

CAUTION: This device can be damaged by static discharge. Please exercise care during installation to avoid this possibility. Discharge yourself to an electrical ground (outlet cover screw) before removing this device from its anti-static bag. Please read instruction sheet completely before attempting to install and operate this product. Save the anti-static bag for possible reuse of storing or shipping the sound unit!

OVERVIEW: This device is an electronic, self contained, sound system for installation in model steam locomotives that are designed to operate with conventional DC track power or other types of control systems including radio with either track or battery power, also as a stationary sound unit. Because of its dimensions (2.7" x 0.9" x approx. 0.5" high) the sound system may be limited to installations in some powered units making the need for use of a "dummy" unit or a trailing car. This unit differs from the standard DC type sound systems in that it contains automatic Whistle play patterns each time the input is triggered. Triggering the play patterns is done by the use of a reed switch passing a fixed magnet. The Bell is also triggered on and off in the same manner. Large gauge "G" operators usually place the reed switch beneath the locomotive. One side is used for the Whistle, the other side for the Bell. Magnet trips are then placed in the track. Another method of operation is to operate the sound system as a stationary unit and place the magnets on the underside of an engine or car.

An on/off switch (not included) must be used to power the sound unit on and off in some applications. The audio amplifier can produce 1.1 watt of power which is in excess of what most small speakers can handle. If more audio power is desired, an amplifier such as item #671 or #672 can be used. The speaker impedance must be 8 ohms or higher. Sound volume is adjustable. Refer to our catalog for available speakers. Always try to use the largest size speaker for the space allotted or multiple cluster's of four smaller speakers also works well.

Sounds produced via momentary reed switch closure are automated Whistle patterns, and a bell. Non-user controllable sounds include periodic air system pressure release, brake release and steam exhaust chuff sound automatically adjusted to speed and load conditions.

INSTALLATION INSTRUCTIONS: The sound system consists of a printed circuit board, a speaker, four 2-pin connectors with wires and one 3-pin connector with wires. Refer to the drawing on page 2 to familiarize yourself with the connectors and controls on the sound board. Then refer to the specific instruction sheets for the type of installation you intend to make. Before proceeding with the installation read the balance of the instructions carefully so you will be completely familiar with what is required and what sounds you should hear.

The circuit board should be mounted so that at minimum, the volume control is accessible either through the frame or via a hatch or a hole in the locomotive body shell. Be certain that the components on the circuit board do not come in contact with any metal objects as such contact can destroy the sound system. The speaker should be mounted as per available space bearing in mind that sound reproduction is enhanced when a speaker is properly enclosed and baffled.

If a DC locomotive is not moving, there is no track power, therefore to have sound it is necessary to have a separate power supply for the sound system. For in locomotive use, this separate supply is a battery. Without a battery, the sound will not work at lower track voltages. For some this is not a problem. Drawings are supplied for multiple types of connections. If using batteries, we suggest the use of one 9 volt or 6 AA or 6 AAA batteries in series to maximize volume potential and battery life. Rechargeable batteries can be used. When connecting the battery (DC) power leads be absolutely certain that wires connect to the proper DC input leads.

Installation of the reed switches is easily done by making the appropriate wire connections and placing the reed switch in the proper location for magnet activation. When removing the reed switches, be careful not to crack the glass. Do not bend the leads at the glass ends, use a needle nose pliers to hold the wire entering the glass and then bend the wire. Bending at the glass will break or deform the alignment of the reed switch. Carefully solder wires and cut excess lead ends. Reed switches are not warranted under any circumstance since they are quite fragile and

easily broken physically and electrically. Extra reed switches are available, item 989. After appropriate lengths of wire are placed on the reed switch, secure the reed switch with either double sided tape (item 388) or other type of glue. Make sure that all wires to the reed switches and sound system do not come into contact with any other metal or power wire since this may damage the sound system.

If any connections are not done properly, especially the power connections, you will damage the sound system. This type of damage is not covered under any warranty. The sound system is thoroughly tested and inspected before packing to insure proper function. There is a minimum charge of \$40.00 plus s/h for repair.

SPEAKER MOUNTING: The speaker generally should be mounted so that the sound can actually "get out" of the locomotive. A hole in the floor of the tender is acceptable but the front of the coal bunker or even through a simulated coal load may be a better choice as the sound can exit forward or upward rather than down toward the track. In some cases, particularly in the larger gauges, mounting a speaker inside the front of the boiler with an open stack can enhance the sound. Enclosing the speaker in a chamber will also enhance sound reproduction. A very simple enclosure can be made with a tube. It is usually best to seal the end of the tube, so there are no air passages to the rear of the speaker, thus creating a sound chamber. By carefully sealing all openings it may be possible to use the entire tender body shell as a sound chamber. A simple wall behind the speaker may be all that is possible or perhaps all that is needed.

Speakers can be attached with double sided tape, with glue or with "hot melt". Enclosures can be made with plastic, wood, card stock or even metal. Film cans or medicine bottles make excellent sound chamber enclosures for small diameter speakers. Attachment with "hot melt" is advantageous as the "hot melt" can be used as a gap filler when creating an enclosure.

A second speaker, wired in series with the main speaker, can also enhance sound quality and will permit a higher volume without damage to the individual speakers.

Speaker enclosure is an art and experimentation is definitely in order for your installation so as to gain the maximum benefit of the superb sound quality available in this sound system.

SOUND INFORMATION: All sounds are discussed assuming that the sound unit is fully powered at all times. If only powered from track power, the sounds will only start when sufficient track voltage is obtained.

AIR PUMPS are needed to maintain air pressure in the train and locomotive braking systems. These pumps must run periodically as pressure drops, due to brake applications or through normal leakage. To simulate this action, AIR PUMP sounds are generated at random intervals when the sound system is on and there is no power to the track / motor. AIR PUMP sounds will also be heard when power is first applied to the sound system. This will give you an indication that the system is in fact functioning.

BLOWERS are used on a steam locomotive to maintain fire box draft when the locomotive is not in motion. BLOWER sound will be generated whenever the locomotive has stopped moving and there is no power to the track / motor.

SAFETY VALVE will vent if steam pressure in the locomotive boiler becomes excessive. The sound system will produce a SAFETY VALVE release at random intervals whenever the blowers are on and steam is not otherwise being used.

WHISTLE sound is controlled by the reed switch trigger. Upon closure of the reed switch via an external magnet, the sound system will begin to play appropriate Whistle patterns. Each activation will trigger a different Whistle signal (play pattern). We used appropriate railroad patterns for a moving train.

BELL sound is first activated by passing the reed switch trigger. After the bell has rung a few times, it may be triggered off by passing the reed switch over the magnet again. The bell will turn off at the end of a ring.

EXHAUST CHUFF is the most notable sound of a steam locomotive in motion. The sound is the result of the used steam from the cylinders being vented through the stack. Each cylinder will exhaust twice during each drive wheel revolution and since most steam locomotives have two cylinders, the exhaust should chuff four times for each drive wheel revolution. EXHAUST CHUFF sounds should vary from a very slow chuff rate to an almost continuous roar at high speed. EXHAUST CHUFF should also vary as to the load on the locomotive with a heavy train making a louder exhaust. This sound system will vary the EXHAUST CHUFF sound either by voltage supplied to the track / motor or, as an option using switch contacts or our OPTICAL INPUT (Item #583), with actual movement of the drive wheels or other axles (see pg 6). The EXHAUST CHUFF volume will increase above normal during acceleration and will be lower when decelerating. Mallet systems feature a doubling auto-chuff.

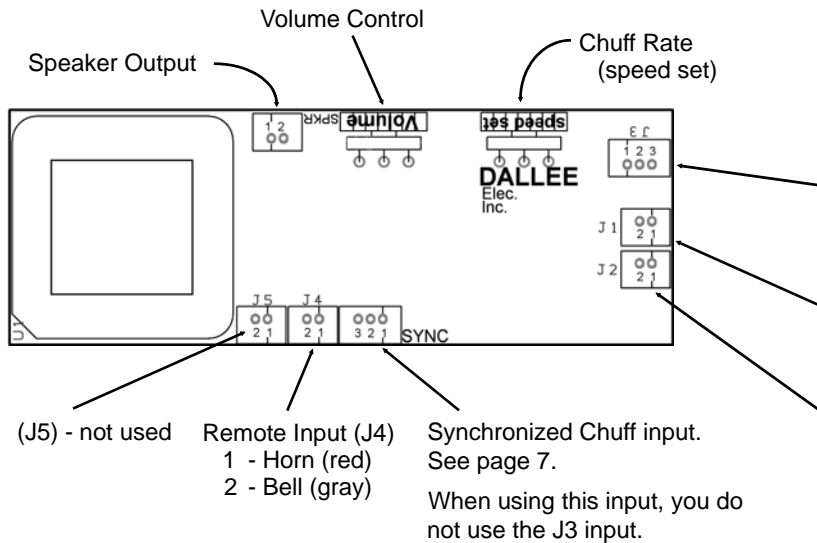
GENERAL OPERATING INFORMATION:

VOLUME ADJUSTMENT: should be set as desired for your application. Please remember that the amplifier can produce more power than a small speaker can handle and that the sound will be louder if the speaker is properly enclosed and baffled. If you are using batteries, the louder the volume the shorter the battery life.

CHUFF RATE control adjusts the rate of chuff when in auto-chuff mode. This adjusts the maximum chuff speed for voltage variable automatic exhaust chuff. Rotate the control CCW to

increase the voltage required to reach maximum chuff speed. Adjust as desired for a chuff rate to match your locomotive. "G" operators would usually set this control full CCW. If the full CCW adjustment does not create a chuff rate slow enough, place a 2.2k (1/4 watt) or higher value resistor in series with either the black or white wires of J3. This will slow down the auto-chuff rate for higher track voltages. When using the "SYNC" input, the CHUFF RATE control has no effect and wiring to J3 is also not necessary.

Common Whistle signals used with this sound system	
SOUND	INDICATION
long, 3-short.....	flagman protect rear of train
2-short.....	acknowledgment
4-short.....	call for signals
short, long.....	inspect train line for leak or brakes sticking
2-long, short.....	approaching meet or wait point
2-long, short, long.....	approaching grade crossings
continuous long.....	approaching stations or junctions
successive shorts.....	alarm for something on track



Wiring standards:
wires with a "•" ARE a connection!
wires crossing over (without a "•")
DO NOT CONNECT!

SPECIFIC INSTRUCTION SHEETS	
PAGE	INSTALLATION TYPE
3.....	Conventional DC
4.....	Conventional DC with rechargeable battery
5.....	sample installation
6.....	Reed Sw/Magnet mounting
7.....	Chuff synchronization
8.....	sample speaker installation

Other wiring / application notes can be found on our web site under "Current Product Instruction Index" then "Sound Related, misc".

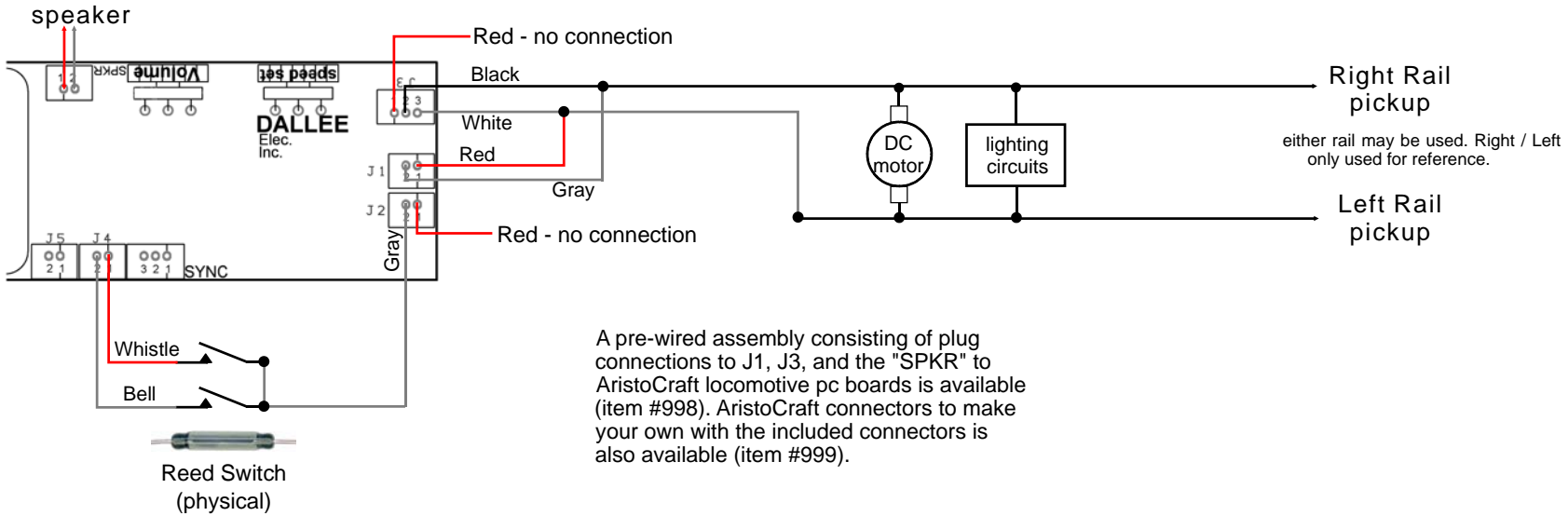
NOTE: The speaker impedance should be kept near or above 8 ohms, therefore four 8 ohm speakers in a series/parallel configuration is acceptable since it yields 8 ohms total impedance. If you care to use two 8 ohm speakers you **must** place them in **SERIES**.

DO NOT touch the speaker wires to anything else, this will damage the amplifier which is not covered under warranty!

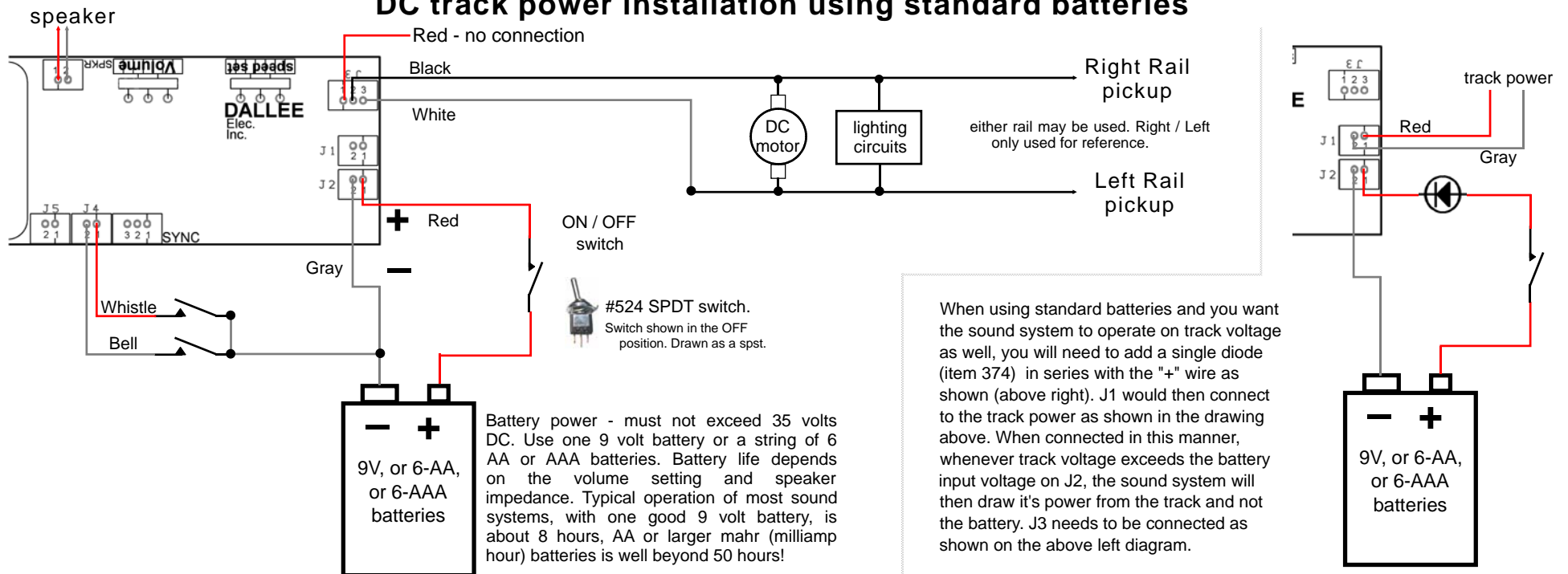
When connecting DC power to the sound unit be absolutely sure that the "+" and "-" are connect correctly! If not, you will either burn out the sound unit or the supply feeding it. This is not covered under warranty!

DALLEE
ELECTRONICS, Inc.
246 W. Main St.
Leola, PA 17540
(717) 661-7041
www.dallee.com

Track power installation without batteries

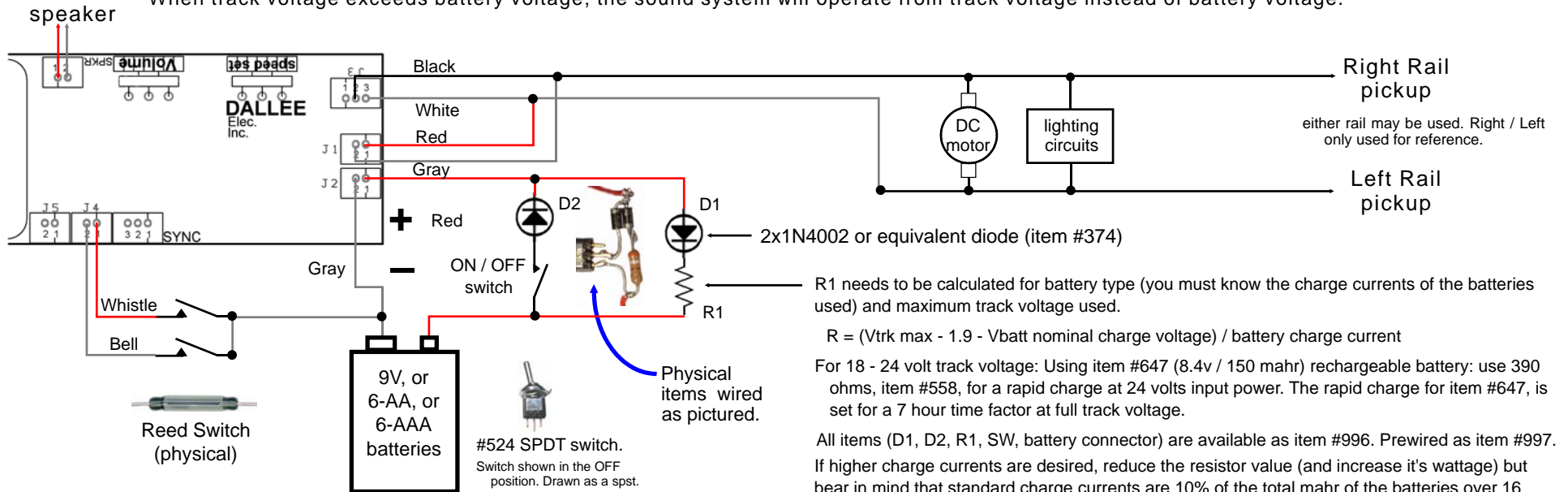


DC track power installation using standard batteries



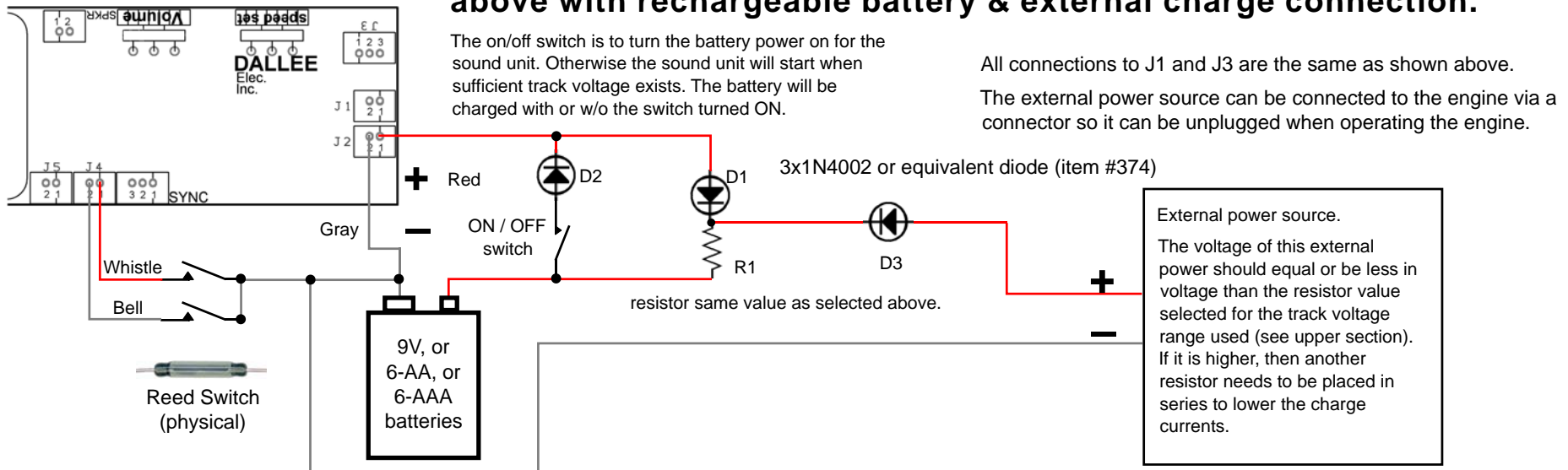
DC track power installation with rechargeable battery.

When track voltage exceeds battery voltage, the sound system will operate from track voltage instead of battery voltage.

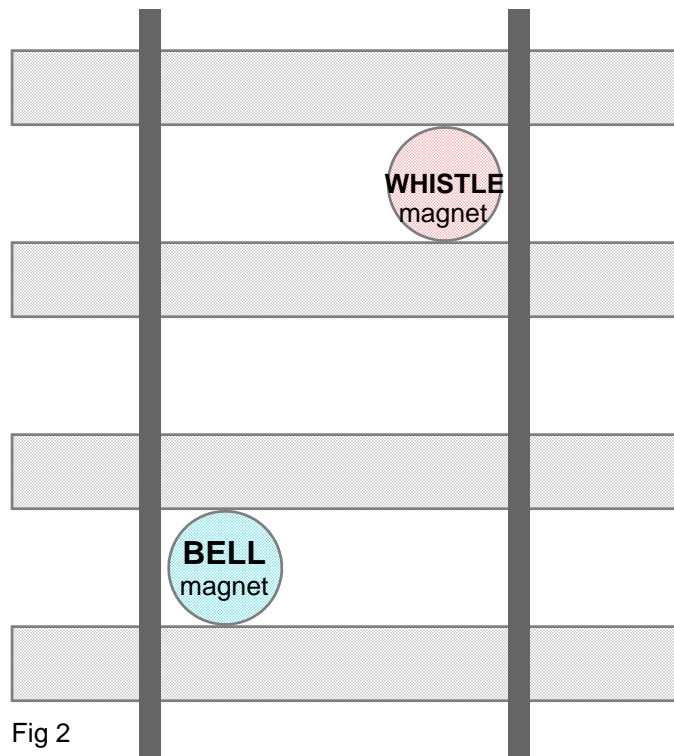
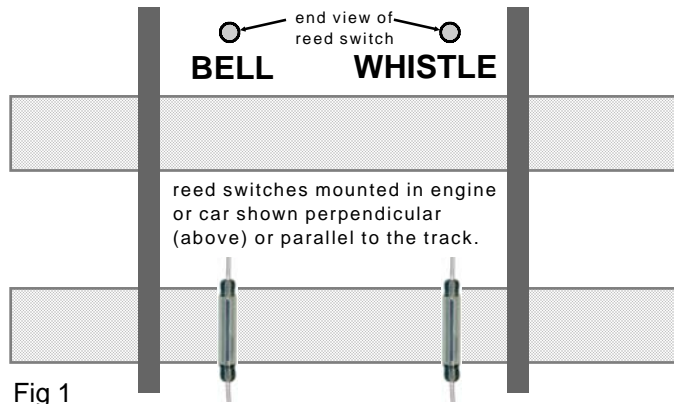


Battery power - must not exceed 35 volts DC. Use one 9 volt battery or a string of 6 AA or AAA batteries. Battery life depends on the volume setting and speaker impedance. Typical operation of most sound systems, with one good 9 volt battery, is about 8 hours, AA or larger mahr (milliamp hour) batteries is well beyond 50 hours!

above with rechargeable battery & external charge connection.



Reed switches mounted under engine or car



When operating with reed switches and magnets, it is necessary to orient the reed switch for the best sensitivity. If you need to experiment with your magnet's polarization properties, connect the reed switch to a small lamp and move the magnet about to turn the lamp on/off. This will give you a very good idea as to which way the reed switch needs to be oriented vs the magnets polarization. Reed switches can be easily mounted with double sided foam tape (item 388).

Mounting methods:

1 - Perpendicular to plane of track: The easiest to mount in most cases would be to mount the reed switch perpendicular to the track plane. By doing so, you minimize the sensitive area of the reed switch and make it more selective for what the magnet is going to operate. As can be seen in the top section of fig1 on this page. The magnets are strategically located to trigger each function. By proper locating the magnets, individual functions can be controlled (fig2).

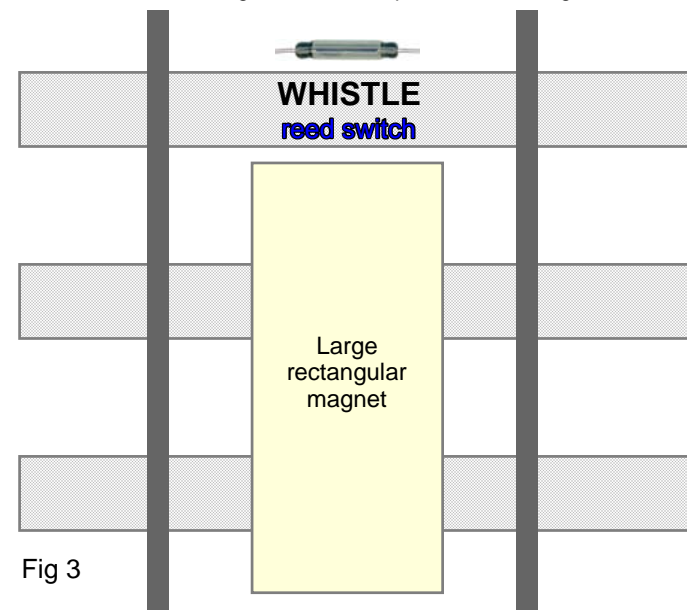
2 - Parallel to plane of engine:

Method 1: Mount the reed switches 90° from that shown in the lower portion of fig1. Position the magnets over the end area of the reed switches as shown in fig 2. This way other rectangular magnets can be used as well. If you do not want this system to be triggered by certain rectangular magnets but do want it to activate with item 988 magnets, then orient the reed switch as shown in fig 1 and place the magnets directly under the reed switch. This way you could make the engine more specific as to which magnets will trigger the sound system. Fig 3 shows activation with a rectangular magnet.

Method 2: For use with item 988 magnets you can orient the reed switch "in line" with the locomotive. This will not yield selective operation but will allow them to operate with other magnets.

Don't forget, you do need two triggers for the bell. One to trigger the bell "on" and another further down the track, to trigger the bell "off". As shown in fig 2, you could trigger the Whistle and Bell with one magnet, item 988, properly placed in the center of the track.

The distance between the magnet and trigger needs to be 1" or less for reliable operation. When traveling at fast speeds, and you do not get a trigger, either decrease the magnet distance or place another magnet in the line of travel.

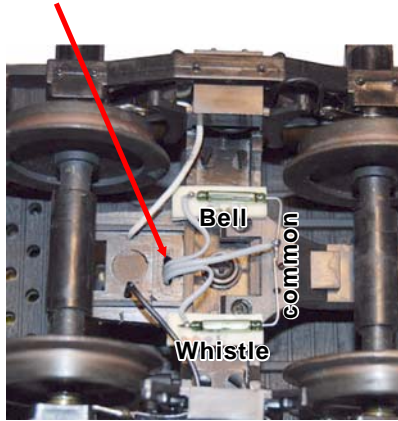


Since magnet strength and reed switch sensitivity varies, you may need to adjust placement to suit your needs. The basic scheme is shown for proper magnet placement. Do not place magnets exactly opposite of each other.

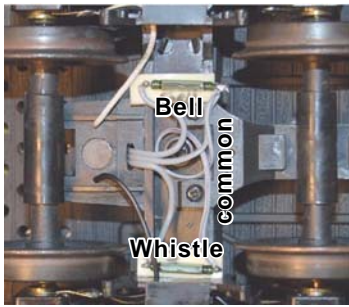
Sample installation

- 1 - Reed Switches - locate and wire the reed switches as shown. Since they both connect to a common wire, only 3 wires are needed between them and the sound board.
- 2 - Since one reed switch controls the Whistle and the other controls the Bell, they need to be mounted on opposite sides of the chassis or truck. These are shown below, attached with double sided tape (item 388), inside the sideframe. To keep things consistent, use the right side of the engine for Whistle activation and the left for Bell. By wiring all engines the same way, it is easy to know which side activates which function.

Make a notch or other small holes to secure the wires. This helps to prevent a turning truck from destroying the wire connections.



Note: You may want to test the activation distance for the reed switches before final assembly. Since not all reed switches are made alike, some will activate at a very low magnetic field strength and others at a higher strength. The higher strength isn't the problem as much as a lower strength. A lower strength reed switch might activate from a magnet located on the opposite side of the rail (from a far distance). This is tested by using an ohm meter to test for closure of the reed switches or by wiring to the sound system and passing a magnet for the opposite activation. This is demonstrated in the second picture. In this case the Whistle reed switch was too sensitive and activated with the Bell magnet. To prevent this, the Whistle reed switch was moved further away. Since it is a sensitive reed switch, there is no problem activating with a magnet on the inside of the right rail.



- 3 - attach the track power wires and appropriate materials for the track power pickup (J1 and J2) as shown in the main instructions. An easy installation of the rechargeable 9v battery (item 647) with a 9v battery snap connector (item 578) is easily accomplished with double sided tape (item 388).
- 4 - a sound on/off switch (item 524) can be easily mounted by drilling a small hole in the shell. Place it in the same direction as other switches if present. This way the "ON" position will be easily known. This tender already had a switch which was utilized for this operation. "ON" is easily identified by pushing the slide switch towards the locomotive.

- 5 - mount the sound board. This board was mounted towards the front of the slope back tender since it has an access cover which makes easy adjustments to the controls on the sound board. Since this 0-4-0 engine is a PRR type, we used an appropriate PRR Banshee / Freight sound system, item #906.



Optional synchronized chuff installation.

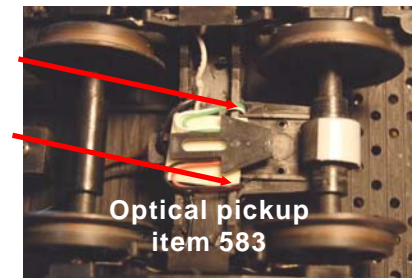
Although a correct synchronized exhaust chuff is best when read from the locomotives drive wheel or axle, reading a tender axle is much easier with some locomotives.

As can be seen in the picture to the right, it is easy to install a synchronized chuff pickup on a tender axle. Item 583 can be mounted to read any axle or rim. This locomotive already had a rotating ferrite pressed onto the axle which makes for an easy target. Remove the upper magnetizing piece to allow for an easier rolling axle and cleaner stripe. The optical coupler was mounted with double sided tape at an appropriate distance of 1/4". A piece of electrical tape was placed on the axle to make 1/2 of it reflective via the tape (white section) and the other half not reflective (black section) due to the ferrite material. This will produce 1 exhaust chuff sound per revolution of the axle. If more exhaust chuff's are desired, merely make more black / white regions.

Wire the optical pickup as per the sound systems instructions. If additional connectors are desired, please refer to our price schedule or catalog.

If a painted pattern is chosen over this method or the pre-printed patterns included with item 583, care must be given since black paints will still reflect an infra-red beam. It is best to rough up the surface to prevent a reflection instead of painting it black.

Make a notch or other small holes to secure the wires. This helps to prevent a turning truck from destroying the wire connections.

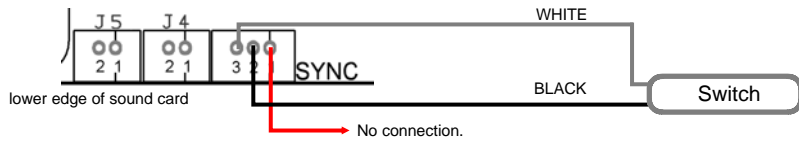


Optional Synchronization of Exhaust Chuff

Switch Synchronization:

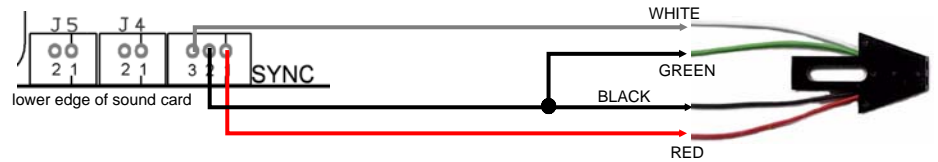
- 1 - connect Common (C) of the switch to the White wire from the SYNC input.
 - 2 - connect Normally Open (NO) of the switch to the Black wire from the SYNC input.
- Switch closure should occur on peaks of quartering lobes. We recommend using optics since they can switch much faster, don't bounce, and do not interfere with the mechanical operation of the axle.

DO NOT use a leaf switch to the chassis (quartering lobe) this will damage the sound unit!



Optical Coupler (item #583) Synchronization:

- 1connect Black and Green optical pickup wires together, this then connects to the Black wire from the SYNC input.
 - 2.....connect Red optical pickup wire to the Red wire from the SYNC input.
 - 3.....connect White optical pickup wire to the White wire from the SYNC input.
- see page 11 for picture of installation.



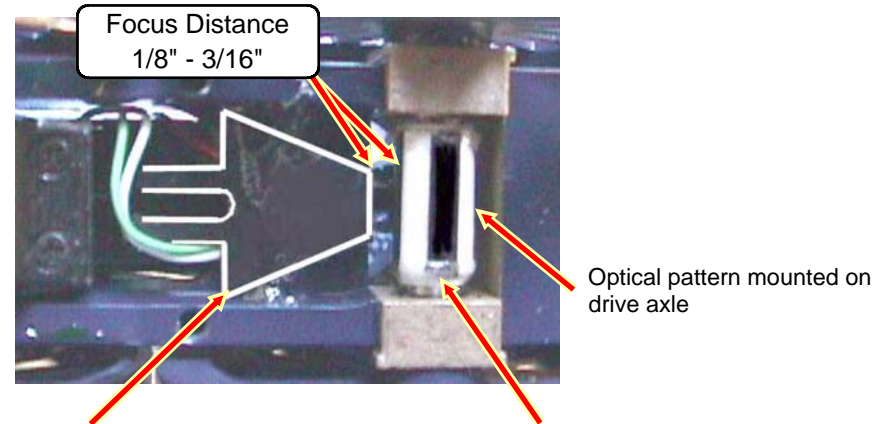
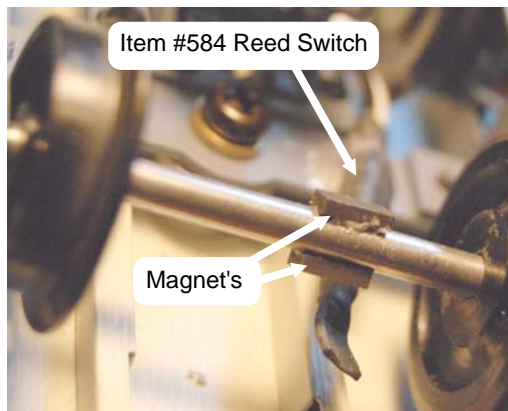
Reed Switch Synchronization

Axle synchronization can also be accomplished by gluing one or two magnets onto any axle. The reed switch is supplied with two wires and encased in heatshrink tubing. These connect to the White and Black wires from the "SYNC" connector as shown above.

To create one chuff per revolution, which most will find creates the sound effect desired, merely glue one magnet onto the axle. For two chuff's per revolution, the second magnet needs to be glued onto the axle in the opposite position. Most trailing wheel sets are 1/2 the diameter of the main drivers, so two magnets would yield 4 chuffs per revolution of the main drivers.

These magnets are very small and measure only 0.1" wide x 0.2" long x 0.045" thick.

Two magnets and one reed switch assembly are included in this package, item #584.



Optical Coupler, item 583 (hi-lighted for ease of viewing), mounted to frame 3/16" from optical end to pattern. In this installation, the end mounting ears had to be trimmed to obtain clearance to the drive gear box. When doing so care must be used to not damage the optics.

apply a thin layer of glue on each side to prevent oil from contaminating the optical pattern.

Synchronization Note:

When using a synch input, DO NOT connect the black and white wires of J3 to the motor brushes. While no harm is done in doing so, it is not necessary.

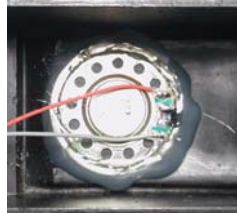
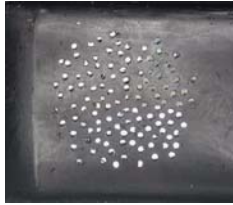
It is not necessary to use the black / white stripe pattern, anything that will come in and out of focus to the optical reader will work! So, engines with cams installed or a piece of rectangular tubing cut and mounted to the axle may also work with proper alignment. Remember, some paints and other type markers will still reflect the infra-red light. So, just because it's black doesn't guarantee that it will work. The optical coupler comes with laser printed stripes.

Sample Speaker Installations

Closed top Tender

It is best to have the sound projected up instead of down. To do so, locate the highest part of the existing coal pile. Use a small, sharp, drill bit (#60) to open a series of holes within the speaker cone diameter. Always drill slowly so the plastic does not melt.

Mount the speaker with "Hot Melt" or glue. Be sure to cover all sides of the speaker so no air can escape.

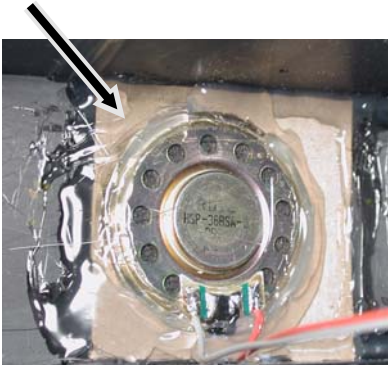


In larger tenders with a lot of air passage between the tender top and frame, it may become necessary to make your own enclosure as shown here. Especially if you don't want to drill the top open (or it's an oil burner).

Open top Tender

Make a cardstock cutout with an opening for the speaker. Mount the cardboard cutout with "Hot Melt" or glue. After the cutout sets, mount the speaker. Be sure to cover all sides of the cutout to the tender and speaker so no air can escape.

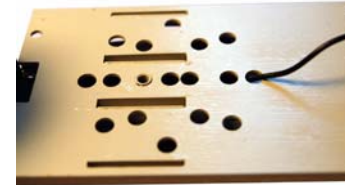
If you have other openings, be sure to close them.



top view of completed speaker installation.

Chassis Mount

When mounting the sound unit in an open chassis (car or locomotive) area with a power feed entering under the speaker requires raising the speaker from the chassis floor. This is easily accomplished by adding item #388, 1/8" thick double sided tape, to the rim of the speaker. As you can see, only a small amount is needed. This creates an air tightness from the front side of the speaker which is required for a good baffle. In this case, the entire body shell is used for the speaker baffle which is why nothing is required on the back side of the speaker.



DO NOT allow the speaker wires to contact ANYTHING else INCLUDING the chassis of the engine or the speaker frame. **This will damage the sound unit and voids the warranty.**

