

Phoenix Sound Systems, Inc.

**PHOENIX BIG SOUND™**

**SPECIAL INSTRUCTIONS**

**FOR**

**BACHMANN SHAY INSTALLATION**

These instructions should be used when installing BIG SOUND™ into Bachmann's Spectrum® Shay two-truck engine. The standard manual is also enclosed in your kit as an additional reference.

January 2000

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## SECTION 1: INTRODUCTION

Your full installation manual, which is included in your kit, has basic information for all our sound systems. Bachmann's Spectrum™ Shay has special features that make installation of a sound system straightforward. Although it will take some time to do a good installation, the time spent is well worth the effort. Make sure you set aside time so you are not rushed and things will go smoothly. We have modified our kit with components that fit neatly into the allotted space inside the coal tender, and these supplemental instructions explain our recommended installation for the Shay.

The reference sketches in this manual are provided as visual aids only to make the written instructions clearer; they are not drawn to scale and detail is omitted. We suggest that you use this supplement and the full installation manual when you install your sound system. Detailed engineering drawings of the Shay chassis, assemblies, and wiring can be found in Bachmann's Shay manual, pages 20–27.

Bachmann Industries strongly recommends lubricating your new engine before you use it. We urge you to follow the manufacturer's recommendation.

Please be sure to read page 17 of the Spectrum™ Shay manual for instructions for preparing the tender for sound installation. We urge you to read Bachmann's entire Shay manual before installing our BIG SOUND™ or before running your engine.

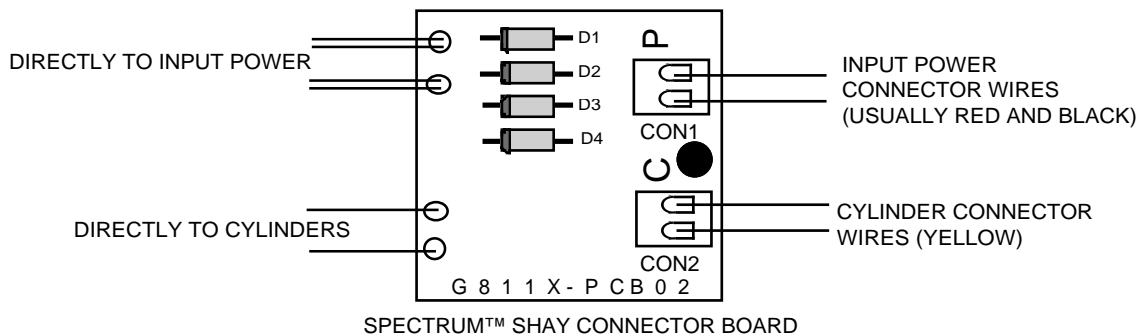
Once you've removed the tender and coal load, you're ready to get started with the sound installation. Remember: it will take a little time, but it's not really difficult. Relax and have fun!



## SECTION 2: PREPARING THE SHAY FOR SOUND INSTALLATION

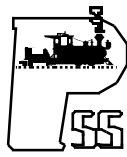
When you remove the coal tender, you will find a small printed circuit board (PCB) attached with a phillips screw at about the center inside the tender. This small board is not needed for our BIG SOUND™ system. We offer instructions for removing this unnecessary connector board and installing the wires for power and for cylinder chuffing directly into the BIG SOUND.™ It is possible to use our system without removing the small PCB, but the timing of the start-up will not be accurate and the start-up and stopping sounds will be cut short. Between start-up and stopping however, the Shay sound will work as expected. We believe you will be happier with the performance of your Shay sound if you remove the connector board.

Here is a sketch of the connector board. The four input power wires (usually red and/or black but possibly another color) are wired in pairs into one side of the connector board. In the middle section of the board are four diodes that reduce the flow of current before it reaches the white connector on the opposite side of the board. From the white connector, the current is intended to travel to the sound board via a pair of wires (usually one red, one black). Just below the four power wires are two black wires that lead to the cylinders. These black wires flow through the connector board and pass to a second white connector just opposite. Two yellow wires lead



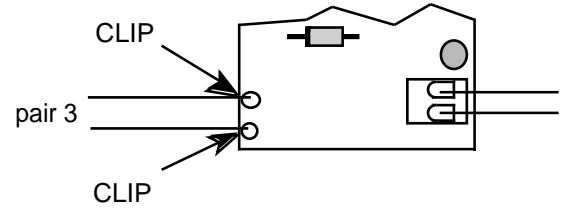
away from the connector board and are meant to be installed into the sound board.

Unfortunately, it is the four diodes—which reduce the voltage to the engine-sound system—that cause the truncated start-up and stopping sounds and affect the timing of the start-up. We offer instructions for eliminating the connector PCB completely and instructions to modify the PCB so it does not interfere with your sound output. Choose one or the other; neither method is difficult, but it takes a little time. Remember, you can leave the connector PCB "as is," but the sound sequence will be affected.



## OPTION 1: COMPLETELY REMOVING THE CONNECTOR PCB

We suggest using this option. Unscrew the PCB from its mounting inside the tender and gently pull it out toward you. The wires will restrict movement somewhat, but you will be able to maneuver it enough to work with it. To remove the connector board from the circuit, you must clip all the input wires where they enter the connector board. Start with the first pair of input power wires (usually one red and one black), cut them free using diagonal cutters, and then take a small piece of electrical tape and bind this pair together, leaving tails extending that can



pair 1            to P1 #2

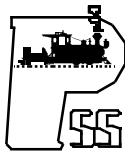
pair 2            to P1 #1

pair 3            to P2 #1  
           to P2 #2

be stripped, twisted, and tinned (optional) before insertion into the BIG SOUND.™ Use the electrical tape as a label for this pair. Mark it "1." Do the same with the second pair of power input wires, cutting, taping, and stripping the tail ends. Label the second pair with a "2."

There are only two black wires for the cylinder chuff input, each wire entering into the connector board through its own small hole. Cut each cylinder wire from the board and then tape these together, once again leaving a tail that can be stripped, twisted, and tinned in preparation for connecting to the BIG SOUND.™ Mark a "3" on the tape securing this pair.

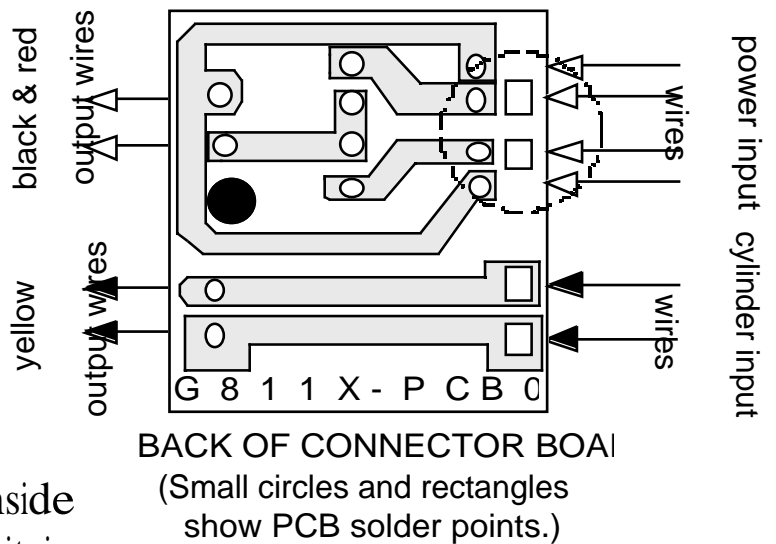
With the connector board removed, you have freed up extra room inside the tender for sound kit components.



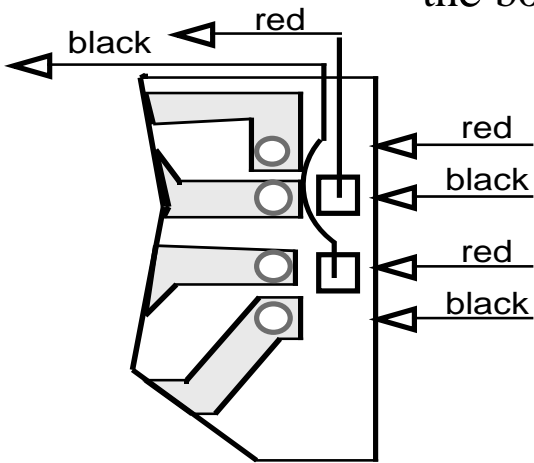
## OPTION 2: BYPASSING THE POWER INPUT DIODES

This is not as difficult as it sounds! You will need a section of red coated wire and another of black coated wire of sufficient length to reach from the PCB to the sound board. The gauge is not critical, although you may find 22AWG or finer more pliable and easier to use. Strip each end of both wires (and tin them if you wish).

Remove the PCB from its mounting inside the tender (one phillips screw holds it in place) and gently pull it away from inside the housing. Turn the PCB over so you are



looking at it with the part number along the bottom of the board, as shown in the sketch to the right (all the



power input wires may be black, but usually each pair contains one red and one black wire). The wires restrict movement somewhat, but orient the board as best you can. From this view along the right hand side, you will see four small rectangular-shaped solder points. The two rectangles at the top of the board are the terminals you need to modify.



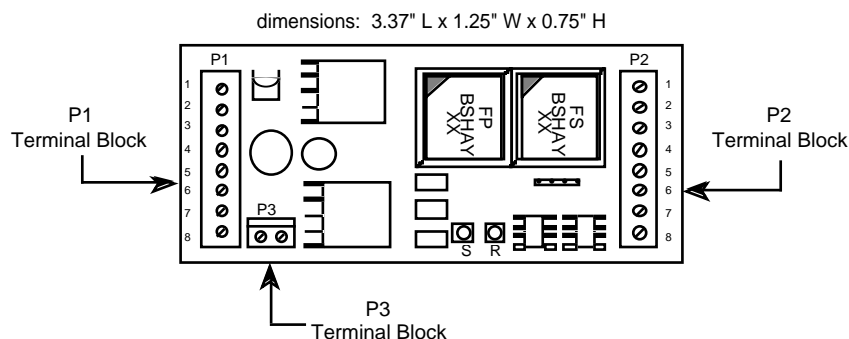
Check your soldering tool to make sure the tip is clean and in good condition. Preheat the soldering unit to about 600°F. Start with one end of the new red wire, and using a quick-melting solder, connect the red wire to the top solder rectangle. Make sure you get a good solder joint; the solder should have a shiny finish. Now solder the new black wire to the second solder rectangle. **BE CAREFUL NOT TO SOLDER THE TWO MOUNTING PADS TOGETHER!** You do not want to short the connection. What you have done is to create a new energy route ignoring the four diodes and giving **BIG SOUND™** the full voltage from the power source. This completes the modification; you use the two new wires for power input to the sound board and the two yellow cylinder wires for chuffing input to the sound board. (You can remove the black and red output wires from the Shay PCB connector, if you wish; they serve no purpose after the bypass modification.) Reattach the PCB to its designated spot inside the tender body.

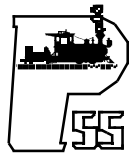
Although Option 2 does not free extra space inside the tender, there is still plenty of room to accommodate all the **BIG SOUND™** kit components.



### SECTION 3: THE BACHMANN SHAY BOARD AND ITS COMPONENTS

The Bachmann Shay **BIG SOUND™** board is depicted below to help you correctly wire your unit. You will find more detail in the following pages of this booklet and also in the standard manual included in your kit. **IMPORTANT NOTE:** after wiring **BIG SOUND™** and before putting your tender back together, test to be sure you hear two whistle toots at start-up and three whistle toots in reverse. If the reverse is true, swap the wires in positions 1 and 2 on block P1. Sometime the wire pairs from the engine block are not soldered to same solder pad each time.





Use this diagram for wiring terminal blocks P1 and P2 if you completely removed the PCB from the circuit using OPTION 1:

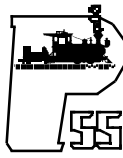
### LEFT SIDE - P1

- 1 pair #2 track wire & either green BIG BOOST™ wire
- 2 pair #1 track wire & either green BIG BOOST™ wire
- 3 blue jump wire for 9V battery (7.2V use rating)
- 4 red battery cap wire & red BIG BOOST™ wire (positive)
- 5 black battery cap & blue BIG BOOST™ wires (negative) & blue jump wire
- 6 volume increase switch outside wire
- 7 volume control switch center wire
- 8 volume decrease switch outside wire

### RIGHT SIDE - P2

- 1 1 black wire of pair #3-chuff wire
- 2 1 black wire of pair #3-chuff wire
- 3 crossing whistle reed switch (optional)
- 4 bell reed switch (optional)
- 5 not used for Bachmann Shay
- 6 not used for Bachmann Shay
- 7 not used for Bachmann Shay
- 8 ground for optional reed switches





Use the following diagram for terminal blocks P1 and P2 if you modify the connector PCB using OPTION 2:

### LEFT SIDE - P1

- 1 black track power wire & either green BIG BOOST™ wire
- 2 red track power wire & either green BIG BOOST™ wire
- 3 blue jump wire for 9V battery (7.2V use rating)
- 4 red battery cap wire & red BIG BOOST™ wire (positive)
- 5 black battery cap wire & blue BIG BOOST™ wire (negative) & blue jump wire
- 6 volume increase switch outside wire
- 7 volume control switch center wire
- 8 volume decrease switch outside wire

### RIGHT SIDE - P2

- 1 either yellow wire for chuffing
- 2 either yellow wire for chuffing
- 3 crossing whistle reed switch (optional)
- 4 bell reed switch (optional)
- 5 not used for Bachmann Shay
- 6 not used for Bachmann Shay
- 7 not used for Bachmann Shay
- 8 ground for optional reed switches

Terminal block P3 is used for the speaker in either case.

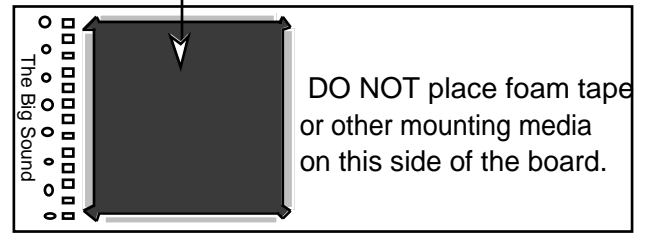
### BOTTOM - P3

- 1 & 2 speaker wires (no positive/negative polarity)



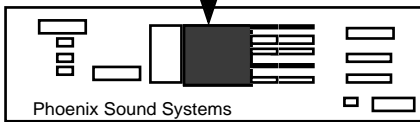
Your kit contains foam mounting squares for attaching the Big Sound™ board and the Big Boost™ board to the tender body. (See section 4 in this supplement for our suggested component placement.) You may want to use hook and loop tape (Velcro®) instead so the components can be

Place mounting pad here.



BACK OF BIG SOUND™

Place mounting pad here.



BACK OF BIG BOOST™

removed easily if necessary. For whatever adhesive you use, be sure to avoid placing it directly on the board circuitry. On the back of the sound board is a large black square (the microprocessor), which is a good spot for the tape. On the back of the booster board, a good spot is the small black square (I/C chip).



## The Sound Chips

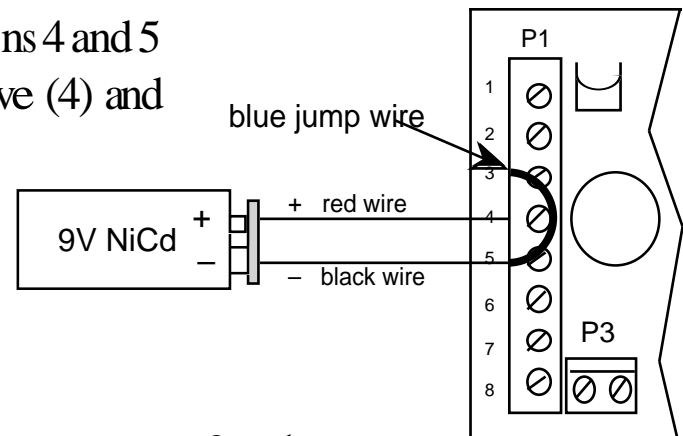
Your Bachmann Shay kit has specially programmed chips to allow the engine to produce the actual chuffing directly from the cylinders. For general information about the sound chips, please refer to the full instruction manual.

## The Battery

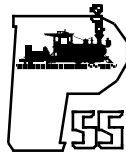
If your Shay is to be used with track power, you will need to install the 9-volt rechargeable nickel cadmium battery. To conserve space in the Spectrum® Shay installation, we have chosen to include a 9-volt battery with your Shay kit instead of the larger 6-volt gel-cell battery. Please note that the use rating for the 9-volt battery is 7.2 volts. There are 9-volt batteries with higher use voltages, but they are not appropriate for the BIG SOUND™ system. When we refer to a 9-volt battery in our drawings and written instructions, it is use rated at 7.2 volts.

To insure correct operation of your sound system, make sure your battery is fully charged the first time you run it or after it has been stored for an extended period. Batteries lose a small amount of charge sitting idle.

When you open your kit, the BIG SOUND™ board already has installed a battery snapcap in positions 4 and 5 on the P1 terminal block; the red wire is positive (4) and the black wire is negative (5). To install the battery, simply snap it into place matching the battery terminals with the cap terminals. That's it! Also installed in the sound board is a blue jump wire between positions 3 and 5.



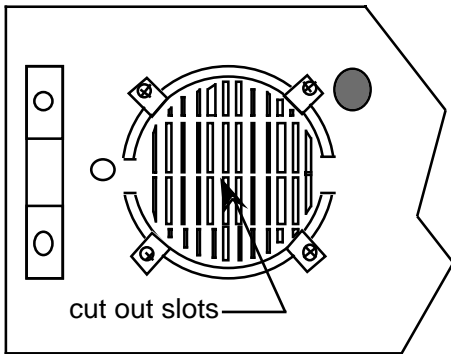
This jump wire must be installed when you use a 9-volt battery. If you decide to use a 6-volt sealed lead-acid battery instead, you would remove the snapcap and blue jump wire. Be sure to install the red (positive) wire into position 4 and the blue (negative) wire into position 5 if you use a 6-volt gel-cell battery. The screw-down terminals have a wire protector inside the holes, but more than one wire will fit in. You may have to loosen the screw all the way, insert the wires together, and then tighten the screw.



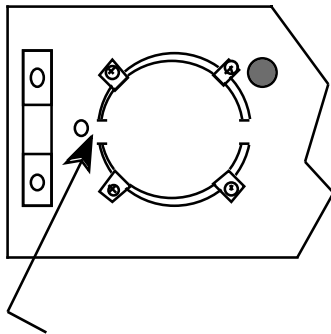
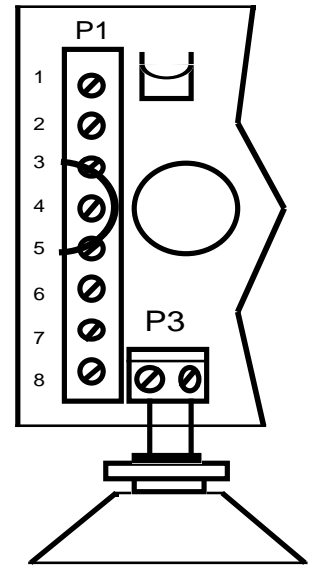
If you ordered a Bachmann Shay kit to be used with a power source other than track power, you do not need the battery, snapcap connector, or the blue jump wire. Your kit contains these things in case you decide to switch to track power in the future. Before installation you must remove the blue jump wire and the snapcap connector:

## The Speaker

Your Bachmann Shay kit contains a 3-inch round speaker without mounting "ears." The tender has a designated speaker opening, and the 3-inch round speaker fits neatly in the designated space. As with all BIG SOUND™ model 96 and model 97 kits, the speaker is installed into

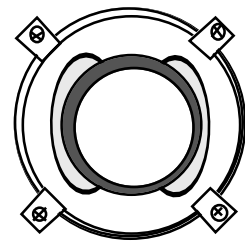


its own terminal marked P3 on the sound board. Page 7 of the full manual offers some additional comments about the speaker. There is no need to drill holes in your Spectrum™ Shay for the speaker opening; slots have been cut out for you.



Bring engine wires out here so speaker will not cut into insulation and short system

Even though the Bachmann Shay kit speaker does not have mounting "ears" with screw holes to secure it in place, the speaker opening in the floor of the tender is fitted with four screw-down clips. Loosen the screws, slide the speaker basket under the clips, and tighten the screws.





## The Switches

Your Bachmann Shay BIG SOUND™ kit includes a toggle switch for volume control and two reed switches that can be used with track magnets if you prefer to hear the whistle and bell at specific locations on your layout. (The chuffing reed switch and the DIP switch—which are standard kit components for other sound selections—are not needed for the Bachmann Shay installation.)

### Reed Switches

If you choose to use magnets on the track for bell and whistle activation at specific locations, you will need to mount the reed switches on the underside of the engine. We believe most operators will use either our speed-controlled, programmed sound sequence or a remote activation system, such as Locolinc® or Digitrax®. However, we have included two reed switches in the Bachmann Shay BIG SOUND™ kit in case you choose to use them. Here are our tips and suggestions for mounting the optional reed switches on your Bachmann Shay.

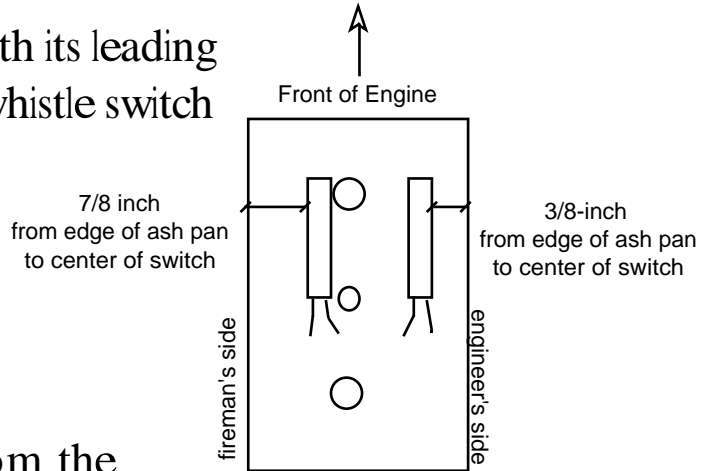
If you decide to use LGB magnets, the reed switches would be installed in a horizontal position on the underside of the engine on the ash pan since the LGB magnets are not particularly strong. If you want to mount the switches out of sight inside the engine's ash pan, you should choose stronger ceramic magnets such as Radio Shack model 64-1879 or model 64-1883. In our tests, the LGB magnets did not trip the reed switch mounted inside the engine in a consistent manner.

Mounting the reed switches inside the ash pan, when using Radio Shack magnets:

1. Remove the two screws that hold the ash pan in place on the bottom of the engine. Also remove the center screw that holds the engine's PC board in place. This allows you to remove the ash pan cover from the engine.
2. For installation of the switches, orient the ash pan so the silver side is face up as shown in the diagram on the next page. (The outside of the pan is black and the inside is silver-colored.)
3. We mount the bell activating reed switch on the fireman's side of the engine and the whistle activating switch on the engineer's side. The bell switch is mounted



7/8-inch from the edge of the ash pan with its leading end even with the front screw post. The whistle switch is mounted 3/8-inch from the edge of the ash pan also with its leading end even with the front post. This placement allows clearance on the underside of the PC board.

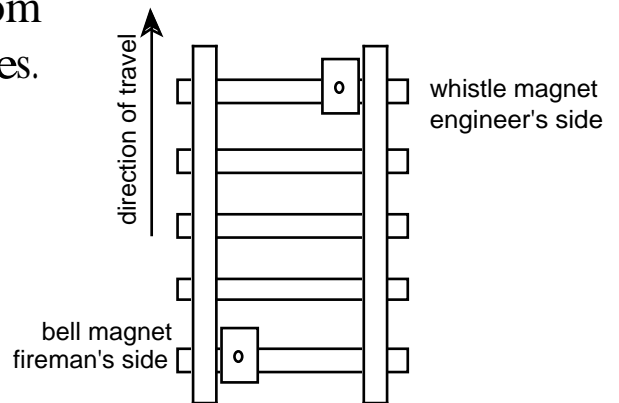
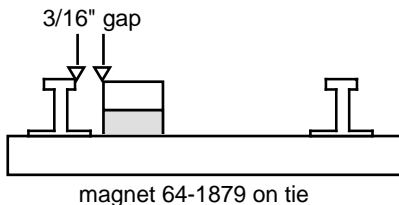


4. A group of engine wires extend from the electronic board in the ash pan to the tender. This group of wires is covered by a black plastic molding that is fastened to the underside of the engine by two phillips head screws, one near the ash pan on the bottom of the engine and the other (topside) inside the coal bunker on the floor. The wires from the two reed switches can be concealed by running them along with the Shay engine wires inside this molding

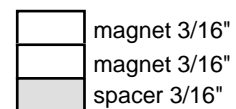
5. Radio Shack magnets, model 64-1879, are 3/16-inch thick. In order to bring the height on the magnet flush with the top of the rail, add a 3/16-inch spacer to the bottom of the magnet. The spacer may be wood, plastic, or any other material that will do the job.



6. Magnet 64-1879 should be located 3/16" from the rail on top of the tie, as shown in the sketches.

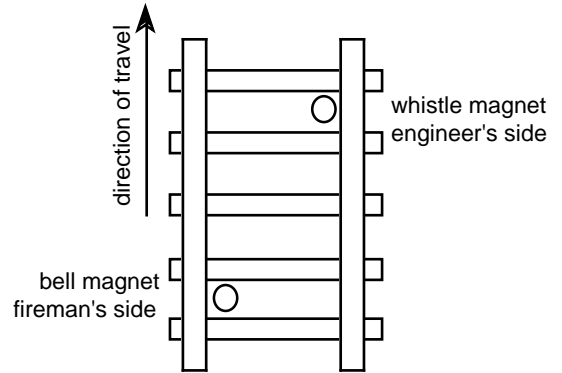
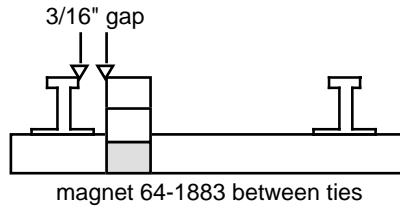


7. For Radio Shack model 64-1883 magnets, place two together and add a spacer of approximately 3/16-inch to make the stack even with the top of the rail.



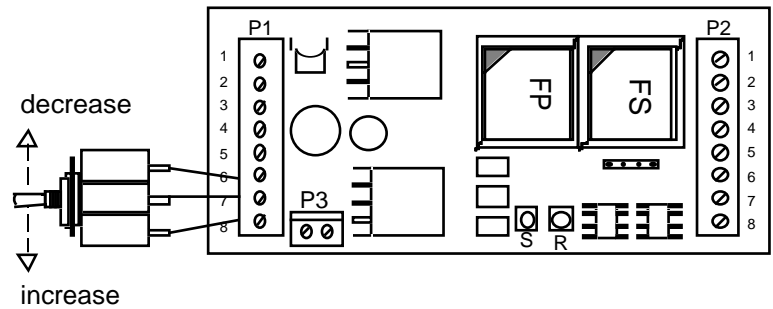


8. Place the 64-1883 magnets 3/16-inch from the edge of the rail, between the ties, as show in the sketches.

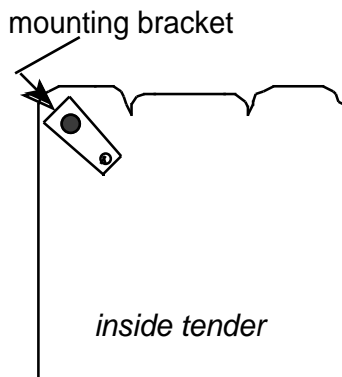


### Volume Control Switch

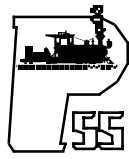
The volume control switch has three wires: the two outside wires are installed in positions 6 and 8 in terminal block P1 and the center wire is installed in position 7. After all components are installed and your system has power, you can set the volume to your liking by pushing the toggle in one direction for increase (toward position 6) or the opposite direction for decrease (toward position 8). Simply hold the toggle in the chosen position until the volume reaches the level you desire. The system "remembers" your selection each time you start up. Page 10 in your full manual gives additional information.



Your Bachmann Shay has a special place for the volume control switch that makes it readily accessible when you wish to adjust the volume.

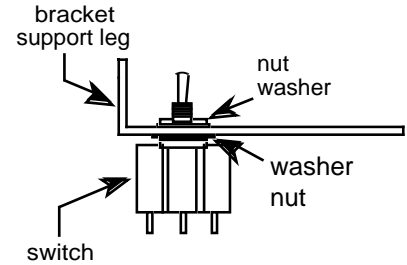


On the outside of the tender, look at the cab end of the coal load, on the engineer's side of the train. There is a small water valve fitted with a lid that has a crank handle. The lid pulls out to expose a hole, the perfect spot for the toggle lever of your volume control switch! [Please note: in later versions of the Shay, the crank handle cylindrical support may be glued to the tender body.



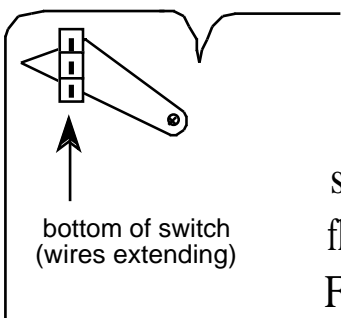
By using care the glue seal can be broken and the lid removed to expose the hole for the toggle lever.] Inside the tender body below the hole is a metal bracket fastened to the car with a phillips screw. Remove the screw and plate.

One extension of the bracket functions as the support leg. The larger hole in the other leg of the bracket is for mounting the volume control switch. On the volume control switch, unscrew one nut and one lock washer from the threads below the toggle lever. Leave the other washer and nut in place to serve as a spacer to properly adjust the protrusion of the toggle through the tender floor. This is important because the tiny valve lid will not fit back in the outside hole if the toggle extends too far. You need only enough of the lever peeking up to move it in either direction using your fingernail or a small screwdriver. A little experimentation may be necessary.



If you want the toggle lever to extend further through the tender floor and still have the water valve cover fit down over it, you could trim down the handle extension inside the valve lid and put a drop of glue to hold the handle in place. To extend the toggle lever's reach through the hole, experiment with removing one (or more) washers or nuts from the switch until you get the results you want. You want to be sure the valve cover will slide into the hole without obstruction. Keep in mind, though, that the lever cannot protrude too far or the valve lid will not fit flush (or nearly so) even after you have trimmed the handle extension.

In order to avoid loosening the switch mounting screw if you move the toggle lever often, position the switch relative to the bracket as shown in the sketch to the right



before reinstalling the bracket to the inside of the tender body. Insert the toggle lever through the hole in the floor of the tender and check the positioning of the toggle lever, making sure the tiny water valve lid fits back into place. (It may not fit flush with the tender floor, but it should not protrude too far.) Fasten the phillips screw securely.

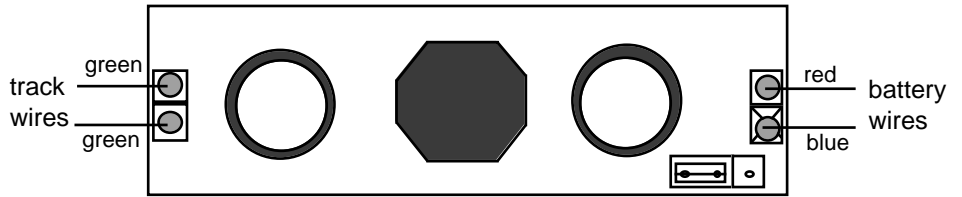




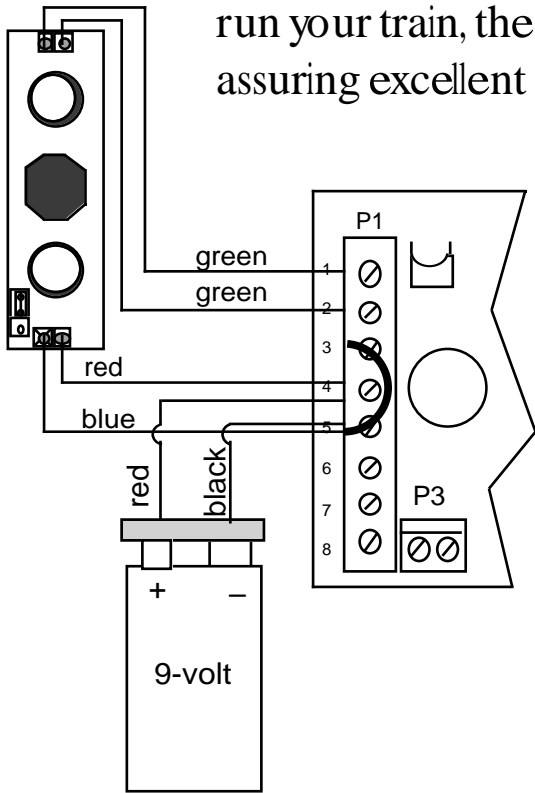
# Phoenix Big Boost™

dimensions: 2" L x 1/2" W x 1" H

Big Boost™ is included in your Shay kit if you are using track power with your train. If you are using battery power for your train, skip this section.



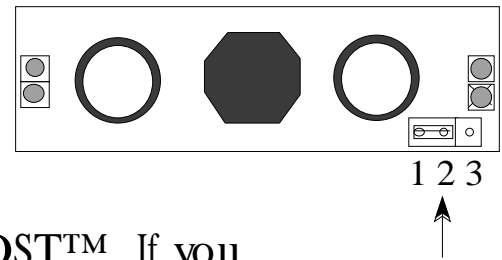
This compact board provides a power boost to your Shay system so when you are running at the typical slow speeds for Shay and using track power to run your train, the battery is kept charged and in optimal condition for assuring excellent sound output. When you place it inside the tender in the place designated in Section 4, you must tip it slightly to fit it inside the cavity.

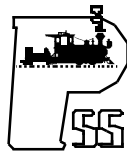


BIG BOOST™ is installed directly into the BIG SOUND™ board. The red and blue wires connect to positions 4 and 5 on terminal block P1, together with the battery snapcap wires. The red wire is positive (position 4) and the blue wire is negative (position 5). The snapcap wires are red for positive and black for negative. The green wires on the BIG BOOST™ are installed in positions 1 and 2 on the P1 terminal block along with the track power input wires from the Shay engine.

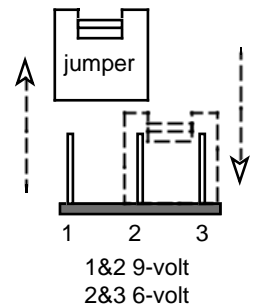
the Shay engine.

Near the red and blue wires on the end of the BIG BOOST™ board is a small block of three pins. A tiny jumper is installed on pins 1 and 2, which is the correct setting when you use a 9-volt (7.2V use rating) battery along with BIG BOOST™. If you should decide to use a 6-volt battery with your sound system, you will need to remove the jumper from pins 1 and 2 and place it on pins 2 and 3.





This is a simple matter of taking hold of the jumper and sliding it straight upward, then centering it over pins 2 and 3 and sliding it straight downward. If you intend to use BIG BOOST™ only with a rechargeable 9-volt nickel-cadmium battery (as it is packaged), you do not need to do anything with the jumper.



Our BIG BOOST™ can be used with both model 96 and our new model 97 kits. Although BIG BOOST™ is not a required component for our standard kits, it is especially useful if you run your trains consistently at low speeds. As the battery falls below its optimal point, BIG BOOST™ pushes the voltage to charging level to keep your system operating a peak performance. Even if you run your trains "all the time," BIG BOOST™ lets you forget about the battery and still have great sound each time you start up. If you decide to store your BIG SOUND™ for awhile, we recommend that you store it fully charged. There is no need to disconnect the battery. It's a good idea to charge your battery every six months for 6–8 hours and avoid letting the charge fall to zero.

A dedicated BIG BOOST™ can be wired into a five-volt LGB smoke unit, if you wish to have smoke at lower voltage. (The smoke unit in your Spectrum™ Shay is not a five-volt unit; you would have to retrofit the LGB smoke unit into your Shay.) BIG BOOST™ can also be wired into your lighting system to activate it at lower voltage and help keep the lights constant. One dedicated BIG BOOST™ can be used for both smoke and lighting systems. **DO NOT USE YOUR SOUND SYSTEM'S BIG BOOST™ WITH OTHER ACCESSORIES.** If a smoke unit is wired into the dedicated sound system booster, the system's battery will keep the smoke unit ON and HOT with the chance of ruining your engine or causing more serious hazards. And your system's battery would eventually drain completely, defeating the primary function of the booster.

BIG BOOST™ can be purchased separately—with complete wiring instructions—from your favorite hobby shop or directly from Phoenix Sound. Your kit contains a copy of the wiring instructions to provide more detail about BIG BOOST™.



## Section 4: TROUBLESHOOTING

Your installation is complete and it is time to run your Shay, something you've been patiently waiting to do! If you find that the chuffing pattern sounds irregular or odd, the likely cause is inconsistent contact of the cylinders with the sound contacts. For the Spectrum® Shay, the mechanics of the engine determine the chuffing rather than a program in the sound chips. An interrupted chuffing pattern can also cause bells, whistles, and other sounds to emit randomly or unexpectedly. If you encounter sound pattern problems, you should check the cylinder–sound contact action of your Shay. To do this you must remove the cylinder assembly to look inside the engine. Please refer to the Troubleshooting Guide in your kit (page 7–8) and to Bachmann's Operator's Manual (page 24) for help in getting inside the Shay.

In correct operation, the cylinders pump up and down and a momentary contact made between the cylinder head and the brass sound contact. If the cylinder and sound contact do not meet consistently, the chuffing pattern will not be correct and the sound system cannot determine what action is required. You should check to see whether the sound contacts are bent, out of alignment, or broken. If the contacts are simply bent a little, you may be able to gently straighten them into position. However, if the contacts are seriously out of alignment or if they are broken, you should get in touch with Bachmann for further help with repair.

When the connection between the cylinders and sound contacts is firm and consistent, the chuffing will sound right and all the sounds will then be in synchronization with the movement of your train.

We wish you many hours of listening pleasure with your Phoenix Big Sound™ system.

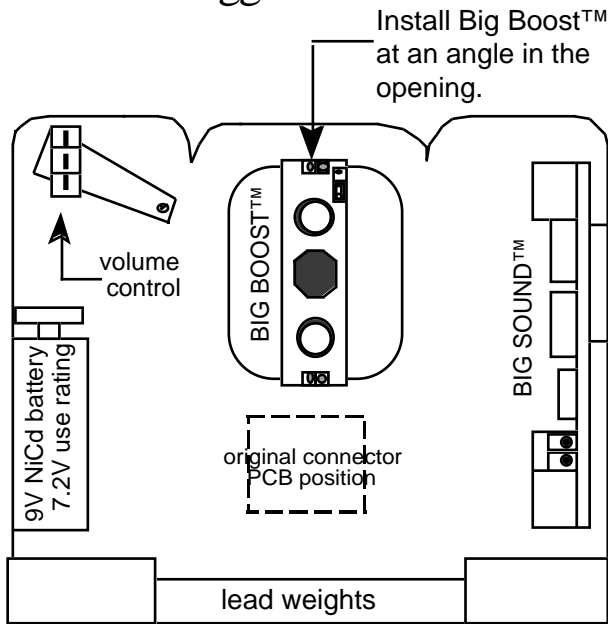
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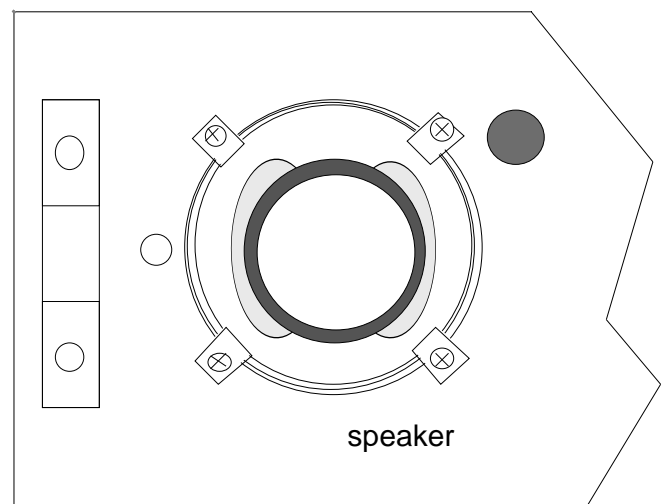
## SECTION 5: COMPONENT PLACEMENT

Please note (again!): the sketches in this manual are not drawn to scale and are very simplified. Their purpose is to offer you a visual aid when installing your BIG SOUND™

If you have removed the connector PCB board, you have freed up extra room for your sound system. But even if you chose to leave the connector PCB in the wiring system, there is still plenty of room for all the kit components. Here is the component placement we suggest:



LOOKING UP INSIDE  
TENDER SHELL



LOOKING DOWN ON FLOOR  
OF TENDER