BigSound™ 2K2 Handbook

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Introduction

Dear Model Railroading Friends,

Thank you for allowing Phoenix Sound Systems to enhance your railroad. This board is the result of several years of working with sounds, listening to our customer's feedback and researching the latest in electronic components. The 2K2 board is smaller than our previous systems and is designed for applications that have constantly available power - such as DCC, constant track power or on board batteries.

One of the things we know many of our customers will like is the ability to load sounds from our Library CD using a personal computer. You will also be able to extensively configure the system to sound the way you would like it.

We know you're eager to do some listening, so continue on through the initial checkout. The Phoenix Big Sound™ board comes with even higher voltage tolerance to protect against improper wiring and over-voltage gremlins. Even so, if you notice static electric sparks when you touch things - ground yourself by touching something conductive before handling your board. Also be careful not to lay the board on metal surfaces or model parts when powered. Basic electrical component handling care is always a good idea. Happy Listening!

Initial Checkout

Your kit would normally include: the sound board (pictured below), a battery that plugs into the board, a speaker, a volume switch, reed switches, and the Remote Access Jack. Reed switches (the little brown tubes with wires) are switches that close in the presence of a magnetic field. Most steam kits also include two small magnets (usually stuck together) that are mounted to an axle to sense train speed.

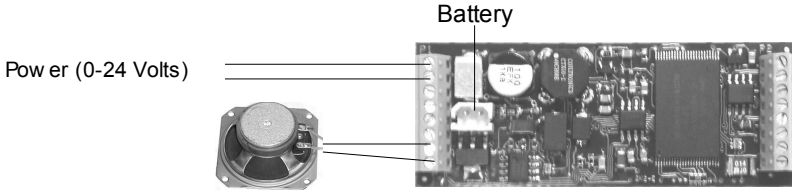Terminal 1 ... Terminal 16

Terminal 8 ... Terminal 9
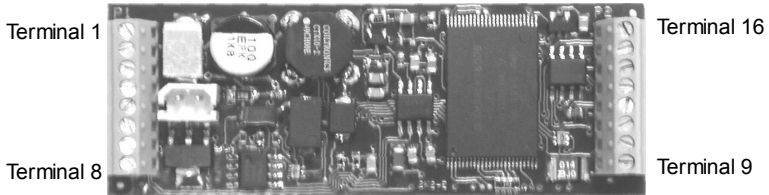
The Terminals, 8 on each end of the board, are numbered 1 through 16. Terminals 1-8 are on the same end as the battery connector. 9-16 are at the opposite end. Terminal 16 is across from terminal 1. The terminals are defined as follows: terminals 10 through 15 are the "trigger" inputs. They are used to cause sounds or effects to occur. Terminal 10 can be used as a trigger input even if the computer access jack is connected

Terminal	Function	Terminal	Function
1	Track/Motor Power	16	Ground / Access Jack (Black)
2	Track/Motor Power	15	Input (Speed)
3	Line Out (Audio)	14	Input (Whistle/Horn)
4	Volume (Increase)	13	Input (Bell)
5	Volume (Ground)	12	Input
6	Volume (Decrease)	11	Input
7	Speaker	10	Input / Access Jack (Yellow)
8	Speaker	9	Access Jack (Red) / 5V 100mA

The Basic Bench Test

Each system is tested before it is shipped but we recommend that you hook things up on your workbench, play with the system a little, charge the battery, and do any configuring needed before you begin the installation.

Battery

Power (0-24 Volts)

For bench testing, connect the speaker to terminals 7 & 8, plug in the battery, and hook your bench power supply to terminals 1 & 2.

Until the battery is charged, you will not get sound until the external power supply reaches near 6 Volts. Also, since the board runs off the battery below 6 Volts, you will not get idle sounds and you will not be able to adjust the starting voltage until the battery is charged.

Maximum battery charging occurs at about 8 Volts (30 minutes will bring the battery up enough for normal operation while 2 hours gives you a full charge). With a charged battery, the sound system should play the idle sounds for approximately 20 seconds after turning off the power supply and then shut down.

Diesels will rev up and down as you adjust the supply voltage. A steam engine system on the other hand will sit in idle (Coal Shoveling and Air Compressor play periodically) until it sees motion contacts connecting terminal 15 to ground. Each closure produces a Chuff. At first Chuff, the directional toots play and the bell starts ringing.

Steam can be configured to run off of voltage and diesel can be changed to look for wheel rotation. We initially set them up the way most modelers will use them.

Further Explorations

Hook up the volume control switch (terminals 4, 5 & 6) and run the volume up and down. Hold the switch until the volume reaches the level you want, and then release it.

Find a short wire or a pair of tweezers. Momentarily short between terminals 14 and 16, this should cause the crossing whistle (horn) to play. Then try terminals 13 and 16, this should be the bell.

If you will be using reed switches and magnets, you might want to hook them up and experiment with the magnets to get an idea of the sensitivity of the reed switches. This will help you decide how to mount them in the locomotive or car. At this point, you may want to study the manual further to decide if you want to do some configuring or further testing before installation.

In order to take full advantage of all Phoenix BigSound™ 2K2 features we recommend the ...

Computer Interface

A CD and serial cable are available for use with Windows 95, 98, ME, 2000,XP and Vista. The CD contains software to customize sounds from the Phoenix Sound library. Connecting the serial cable to the 2K2 board through the jack supplied with the sound system allows you to download sounds for different engines and change the following:

- Individual sound volumes
- Manual vs. Programmed response for bells and whistles (horns)
- Assign sounds to terminals and DCC functions
- Adjust how often a sound plays
- Set maximum power consumption from track
- Change turn off time
- Change and modify chuff rhythm, compression and tone
- Configure for various control systems such as: AC, DC, DCC, RC, Locolinc®, Aristocraft/Crest Train Engineer, RCS, Reeds and Air Wire 900
- And more!

All adjustments, upgrades and sound loading are made through the access jack. You will not need to take the model apart after installation.

Sounds and Effects

Standard Configuration

Almost all sounds will play automatically based on train speed. Many sounds are also preset to play using designated trigger inputs. The following section describes the standard sound system configuration.

All Systems

Whistle/Horn — Toots when starting (2 forward, 3 reverse) and stopping (one toot). Crossing whistle sequence plays when you reach the Whistle/Horn play speed. You must slow down to at least 75% of the play speed in order to have it play again when you speed back up.

Bell — Plays when you first start moving and just before stopping. You must reach twice the bell stopping speed in order to replay the bell when stopping. The bell will not replay unless 35 seconds have elapsed from the last time it played.

Coupler Clank — Plays when you come to a stop in reverse; will not replay until you go forward and back up again.

Brake Squeal — Plays just before stopping.

Tunnel Fade — This trigger causes the volume to fade down to a lower setting. When the input is triggered again, the volume will come back to the prefade setting.

Doppler — In diesel, when you trigger this input, the next time the crossing horn plays it will go thorough the pitch shift that you hear as a train is speeding toward and then away from you. Doppler is speed sensitive. In steam, triggering this effect will cause the pitch of the chuff to shift as the engine approaches and a second triggering will cause the pitch to shift back to normal.

Working/Drifting — An effect that makes the locomotive sound like it is struggling with a heavy train.

Demo Mode — Plays a sequence of sounds representing the train at idle, starting out, reaching high speed and coming back to a stop. Used mainly for stationary displays.

Diesel Only

Air Pop — Plays periodically during idle.

Brake Release — Plays as the engine starts moving.

Dynamic Brake — A triggered only sound. It is initially attached to terminal 11 and DCC function F5.

Wheel Squeal — Plays for a set time when triggered.

Rev Up — Causes the prime mover sound to leave idle and go to first rev. This is a toggle function. The diesel cannot drop back into idle until the input is triggered again. Revs 2 - 8 will occur normally.

Steam Only

Blow Down — A longer and more vigorous steam release that clears the flues. Plays as you slow down.

Steam Release — Plays after you come to a stop.

Generator (Dynamo) — Basically runs all the time but the engineer will shut it down if the engine sits in idle for awhile. Comes back on when voltage approaches the start-up voltage.

Water Fill — Plays 10 seconds after stopping, if terminal 11 was triggered.

Coal Loading — Plays 10 seconds after stopping if terminal 12 was triggered.

Air Pump — Plays in idle to maintain air pressure.

Air Pump 2 — A sustained compressor run that restores air pressure after it's been depleted.

Rod clank — Plays at slow speed

Hiss — Plays at low speed, clears the cylinders of excess water.

Mallet Mode — Plays a second set of chuffs, moving in and out of phase with the main chuff. Also known as Double Chuff Mode.

Coal Shoveling — Plays periodically while engine sits at idle.

Default Assignments

Trigger Assignments

Terminal	Diesel Sound/Effect	Steam Sound/Effect
10	Working	Drifting
11	Dynamic Brake	Water Fill
12	Rev Up	Coal Loading
13	Bell (Auto & Pin 13)	Bell (Auto & Pin 13)
14	Crossing Horn (Auto & Pin 14)	Crossing Whistle (Auto & Pin 14)
15	Train Speed (trigger mode)	Train Speed

DCC Assignments

Address: 3

Function	Diesel	Steam
F1	Bell	Bell
F2	Manual Horn	Manual Whistle
F3	Coupler	Coupler
F4	Crossing Horn	Crossing Whistle
F5	Working	Blow down
F6	Dynamic Brake	Water Fill
F7	Rev Up	Coal Loading
F8	<not assigned>	<not assigned>
F9	<future implementation>	<future implementation>
F10	<future implementation>	<future implementation>
F11	<future implementation>	<future implementation>
F12	<future implementation>	<future implementation>

Adjusting Settings

All of the following adjustments can be more easily made using the Phoenix Computer Interface. You can still do a great deal of configuration without the Computer Interface. The functions that can be configured without the interface are summarized in the table below:

Input (terminal)	Open (Not Connected)	Grounded (Connected to terminal 16)
10 Horn (Diesel)	Multiple Chime	Single Chime
Whistle (Steam	Hand rung	Mechanically rung
11 Signal Sequence	Programmed	Manual
12 Input Sense	Active Low	Active High
13 Demo Mode	Off (normal)	On
14 Chuff (Steam)	Normal	Double (Mallet)
Slave Mode (Diesel)	Off (normal)	On
15 Train Speed by	Voltage	Trigger

To ground terminals connect a wire between the terminal you want to ground and terminal 16.

Configuration Overview

Manual configuration is accomplished by connecting volume inputs to ground before turning the board on. The system sees that the volume inputs are not in their normal "off" state and it will enter one of the three configuration modes. These modes are: Option Selection, Start Voltage Adjustment, and Rate Adjustment.

Option Selection Mode

To enter Option Selection Mode, both the Volume Raise and Volume Lower inputs are connected to ground. This is most easily accomplished by putting three short wires in terminals 4, 5, & 6 and twisting them together.

For Train Engineer and Locolinc® — You need to invert the sense of the triggers. (Whistle will be "on" except when you hold the button if you don't do this). Follow the Manual Signaling example but in step 2 connect terminal 12 rather than 11 to ground. If you want inverted triggers and manual signaling, connect terminals 11 and 12 to ground.

For Double Heading — When you don't want any signaling from the second locomotive, set the whistle and bell to manual and do not connect the whistle and bell triggers.

Option Selection Example: Steam Speed from Voltage

1. Connect together terminals 4, 5 and 6.
2. Remove ALL wires from terminals 9-16. This will select all the options in the "Open" (No Connections) column.
3. Apply power to terminals 1 and 2. The board will not make any sound until the next step.
4. Unhook the wires from terminals 4, 5 and 6. The sound will come on as soon as one of the wires is disconnected.
5. Turn power off and remove any option selection jumpers. Hook up your normal wiring.

ALL OPTION SELECTION JUMPERS MUST BE INSTALLED BEFORE YOU APPLY POWER.

This will not only select train speed by voltage, but will also select all the other options in the "Open" (No Connections) column which are the default options.

Option Selection Example: Manual Signaling

The normal setup is for preprogrammed signaling. This automatically gives you the start and stop toots and a crossing whistle at a high speed. If you want to do your own signaling because you have a remote control horn button, you need to switch the horn/whistle to manual mode. In this mode, the whistle blows as long as the button is held down. This is how you would configure for manual signals:

1. Connect together terminals 4, 5 and 6.
2. Select the options – In this case (for Manual Signaling) connect terminal 11 to 16 (ground).
3. Apply power to terminals 1 and 2. The board will not make any sound until the next step.
4. Unhook the wires from 4, 5 and 6. The sound will come on as soon as one of the wires is disconnected.
5. Turn power off and remove any option selection jumpers. Hook up your normal wiring.

NOTE THAT THIS WILL GIVE YOU ALL THE "OPEN" COLUMN OPTIONS EXCEPT FOR THE ONE FOR TERMINAL 11. EACH TIME YOU DO THE PROCEDURE YOU GET A COMPLETE SET OF OPTION SELECTIONS DEPENDING ON WHICH OF TERMINALS 10-15 ARE GROUNDED OR NOT.

Start Voltage Adjustment

If you ordered a sound system to match your locomotive, you can probably skip this step, however you may still want to fine tune the sounds to motion relationship.

The Starting Voltage is the voltage at which the train begins to move and the sound changes from idle to running. In trigger mode there are some sounds that play based upon the starting voltage, even though voltage does not determine speed. To adjust the starting voltage you will need to ground terminal 6 and 5 together. To do this is:

1. Make sure sound system is off.
2. Hold volume switch in LOWER position.
3. Turn on sound system by supplying power to Terminals 1 & 2.
4. When you hear the sound system start, release the switch.
5. Now you are in configuration mode for Starting Voltage.
6. At this point, the volume switch will adjust the starting voltage. For each second you hold the switch, the starting voltage will adjust 1 volt in the direction you are holding it.
7. Test your locomotive with the new settings before shutting it down. You will be in configuration mode and be able to adjust the starting voltage until the system is shut down.
8. When you are satisfied with the settings let the system run for at least 20 seconds before powering down. The system will not save the changes until they have been stable for 20 seconds.
9. If you move set the Starting Voltage to zero, the system will never idle and will not shut down until the battery is depleted. If the system is not shutting off, nudge the volume switch in the raise position to increase the setting from zero. If the battery is removed or drained while in the never shut down condition, it is very difficult to recover.
10. When you power your system back up, your starting voltage should be adjusted to your setting of choice and the volume switch should be back into normal mode and control your sound volume.

Rate Adjustment

The Rate is the relationship between voltage and train speed. To adjust the Rate do the same as above EXCEPT hold the switch to the RAISE position upon power up (step 2). This adjustment allows you to match the Chuff Rate (Steam) or Engine Rev Level (Diesel) to the operating characteristics of the engine.

Installation Guidelines

Speaker — Use the largest speaker that can reasonably fit. For best acoustics, the speaker should be sealed to the floor so that sound going out the front of the speaker is isolated from the back side.
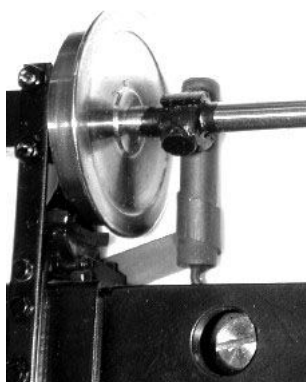
Volume Switch and Access Jack — Unobtrusive but accessible. Typically in the floor of tenders and boxcars and on the fuel tanks of diesels. Many models have removable pieces, doors, etc. where you can mount these. Volume switch requires a 1/4" hole, 9/32" for the access jack.

Mounting Battery & Sound Board — Make sure that the sound board will not bump into anything metal. Use the supplied foam tape, or many modelers prefer the hook and loop tape. A double stick square on the large black chip will secure the sound board.

Reed Switches — If you use track magnets and reed switches to trigger sounds and effects, keep the reed switches away from the speaker magnet and strong motor magnets. Reed switches should ride about 1/4" above rail head and be spaced 1/2" on either side of center. The reed switches can be mounted through 1/4" holes.
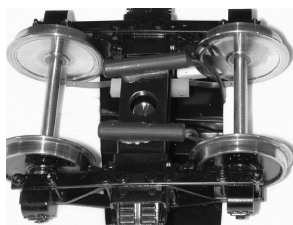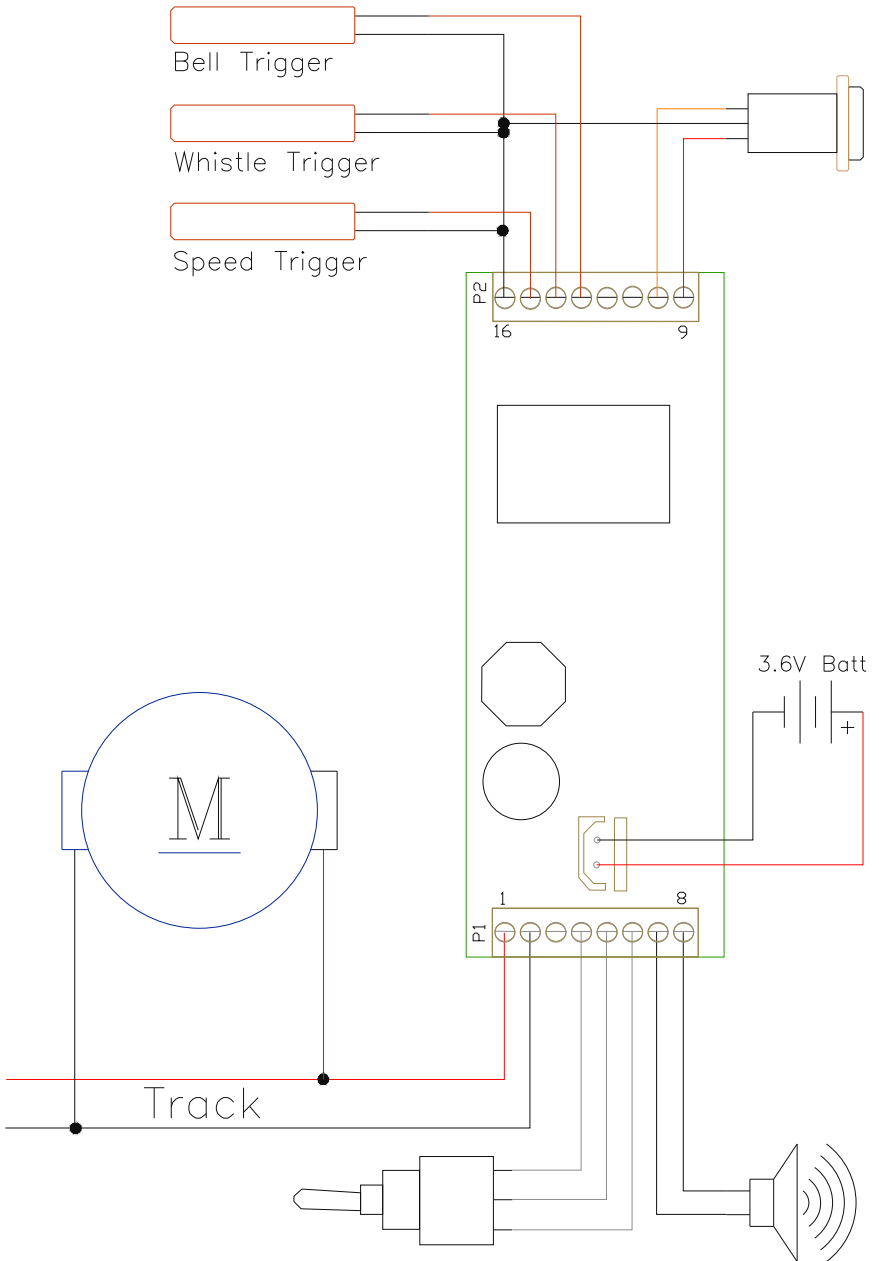
Speed Sensor — You may need to experiment to get reliable triggering from a rotating axle with a magnet on it. After mounting the magnets on the axle, hold the reed switch in various possible positions and hook something to the reed so you can tell when it's tripping. An ohmmeter with a beeper works great. You can point the reed switch directly at the axle/magnets but there will be less motion tolerance. With the magnets sweeping the side of the reed switch (as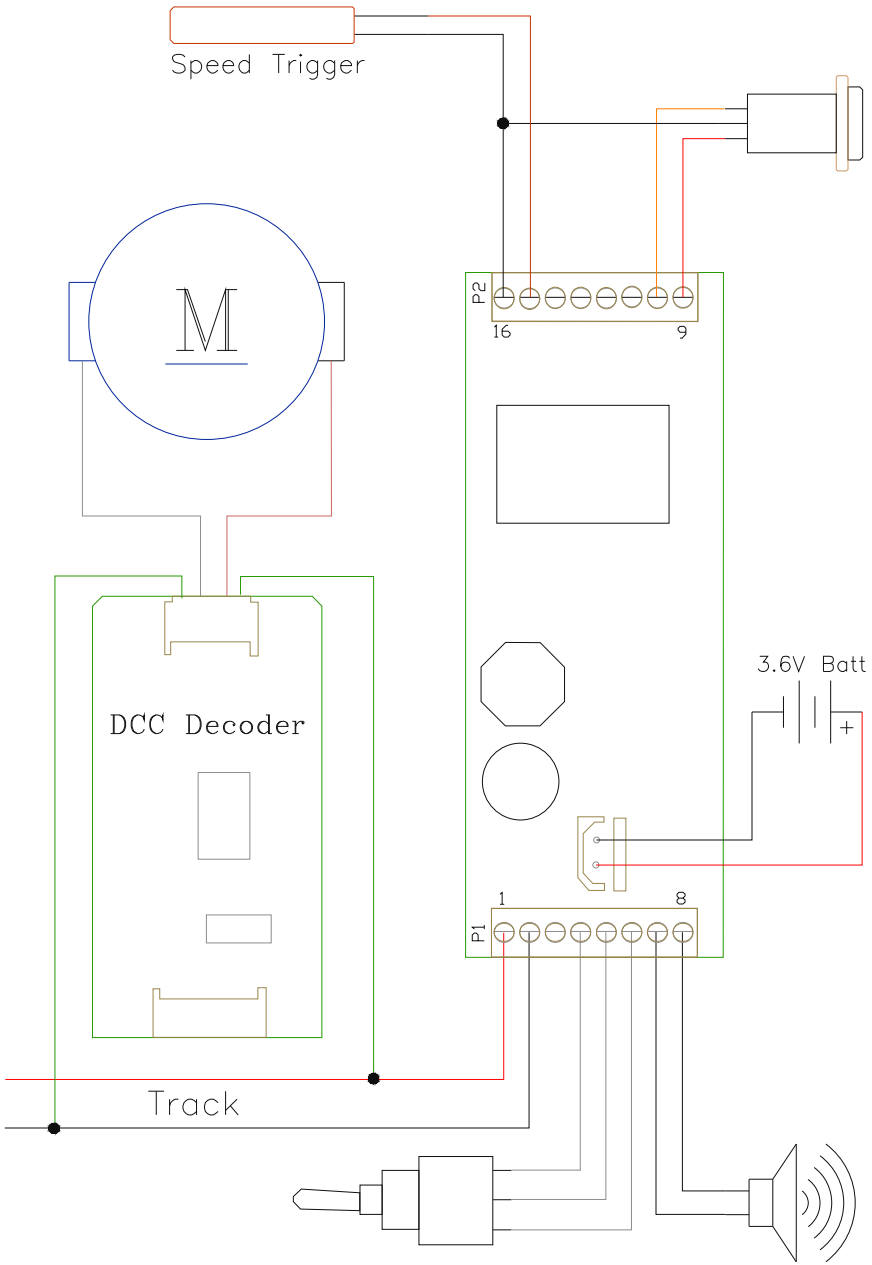 shown) a clearance of about 3/16" is usually about right. If you are too close you may get extra closures—one as the magnet approaches, and one as it leaves.
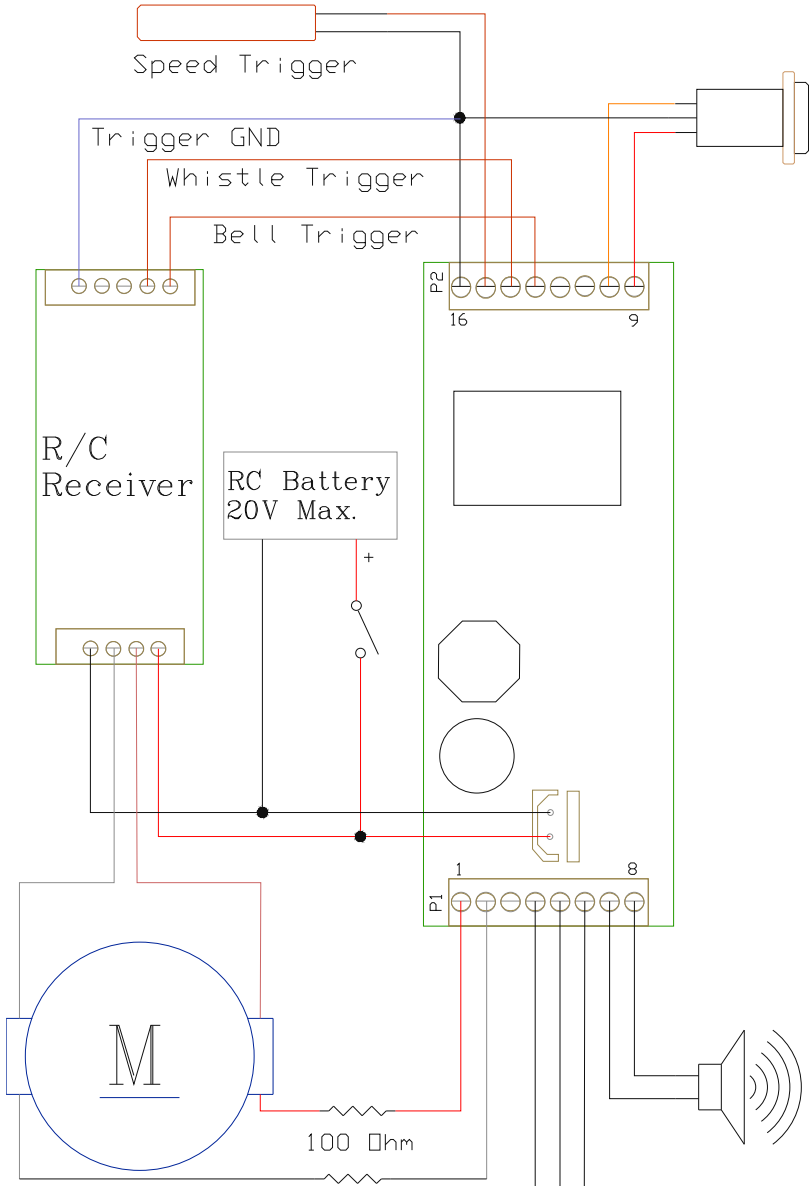
Wiring Diagrams

Basic DC

Bell Trigger

Whistle Trigger

Speed Trigger

P2

16   9

3.6V Batt

+

M

P1

1   8

Track

Basic DCC

Speed Trigger

M

P2

16   9

DCC Decoder

3.6V Batt

+

1   8

P1

Track

Remote Control

Speed Trigger

Trigger GND

Whistle Trigger

Bell Trigger

P2

16   9

R/C
Receiver

RC Battery
20V Max.

+

P1

1   8

M

100 Ohm

Resistors are optional and
suggested. They are not
needed if using the 3.6V Battery

Ride On

Bell Trigger

Whistle Trigger

Speed Trigger

P2

16   9

12V Batt   12V Batt

+   +

MC

M

Amplifier

1   8

P1

100 Ohm

Note: Connect Battery Positve
to Terminal 1 to power system
if not hooking to motor.
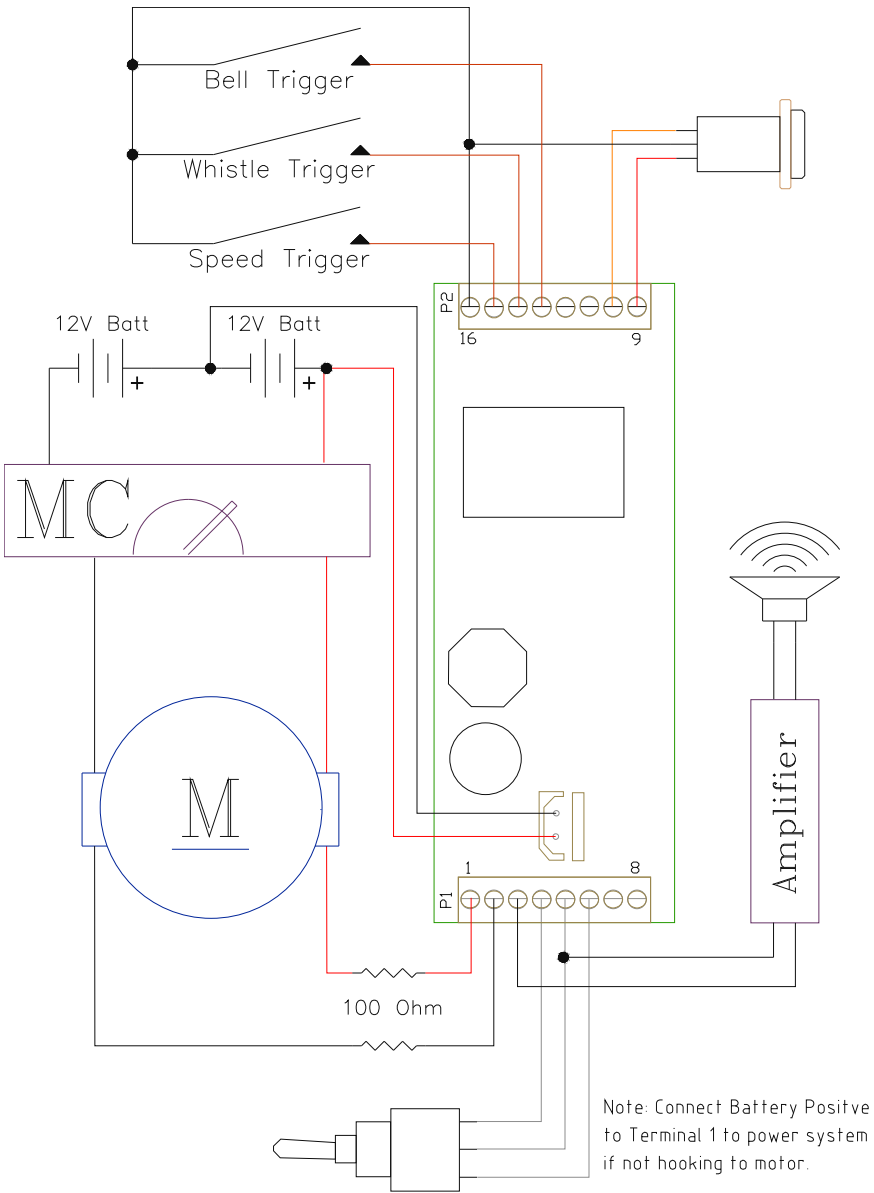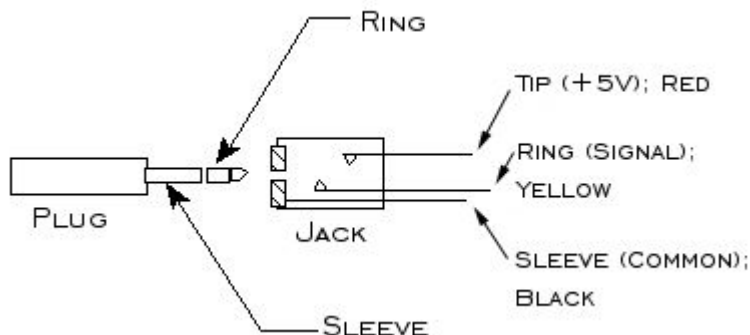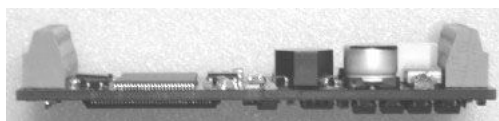
Other Diagrams

Computer Interface Access Jack Wiring Diagram

Circuit Board Dimensions & Specs

Length — 2.87 in; 73 mm

Width — 1.12 in; 2.86 mm

Height — 0.5 in; 1.27 mm

Max Volts at Track — 24V (rev. E, F & G2* boards), 30V (rev. G).

Max Battery Volts — 20V - Filtered DC.

Battery Charging — The sound board will only charge a 3.6V Ni-Cd battery.

Power Consumption — Varies with volume and battery condition; can go as high as 800mA if at max volume and max charging. Typical is less than 100mA - charged battery, medium volume.

5 Volt Supply — 100mA.

Open Circuit Input Voltage — 2.6V.

Speaker — 4 Ohms minimum, two 8 Ohm speakers in parallel is fine.

*REVISION G2 SOUND BOARD SERIAL NUMBERS PREFIXED WITH THE LETTERS G, H AND J.

Troubleshooting

Board never shuts off — Residual voltage on the track. Many transformers leak a little voltage to the track when the speed is set to zero. Try turning the transformer off or unplugging it. The surest test would be to take the entire sound system off the track and see if it shuts down.

Board turns on by itself or when power is turned on — Voltage transients. Railroads can be electrically noisy. Pushing a locomotive by hand can generate a voltage that will trigger the sound system to come on. Power line surges can sometimes feed through the power supply and start the system up.

Wrong directional toots — Swap wires at terminals 1 and 2 or change the polarity setting using the Computer Interface.

No Sound — Start by rechecking the wiring to the speaker, volume switch, and terminals 1 and 2, a connection may have been missed or become loose. Measure the voltage applied to terminals 1 and 2 when you think the board should be on. With a good battery (4 or more volts) the board will turn on at .6 volts. With a discharged battery, 5 volts is needed to make sound. It may be something as simple as the volume is turned down. Try raising the volume with the toggle switch. Also, check the the volume switch and its connectors to make sure there is no damage or broken connections and that the switch terminals are not touching anything metal.

Low Volume — If the volume is lower than your chosen setting when you start up or if the volume gets lower during operation, there's a good chance that the battery needs to be charged. Check the battery's voltage or charge the battery through the built in charging system by letting your sound car/engine stand under power for several hours.

Erratic Chuffing — The axle magnets may not be symmetrically mounted. If the reed switch is not mounted to the truck the distance to the magnet might change during curves. The wires coming from the reed switch might be intermittent, broken, or loose. Engines with built-in contacts (Bachmann Spectrum) may need the contacts cleaned and/or oiled. This is likely the problem if chuffing seems faster than normal.

Can't Set DCC Address — If you are programming the DCC address on a "programming" track you will need to have a charged battery and you will need to send the address twice. When you send the address the second time, the sound system should already be on, running off the battery and expecting the DCC command.

The Battery — If your system has been sitting unused for some time it is possible that the battery is not at full charge. If battery voltage is below 3.6 volts, the board will not make sound until it sees about 5 volts at terminals 1 and 2 instead of the normal 0.6 volts required for turn on. The battery will recover enough for normal operation after about a half hour charging with 8 volts on terminals 1 and 2. A fully charged battery will read 4.2 volts while it is powering the system with no voltage at terminals 1 and 2. The system will run normally until the battery voltage drops to about 3.8 volts. At this voltage, volume reduction starts to occur.

Battery Not Charging — This is usually caused by running very slowly too often or by using a noisy unregulated power supply. The power supply should have at least a 30VA rating (2 amps at 15 volts). Unfiltered supplies do not supply as much useful charging current as a filtered supply. Many engines have a motor cut-off so you can let the engine sit and charge the battery. Please note that voltage greater than 10V at the sound board will actually take the system longer to charge the battery.

Warranty

The BigSound™ electronic board is manufactured to the highest standards using the latest assembly technology and quality, conservatively rated parts. We are dedicated to producing the world's finest sound system for years of railroading enjoyment.

The materials and operation of the BigSound™ electronic board and associated system kit components supplied by Phoenix are guaranteed to perform correctly for one year when installed and operated according to the instruction manual. In the unlikely event that your BigSound™ system fails, please call or e-mail us so that we may evaluate the situation and save any unnecessary shipping. We prefer to pre-access returns because frequently there is a simple explanation for any perceived problem you may be experiencing. Repairs and or replacements covered by this warranty are at no cost. However return shipping may be charged, especially if you return your system in an engine, tender, box car or the like. A service fee may be assessed if it is determined that the failure was not due to any Phoenix supplied components.

Phoenix Sound Systems, Inc. cannot be liable for damage to the system during shipping to our facilities due to mishandling, inadequate packaging or similar circumstances beyond our control. Please be sure to package the BigSound™ in a secure, static safe manner.

Please read the handbook and any included installation notes prior to installation and operation of your BigSound™ system. Contact us if you have questions or are unsure about any aspect of installation or operation.