evenly spaces several chuffs in the interval between the first and second magnet contacts, mimicking the Shay's pistons rapidly cycling to move the engine.

Geared locomotives are prototypically slow moving and tend to drain the battery quickly unless run above 8 volts for part of the time. By using a BigBoost™ with the BigSound™ geared system, the locomotive operates and charges the battery at low voltage. The BigBoost™ is a standard kit component in most geared locomotive kits. BigBoost™ has other applications as well. A dedicated BigBoost™ can be wired into a 5-volt smoke unit to make it work at lower voltages.

## **Section 4: Troubleshooting**

### **4.1: Missed or Erratic Chuff**

If the system skips a beat every once in a while after proper installation the problem may be the result of the wheel binding and not turning smoothly as the train maneuvers curves and dips. Obstructed wheel movement prevents the magnets from passing by the chuff reed switch in a consistent fashion. To check your car, turn it upside down and swing the truck back and forth. If the truck rubs the king post or does not move easily up and down and side to side, free up the fit. If the truck movement is not too stiff, remove the car body and put a washer on the king post. Reattach the car and check the movement. If this simple solution does not give the "float" that is needed, you may have to open the hole to increase clearance. Once the wheels turn properly along the track the problem should be gone.

If you experience consistently erratic chuffs, experiment with the placement of the magnets on the axle and/or adjustments in the distance between the reed switch and magnets. Every installation is unique.

The chuff trigger too often causing a double chuff as the magnet passes by the reed switch. When the chuff skips, the rhythm may sound odd, erratic or seem the engine is traveling too fast. As double chuffing occurs, the whistle will

blow too often and at slow speeds; the BigSound™ system thinks the engine is going much faster, and triggers the crossing whistle.

## 4.2: Power

We recommend at least two sources of power input; e.g. two axles with metal wheels and brush pickups. Some manufacturers install sockets for track power in their cars designated for sound – these sockets can be used with the BigSound™ system as a second source of electrical pick up. If your car or tender seems to have poor pick up through the engine, try using two metal wheel sets instead.

If the BigSound™ board is not getting consistent power, the sound sequence may sputter or reset unexpectedly; the train may move a short distance with no sound and then suddenly burst into full sound. The problem may be as simple as dirty wheels or track, coating on the brushes or poor pick up from the car or tender. A little alcohol on a cotton ball will remove debris from the wheels and track.

Blackened wheels are very popular and add a special look to your train, however the blackening agent interferes with the conductivity of the wheels. To ensure current flow, carefully scrape away some of the black finish on the pickup wheel where it makes rail contact, this is not visible and gives the current a clear path through the wheels.

## Section 5: Suggested Placement and Wiring

