

LocoMatic™ type 4 STEAM Sound & Control for AC or DC TRACK POWER by

Instructions rev 1.2



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.

AC or DC TRACK POWERED SOUND / CONTROL SYSTEM - Steam Locomotives

OVERVIEW: This sound / control system includes features that have not previously been available in the model train industry. DC operators should operate in LocoMatic™ COMMAND CONTROL only. If operated with variable DC track power in standard mode, then normal AC like sequencing will occur with either a Whistle or Bell constantly operating (unless switch 3 is set on for no Whistle or Bell sound). Conventional operation follows the usual forward - neutral - reverse - neutral - forward sequence pattern except that the initial state is switch selectable for either start in forward or start in neutral. A locomotive can also be switch locked in the forward position to accommodate operation under automated situations. An additional direction switch is provided so that if multiple locomotives are run as double or triple headers, simply set this switch on each locomotive to specify which direction is forward.

Recordings of actual locomotives, were digitized, to be reproduced by the microprocessor sound system so that the sounds you hear will be as prototypically correct as possible. Sounds produced include user controlled steam whistle, bell and cylinder blow out, also blowers, random air pumps, periodic safety valve pressure release and steam exhaust chuff sound automatically adjusted to speed and load conditions. Exhaust chuff can also be synchronized to actual piston movement or drive wheel or axle rotation. This sound / control system also incorporates provisions for directional head and back up lights, also marker lights as well as interior lights and fire box glow. Most lighting can also be manually controlled by means of the exclusive LocoMatic™ controller. The LocoMatic™ controller is also used to activate optional electric coil couplers for remote uncoupling of the locomotive from its train (requires coil couplers).

This sound / control system can be operated by all known classic and modern power transformers that output low voltage (6-18vAC, 25v DC max) to the track and will also operate with Lionel Trainmaster in conventional mode. See appended instructions regarding the operation of this sound / control system in LocoMatic™ command mode simultaneously with Lionel Trainmaster Command Control.

Additionally the sound / control system will operate with the LocoMatic™ controller either in conjunction with your transformer or independently with a fixed voltage supplied through the LocoMatic™ controller to the track. If all you want are sounds, merely connect the speaker and track power inputs. As long as the internal e-unit remains in sync with the LocoMatic™ sound / control systems e-unit the sounds will be produced in sync with the locomotive. Exhaust chuff sound can also be disabled (keeping only the original plunger sound) - see manual chuff input installation pg15.

INSTALLATION INSTRUCTIONS: This sound / control system consists of a double stacked printed circuit board with an additional small circuit board attached by a wire harness. Also included is a speaker, two screws, two 5 volt light bulbs (item #756), one 0.1mfd capacitor, a 6 pin, a 3 pin, and twelve 2 pin connectors.

Refer to pages 6 and 7 to familiarize yourself with the connectors and controls on the sound / control board. 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 stacked circuit board measures 4.2" l x 1.3" w x 1.4" h and should be mounted where space permits using the double sided tape attached to the circuit board. The small circuit board (1" x 3/4") containing the volume control and 6 switches should be mounted so that the controls are accessible either through the frame or via a hatch or a hole in the tender body shell. 2/56 x 1/4" screws are supplied to mount this board. Be certain that the components on the circuit boards do not come in contact with any metal objects as such contact can destroy the sound / control system.

LIGHTING INSTALLATION: There are eight 2-pin connectors located along one edge of the lower circuit board. These connectors output 5 volts for lighting applications as follows:

- Cab 1 "on" when sound / control system has power
primary use is for cab interior lights
 - Cab 2 flickering lamp to be used for fire box glow
 - Lmp F automatic / manually controlled headlight
 - Lmp R automatic / manually controlled back up light
 - Mkr F automatic / manually controlled forward marker lights
 - Mkr R automatic / manually controlled rear marker lights
 - Aux 1 manually controlled as desired
 - Aux 2 manually controlled as desired
- Note - if you prefer controllable cab interior lights use Aux 1 or 2 rather than Cab 1. Not all outputs are functional on all sound / control systems.

SPEAKER INSTALLATION: The 8 ohm speaker should be mounted as per available space bearing in mind that sound reproduction is enhanced when a speaker is properly enclosed and baffled. The speaker is to connect to a 2 pin connector located near the center edge of the main circuit board.

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 upward rather than down toward the track. In some cases, particularly in the larger locomotives, 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.

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. Observe the installation example pictures for more ideas.

OPTIONAL ITEMS INSTALLATION Exhaust chuff can be synchronized either by the installation of a switch input, from a cam or magnets mounted on an axle, from piston or other rod travel, or by the installation of our optional optical input (item #583). A 3 pin connector is used to connect either method of synchronization to the sound / control system.

This sound / control system also has a 2 pin connector that can be used to add an optional battery backup. The battery must be an 8.4 volt high capacity rechargeable type. Our Item #647 is specified for this unit. Once installed with the sound / control system, the battery will be charging whenever there is track power "on". When track power turns "off", the battery will remain in circuit for about 30 seconds and then automatically turn "off" (providing sufficient charge exists in the battery). Battery backup is not generally necessary as this sound / control system has storage capacitors that are adequate to keep the sound system functioning during normal power "off" for direction sequencing.

In LocoMatic™ COMMAND MODE, a battery backup is definitely not needed as full voltage track power is "on" continuously. Under this operating mode it is suggested that no battery be installed or that if a battery is in circuit you limit operation to not more than a continuous 4 hours so that you do not overcharge the battery.

SOUNDS REPRODUCED:

WHISTLE is user activated in several ways. It can be activated by the whistle switch or button on transformers so equipped or by a separate sound activation button. The whistle can also be activated by the HORN button on the LocoMatic™ controller. The whistle will play as long as the switch or button is held on. A manual switch allows the whistle and bell to be deactivated so that, for multiple locomotive operation, only the lead locomotive's whistle and bell will sound.

BELL is user activated by the bell control on transformers so equipped or by a separate sound activation button wired to do so. The BELL can also be activated by the BELL button on the LocoMatic™ controller. BELL sound will latch "on" when the bell control is activated and will latch "off" when the control is again activated. If the BELL is "on" it will

override all other sounds, except a Whistle request, until it is turned off. Again, a manual switch allows the bell to be deactivated for multiple locomotive operation.

CYLINDER BLOW OUT is required to remove condensate that accumulates in the cylinders when a locomotive has been at rest. This condensate must be exhausted from the cylinders prior to the pistons being powered by steam or there can be damage to the cylinders. BLOW OUT sound is user activated by depressing the ALT/FORWARD button on the LocoMatic™ controller. This sound will continue until the button is again depressed or the locomotive has started in motion and an exhaust chuff is sounded.

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

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 / control system is powered "on".

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.

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 / control system will vary the EXHAUST CHUFF sound either by voltage supplied to the motor or, as an option using switch contacts or our optical input (Item # 583), with actual movement of the drive wheels or other axles. When the sound / control system is initially powered on, voltage variable automatic exhaust chuff is in operation. If you have installed an optional manually synchronized exhaust chuff, the sound / control system will switch to this synchronized mode on the first chuff input and will continue synchronized as long as sound system power remains on. Additionally, the EXHAUST CHUFF volume will increase above normal during acceleration and will be lower when decelerating. The exhaust chuff sound can be disabled, as may be desired in AF units, by connecting the Sync input Black wire to the White wire. See page 15 for details. For those desiring polyphonic sound and room exists, consider placing a chuff board (item #711) This unit provides a selection of five different exhaust pitches to simulate large cylinders to smaller locomotive cylinders (ref pg 13).

LIGHTING FEATURES: The sound / control system has outputs at 5 volts available for head lights, back up lights, front and rear marker lights and two auxillary lights.

The sound / control system allows lighting that is directional so that the forward headlight and the rear marker lights will illuminate when the locomotive is in forward motion. When the locomotive is in reverse motion the rear headlight and forward marker lights can illuminate. The headlights, marker lights and auxillary lights can also be manually operated by means of the LocoMatic™ controller.

Two 5 volt light bulbs are included with this sound / control system and additional 5 volt bulbs are available in 5 - packs (Item 756). These are high intensity, low current, bulbs and are ideal for headlights. For interior or other lighting locations it is suggested that 2 bulbs be wired in series to afford a lower light level.

In most cases, marker lights have been represented by LED devices usually wired in parallel. LED marker lights will function best with this sound / control system if they are rewired in series with each other and in series with a 68 ohm, or larger, 1/4 watt resistor. In some cases, 1.5 volt bulbs have been used for marker lights and / or headlights. There are many variations of these 1.5 volt bulbs dependent on current draw, but generally if two bulbs are wired in series and in series with a 100 ohm 1/4 watt resistor they will function properly with this sound / control system. See item# 382 for 1.5v lamps.

Because of size considerations a single 1.5 volt bulb may have been used for a headlight or backup light. In this case, again dependent on current draw of the bulb, you can generally use about a 220 ohm 1/4 watt resistor in series with a single bulb for satisfactory function with this sound / control system.

Each of the lighting outputs is designed for a 60 milliamp load and should not exceed 120 milliamps or damage will occur to the lighting output. The cumulative output should be less than the total current capacity of the lighting regulator which is 1/2 Amp. Should this 1/2 Amp capacity be exceeded the lamps may become somewhat dimmed or the regulator itself may shut down. If this situation occurs, it may be necessary to turn "off" one or more of the lighting functions so the total current is less than the 1/2 Amp capacity.

MANUAL ADJUSTMENTS: A potentiometer, located on the lower circuit board, permits adjustment of the exhaust chuff automatic rate. This potentiometer is factory set at a minimum range (8 o'clock). Rotating this control clockwise will increase the exhaust chuff rate for a given track voltage. If a manual exhaust synchronization is installed and operating in standard mode, this controls the exhaust chuff pitch range. If you are in LOCOMATIC™ COMMAND MODE this control has no effect.

There are six switches and a volume control on the small circuit board which should be mounted as space permits and is still accessible. It is suggested that the volume control be set at about the 10 o'clock position for comfortable listening. The six switches are normally set to the "off" position and select the

following operations:

	OFF	ON
Switch 1 ----- start in		
	forward.....	neutral
Switch 2 ----- sequencing		
	normal.....	lock in start position
Switch 3 ----- whistle & bell		
	can sound.....	do not sound
Switch 4 ----- forward coupler		
	operational.....	deactivated
Switch 5 ----- rear coupler		
	operational.....	deactivated
Switch 6 ----- forward direction is to locomotive		
	front.....	rear

Switches 3 thru 6 are used primarily when two or more locomotives are operated together. You can turn off the whistle and bell in the trailing locomotives and deactivate the couplers between locomotives so that only the couplers at the front and rear are operational. If any of the locomotives are actually facing to the rear, Switch 6 on such locomotives allows operation in concert with other locomotives facing forward. When Switch 6 changes forward to rear all directional functions such as headlights, marker lights and couplers are switched also.

OPERATION USING A TRANSFORMER: With this sound / control system installed, your locomotive will operate in the same manner as other locomotives when using a transformer to vary speed. When power is applied the locomotive will come "on" in either the forward or neutral position as you have selected. Momentary interruptions of power will allow the locomotive to sequence through the usual direction positions. Sequencing can be accomplished either by a direction switch / button or by turning the speed control to "off" and then back "on".

Power interruptions for direction sequencing should be momentary only. If power remains "off" for more than a short time it is possible that the stored energy will be used up and the sound / control system will shut down. When power then returns the system will come "on" in its initial start position. If you prefer to employ a battery back up to maintain operation during more extended power "off" situations, provisions are there to connect a rechargeable 9 volt (8.4 volt actual) battery (item 647).

If your transformer includes whistle or bell controls, or if you have provided sound activation buttons, you will be able to sound the whistle or the bell with these controls whenever there is power to the track. The whistle will sound as long as you hold the control "on". The bell control is a push "on", push "off".

An added feature of this sound / control system involves the way the motor is driven, particularly at slow speeds. If track power is set high while in neutral and you sequence to a direction, the locomotive will gradually increase its speed rather than jump directly to the high speed. This type of operation not only looks better but also results in less strain on the entire motor / gear drive system and is less likely to cause derailments of the locomotive or its train.

The LocoMatic™ controller contains ten operating buttons and is

usable either in conjunction with your regular transformer or as an independent control with a fixed voltage applied to the track. The LocoMatic™ controller is a pass through type of device which is wired between your transformer and the track. It will not interfere with track power passing through it when not in use (you do not have to disconnect it for operating standard type trains). Some of the buttons cause activation as long as they are held "on" while others work in a push-on, push-off mode. The lower right hand button, labled 'ALT', is the alternate button which provides a second function to each of the other nine buttons. When using an alternate function it is suggested that the ALT button be held depressed and then another button be pressed. For example; pressing the COUPLER button will operate the trailing coupler while pressing ALT / COUPLER will operate the leading coupler. Not all of the buttons will have alternate functions on all locomotives.

The ten LocoMatic™ controller buttons perform the following:

- BELL.....turns bell "on" or "off"
- ALT / BELL.....restores automatic directional lighting
 Note: lighting is directional until a request is made via the LocoMatic™ controller for a manual activation. Lighting functions will then remain manual via the LocoMatic™ controller. Pressing ALT / BELL will allow all lighting functions to return to directional operation at the next direction request.
- HEADLIGHT.....turns front headlight "on" or "off"
- ALT / HEADLIGHT.....turns rear headlight "on" or "off"
- MARKERS.....turns front marker lights "on" or "off"
- ALT / MARKERS.....turns rear marker lights "on" or "off"
- AUX.....turns front aux lights "on" or "off"
- ALT / AUX.....turns rear aux lights "on" or "off"
- COUPLER.....activates the locomotive's trailing coupler
- ALT / COUPLER.....activates the locomotive's leading coupler
- HORN.....activates the whistle
- ALT / HORN.....activates CAB #2 output when available NOT AVAILABLE ON ALL LOCOMOTIVES
- FORWARD.....forward motion overriding sequencing
- ALT / FORWARD.....activates CYLINDER BLOW OUT sound
- REVERSE.....reverse motion overriding sequencing
- ALT / REVERSE.....turns main sounds "on" or "off"
- SLOW.....neutral position overriding sequencing
- ALT / SLOW.....neutral position or emergency stop
- ALT.....alternate button for second functions.
 When using this button in conjunction with another button, press and hold this button first.

Operation using the LocoMatic™ controller with your transformer: As previously stated, a locomotive with this sound / control system installed will operate with your transformer in the same

manner as other locomotives, but you will have the advantage of additional features available with the LocoMatic™ controller.

The whistle and bell can be activated by either your transformer controls or by the LocoMatic™ controller. If the bell is turned "on" by your transformer it can be turned "off" by either your transformer or by the LocoMatic™ controller, but if the bell is turned "on" by the LocoMatic™ controller it must also be turned "off" by the LocoMatic™ controller.

You can manually operate any of the lighting features on your locomotive, that you have connected to the sound / control system, by use of the LocoMatic™ controller. Once you have selected any manual lighting, all automatic directional operation is overridden, however you can return to directional lighting at any time by using the ALT / BELL button followed by a direction button.

The optional electric coil couplers are activated only by the LocoMatic™ controller. There is a brief waiting time between coupler activations. The couplers can be activated either in neutral or in a motion direction as you prefer.

With the LocoMatic™ controller in place it is no longer necessary to follow the forward - neutral - reverse - neutral - forward sequence. If you are in NEUTRAL and wish to go forward, depress the FORWARD button and advance the speed control. The locomotive will move in the forward direction. You can actually set the speed control at a fixed voltage and operate the locomotive with just the FORWARD, REVERSE and SLOW buttons. The sound / control system has incorporated a momentum feature that will gradually increase speed to the the set voltage rather than just jump to that speed. The FORWARD button will result in a gradual increase in speed up to the preset voltage in the forward direction. The SLOW or ALT / SLOW button will return the locomotive to neutral. The REVERSE button will result in a gradual increase in speed up to the preset voltage in the reverse direction. The momentum feature will also work with the direction control on your transformer if you prefer to employ usual sequencing.

If there seems to be a lack of response to the buttons on the LocoMatic™ controller it is generally due to either poor electrical contact between the pick up rollers and wheels and the track because of dirt, or the lack of a choke (see "supplemental note" below) in series with something that is getting its power from the track.

In summary, a locomotive with this unique sound / control system installed and with the LocoMatic™ controller will function in the same manner as other locomotives, has the added benefit of very smooth slow speed operation with momentum acceleration and has sequence override so that you can select the direction of motion as you desire.

LocoMatic™ COMMAND CONTROL: In addition to all of the previously described features this sound / control system will operate independently with a fixed 15 to 18 volts AC or up to 25 vDC passing through the LocoMatic™ controller to the track. To enter the LocoMatic™ COMMAND MODE all power to the locomotive must be "off" and all stored energy exhausted. Once you are sure that all power is gone, set Switch 1 to select neutral start and set Switch 2 to lock. With the locomotive locked to start in neutral, full LocoMatic™ COMMAND MODE is entered as soon as track power is applied. Turn the speed control on your transformer to output approximately 10 to 18 volts and you are

ready to operate in LocoMatic™ COMMAND MODE. UNDER NO CIRCUMSTANCES SHOULD THE TRANSFORMER VOLTAGE IN THIS OPERATING MODE EXCEED 20 VOLTS AC / 26 VOLTS DC.

With the fixed voltage on track in this operating mode all lights when turned "on" including lighting in passenger cars or other equipment will be at full illumination.

The whistle, bell, lighting and coupler controls function as before except that the locomotive will no longer respond to the whistle and bell controls on your transformer. Lowering the voltage on your transformer will only effect a reduction in the top speed possible.

The FORWARD, REVERSE and SLOW buttons are now speed and direction controls. Press and release either FORWARD or REVERSE and your locomotive will begin in that direction. With each, approximately 1/2 second, momentary button activation the speed will increase one step through a total of 24 steps. Holding a button "on" will continuously increase through the steps to full speed. To slow down you can activate or hold the SLOW button through the steps to a stop. You can also slow down by using the opposite direction button. If the locomotive is in forward direction and you hold the REVERSE button, the locomotive will slow to a stop and then accelerate in reverse. Similarly, if running in reverse, holding the FORWARD button will result in a slow to stop and then an acceleration in forward. The ALT / SLOW button results in an emergency stop.

If there seems to be a lack of response to the buttons on the LocoMatic™ controller it is generally due to either poor electrical contact between the pick up rollers and wheels and the track because of dirt, or the lack of a choke (see "supplemental note" below) in series with something that is getting its power from the track.

NOTE: regarding multiple unit locomotives - because of the possibility of lack of response due to poor electrical contact it is suggested that you do not attempt control changes to multiple locomotives while such locomotives are on track areas of poor contact such as switches or crossings. If multiples lose synchronization between units either increase to full speed or come to a full stop to restore synchronization.

Operating a locomotive, with this sound / control system installed, under LocoMatic™ COMMAND CONTROL is simply the use of the buttons on the LocoMatic™ controller to implement the desired motions and sounds.

***** SUPPLEMENTAL NOTE *****

The signals generated by the LocoMatic™ controller may be adversely affected by any powered device that is connected to the track at the same time that the LocoMatic™ controller is functional. This would include track powered accessories, lighted cars or a lighted or powered locomotive operating from the same transformer that is passed through the LocoMatic™ controller.

To eliminate this possibility it is required that all accessories be independently powered by a separate transformer or transformers. Lighted cars or other lighted or powered locomotives that will be operating with a locomotive with this sound / control system installed MUST BE MODIFIED by installation of a choke in series between track pick up and the lights and / or motor.

The most common installation would be to locate the wires

coming from the center rail rollers (3 rail operators) or right rail (2 rail operators) and disconnect them from the present location. Connect these wires to one end of the choke and then connect the other end of the choke to the same location that the wires were originally connected to. Be sure to properly insulate your connections and to mount the choke so that it does not move. Double sided mounting tape makes a simple and neat installation.

In some situations it may be simpler to connect the choke between the load and the frame ground. Either method is acceptable as long as the choke is in series between the track and the load. See page 14 for more information.

Motor Problems: If your locomotive reset's to the forward position (when operating in standard mode) or lurches intermittently, you will need to install a choke in series with a motor lead to eliminate large motor noise from becoming fed back to the sound system. The choke functions best when placed at or as near to the motor as possible. A choke from item 702 can be used in most cases. There is on board filtering for this problem but it is best handled at the motor brushes. This is also why a capacitor is placed across the motor brushes as shown in the wiring instructions.

APPENDIX: Simultaneous operation of a LocoMatic™ compatible locomotive with a Lionel Trainmaster™ command equipped locomotive. Since both of these control systems can function with a fixed AC voltage it becomes possible to operate simultaneously and independently with both systems on the same track if certain conditions are met.

The fixed voltage power to the Lionel Trainmaster Command System must be passed through the LocoMatic™ controller before being connected to the track. The LocoMatic™ controller does not interfere with the Lionel Trainmaster Command Control System. All Command equipped locomotives or other devices that are common to the fixed voltage power supply will require the installation of a choke in series with power pick up. This series connection can be made either on the center rail pick up or on the ground, whichever is easier. Refer to SUPPLEMENTAL NOTE for additional information.

With the above installation completed and track power "on", the Lionel Command equipped locomotive is operational via the Trainmaster Command Control System. Another locomotive, equipped with a LocoMatic sound / control system in the LocoMatic™ COMMAND MODE, can also be operated at the same time on the same track via the LocoMatic™ controller.

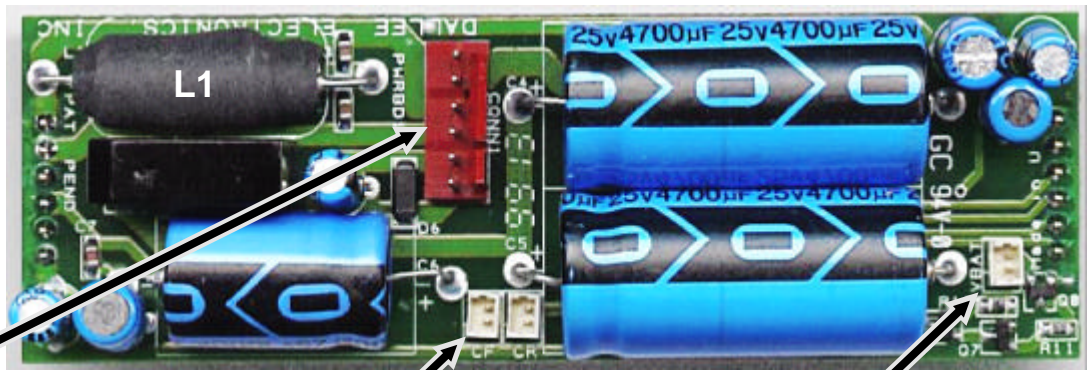
Motor Problems: If your locomotive reset's to the forward position when operating in standard mode, or lurches intermittently when operating in LocoMatic™ command mode, you will need to install a choke in series with each motor lead to eliminate large motor noise from becoming fed back to the sound system. The chokes functions best when placed at or as near to the motor as possible. Chokes from item 702 or 703 can be used in most cases. There is on board filtering for this problem but it is best handled at the motor brushes. This is also why a capacitor is placed across the motor brushes as shown in the wiring instructions. This only happens with motors that produce severe spikes or generate RF when operating.

COMMON WHISTLE SIGNALS

<u>SOUND</u>	<u>INDICATION</u>
short.....	apply brakes, stop
2-long.....	release brakes, proceed
long, 3-short.....	flagman protect rear of train
4 or 5 long.....	recall flagman
2-short.....	acknowledgment
3-short.....	back up movement
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

Installation - Power Board connections

LocoMatic™ Power Board



Main Power / Motor Connections

Motor Brushes

- 1.....Red
- 2.....Brown

Track Power Input

- 3.....Blue (center roller pickup)
- 4.....Black (chassis pickup)

Motor Field Wires

- 5.....Yellow
- 6.....Orange

Coil Coupler Connectors

- CF - Coupler Front
- CR - Coupler Rear

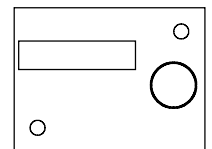
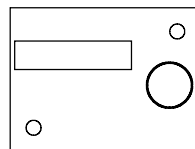
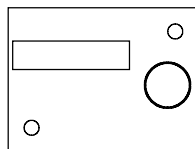
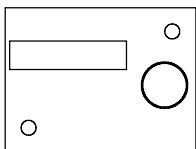
Connect the red and gray wires to the coil coupler wires. Be sure that the coil coupler wires do not touch the chassis! You do have to rewind the older Lionel coil couplers to be insulated from the chassis if you are going to use them.

Auxillary Backup Battery input

Use only item #647 rechargeable battery! Item #578 contains connector snaps with wires. Item #579 contains mounting clips or use Item #388 double sided foam tape.

Connect the red wire to the red battery clip wire and the gray wire to the black battery clip wire. Insulate the connection properly. DO NOT get these wires reversed, severe damage to the battery / unit / and you can occur!

Mounting Templates for LocoMatic™ SwVol Board



mounting template to assist in mounting the switch / volume control board.

Installation - Control & SwVol Board connections

Selector Switch & Volume Control Board.

Mount with two 2X56 screws supplied in a convenient location. Be sure not to allow any metal parts to contact the board, this will damage the system. This board connects to the Control Board with a 9 pin wire harness to allow for a more convenient operator placement.

Rotating the "VOL" (volume) control clockwise will increase the volume. A complete counter-clockwise rotation will yield no sound!

Note: It is possible to destroy the standard 2" round speaker when operating at full volume. The sound system contains a 1 watt audio amplifier and the standard speaker is capable of sustaining 0.2 watts continuous. The standard speaker is a high efficiency type.

LocoMatic™ SwVol Board



speaker



when soldering wires to rear of speaker, care must be taken so that the wires do not come in contact with the speakers metal frame!

LocoMatic™ Control Board

Notch Control

SYNC input
see page 13
for details



- Lighting Outputs
- Aux 1
- Aux 2
- Marker Rear
- Marker Front
- Headlight Rear
- Headlight Front
- Fire Box (cab2)
- Cab1



.Item # 756
5 Volt, 60 milliamp
high intensity lamp.

LocoMatic™ Control Board

Although the bottom board is shown without the top power board, we do not recommend the separation of the two. This is shown for simpler identification of the connectors. When placing the connector mates into their appropriate sockets care must be exercised for proper alignment. Improper alignment may cause a pin to become bent. It is suggested to use a tweezers or small needle nose pliers to place the connectors together. When separating the connectors DO NOT pull on the wires! Instead, slide a tweezers (or small flat screwdriver between the top connectors lip and the board mate. Care must be taken when handling these small connectors.

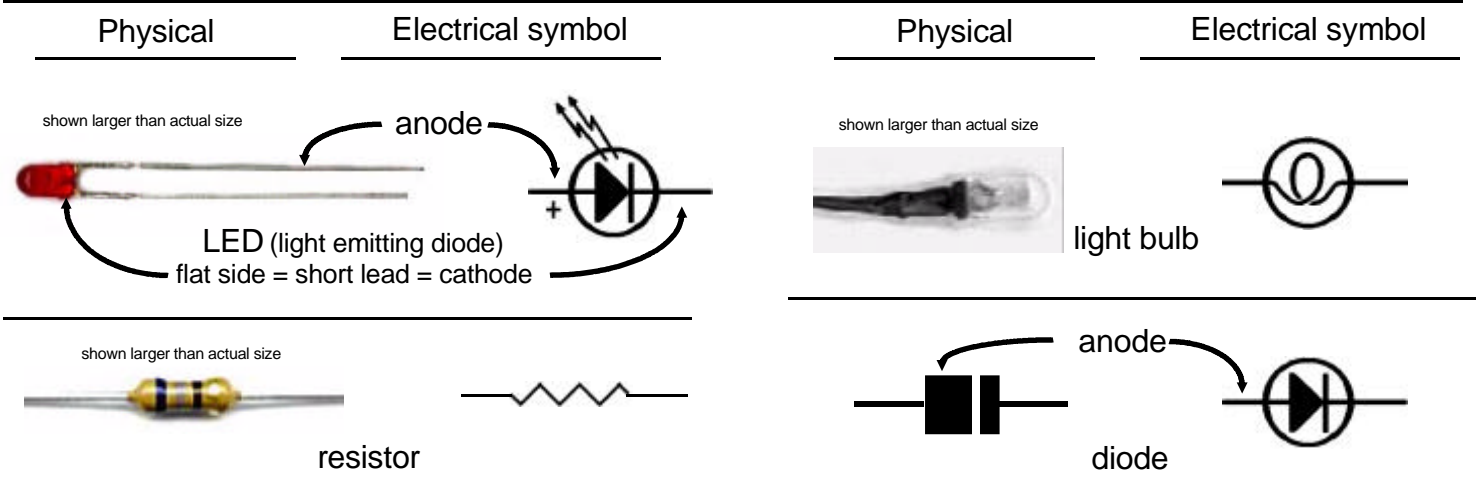
If you do elect to separate the two boards be sure to do so in an electrostatically controlled area and by all means make sure they are not rotated when remated! If the top and bottom boards are reconnected rotated and powered up you will damage the system! In order to assist in alignment, both pictures are shown in the same direction. The picture from the top of the Power Board, on page 6, is oriented in the same direction as the Control Board on this page. When correctly assembled, L1 (shown on the Power Board) should be directly above the Notch potentiometer of the Control Board.

Lighting Outputs: each output shown, as described in the main text, is capable of driving one 60milliamp load. This load may be a light bulb, as supplied, LED's (with limiting resistor), or a series of light bulbs. Item #756 contains more lamps as provided. More detailed optional connections exist on the following pages.

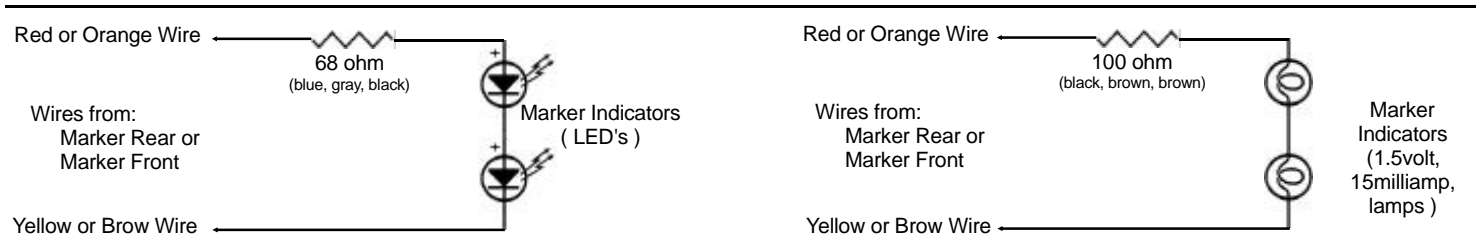
Connect the Red and Gray wires to supplied lamp. Insulate properly. As with any connections, an improperly or uninsulated wire touching the frame or other wire will damage the unit! Any damage as such is not covered under warranty.

When remoting several lamps and one common wire is desired, it is permissible to connect all red wires to a heavier gauge red wire. The red wires are the +5 volt lamp supply. The gray wire is the switched lead except for the Cab1 connection, in this case the gray wire is the same as ground. If any switched lamp output no longer operates, this is a sign that the output was either overloaded or came in contact with another wire. A short between wires to the lamp is also an overload. This would indicate a need for repair and has to be returned. Again, this type of failure is not covered under warranty since it is due to improper handling during installation.

Electical parts and their symbols

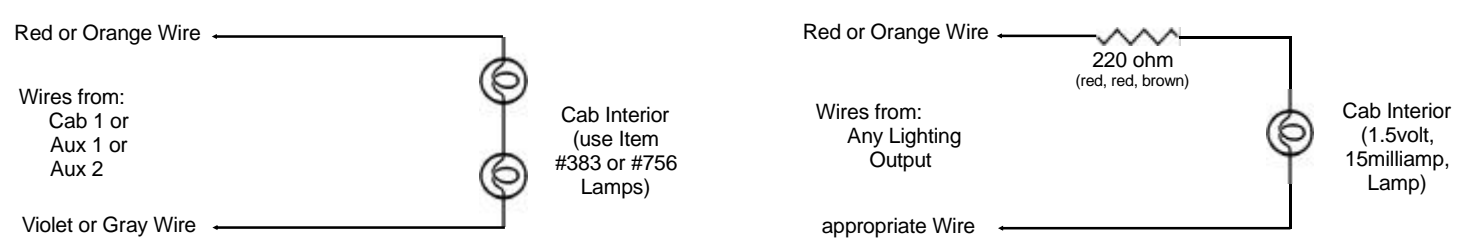


Wiring various Lighting Effects



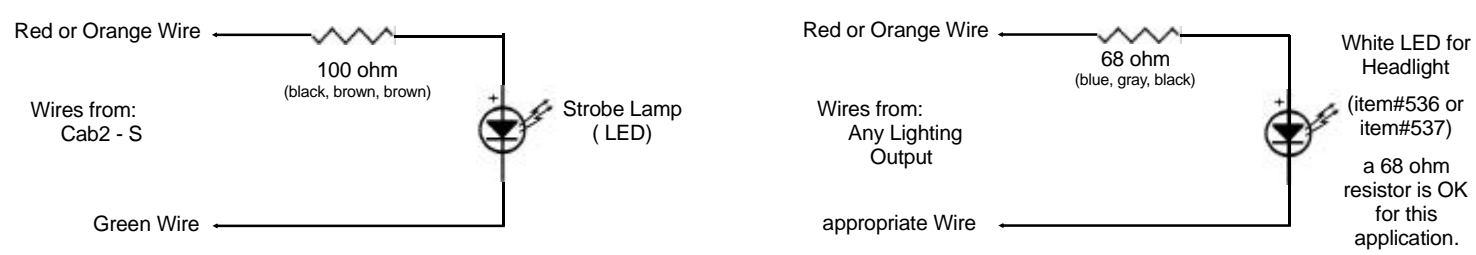
Wiring LED's as Marker Lights

Wiring 1.5v Light bulbs as Marker Lights



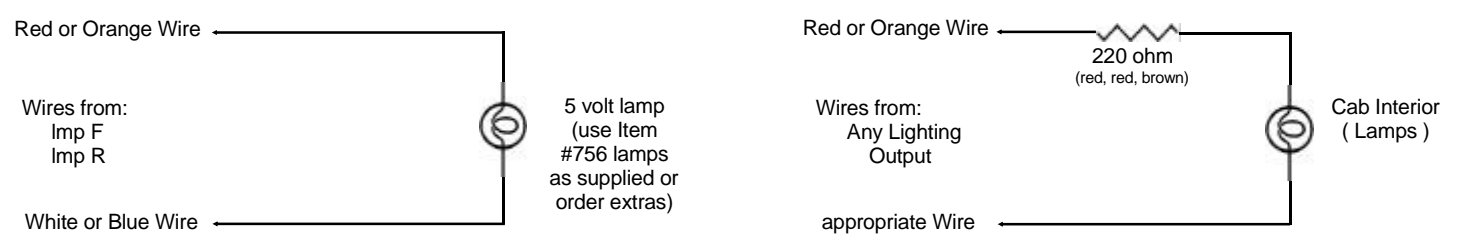
Wiring light bulbs in series as Interior Lights

Wiring 1.5v Light bulb for any use



Wiring an LED as a Firebox Light

Wiring WHITE LED instead of lamps

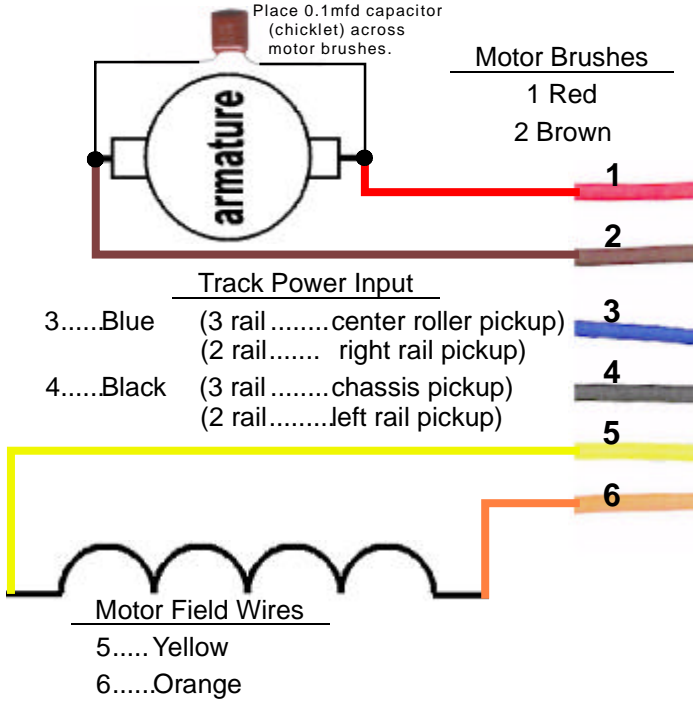


Wiring 5v Light bulb as headlight

Wiring 5v Light bulb for any use

Installation - Series Motor / Track connections

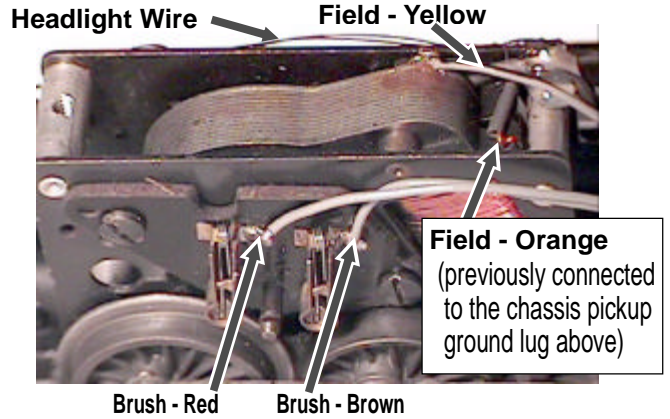
Main Power / Motor Connections



If the engine does not have a chassis (outside rail) pickup from each truck you should add one to prevent intermittent track pickup from occurring. Adding multiple center rail pickups will also help.

Help for Lionel series motors. These pictures show where the grounded field wire needs to be broken from the chassis for the motor power. Picture is early Lionel. It is always better to add a ground wire to both outside rail pickups and the chassis. When more than one center roller is available always connect to both, also secure the center pin from rotating with the roller.

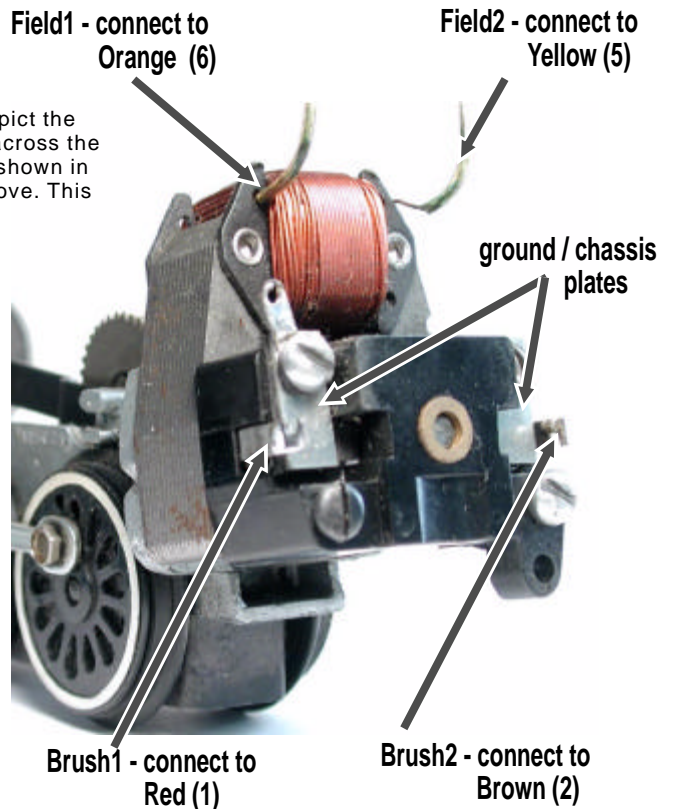
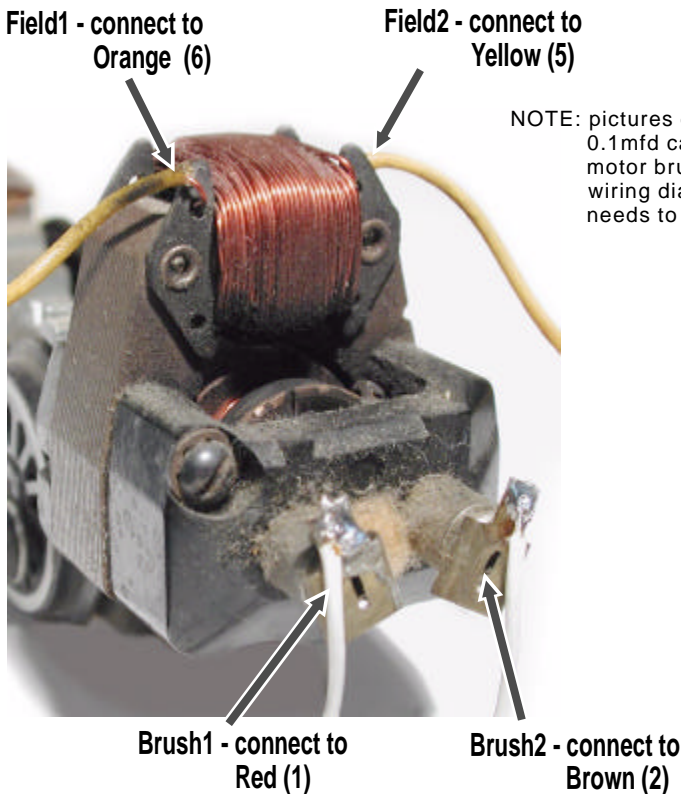
Colors indicated are those that match the LocoMatic™ Board main connector and not the locomotives existing wires.



Help for Am Flyer series motors. This picture shows where the wires are normally terminated. Colors indicated are those that match the LocoMatic™ board connector and not the locomotives existing wires.

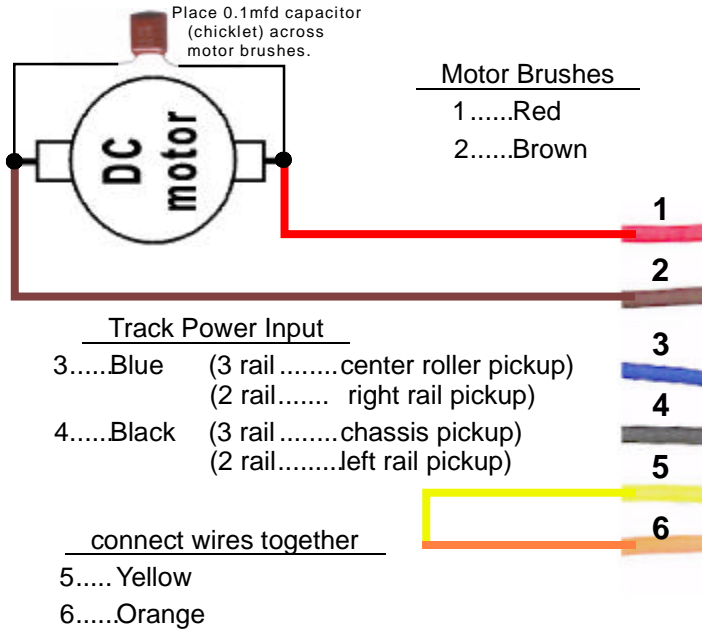
Original type series motors.

Newer type series motors. Make sure the ground / chassis plates **do not** touch the brush motor tabs.



Installation - DC Motor / Track connections

Main Power / Motor Connections

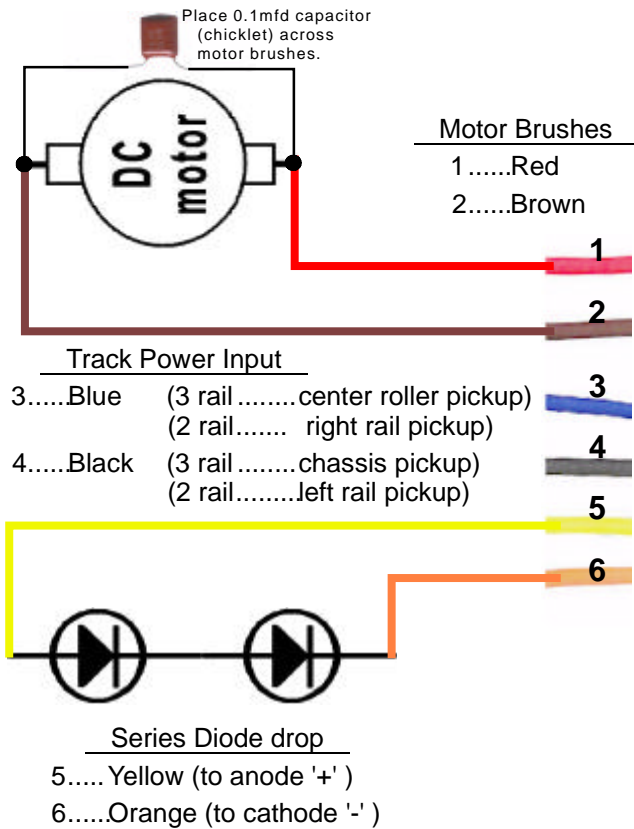


3 rail operators: If the engine does not have a chassis (outside rail) pickup from each truck you should add one to prevent intermittent track pickup from occurring. Adding multiple center rail pickups will also help.

2 rail operators: If the engine does not have a pickup wire for each rail, you should add one. DO NOT rely on proper pickup through the wiping action of a truck against the chassis for a proper pickup.

Multiple motors: when more than one motor is present you may want to wire them in series to reduce the top end speed. This is especially true of most 3 rail chassis since the gear ratio is higher than necessary. Place the capacitor shown on the motor brushes closest to the connection of the power feeds (red & brown) from the main board. If placing motors in series, either place one capacitor on each motor or connect to wire splice at closest motor to power feed.

Main Power / Motor Connections using series diodes to drop motor speed



Series Diode drop:

Use 6 ampere diodes (item 375) for heavy motor loads, 1 ampere diodes (item 374) for lighter motor loads (as in newer 'S' gauge equipment) . One or more diodes can be used. As shown, two diodes are used yielding a 1.5 volt drop. This is also a drop in voltage going to the DC motor, thus lowering it's RPM for a given voltage. By adding more diodes in series you can effectively reduce the top end speed of any locomotive and make a jack rabbit engine more tolerable without effecting the sound system.

Note: When more than one motor is in a locomotive you can either leave them in parallel, as originally wired, or place them in series to reduce the top end speed. Remember, the power stage is rated for 3 amperes. Higher load current will damage the electronics. In general, most newer locomotives with dual motors are only consuming 3 amperes. If in doubt you can always place a fuse in series with a motor brush wire.

Various Lighting Effects with LocoMatic™ Controller - Weaver M1A



no lights



Headlight



Front Marker Lights



Front Marker Lights
and Headlight



no lights



Backup Light



Rear Marker Lights

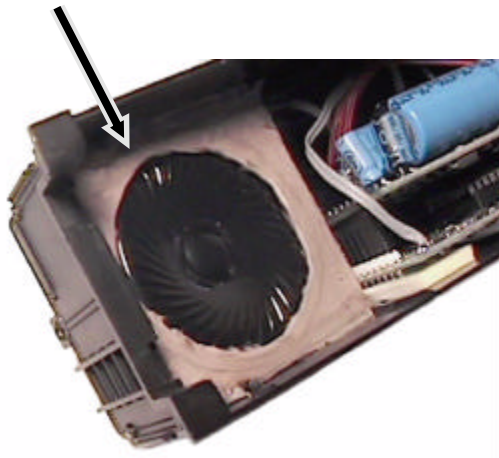


Rear Marker Lights
and Backup Light

Note : to install the supplied 5 volt lamp in the rear marker light position, it is necessary to drill open the existing hole.
All marker LED's have been rewired as shown on page 8.

Sample installation Lionel small tender

since most of these tenders are full of air gaps, make a speaker mount and baffle out of cardboard as shown.



Sample installation tender SwVol board mount

In this installation, a fake mounting plate to hold the SwVol board was installed in the front of the tender.

Item #520, 521, 611 miniature connectors were used for optional lighting and marker light installation. You can also use our ultra-miniature connectors for this purpose (Items 757, 758).



Sample installation - Weaver Reading Crusader

For any locomotive installation: When installing any unit, it is best to have a outside rail pickup present in the locomotive and tender. If there is no pickup in the tender add one by either drilling a hole (or use an existing hole) and attach a wire via screw and nut or by carefully soldering one to the floor. If soldering, DO NOT use any corrosive type flux!

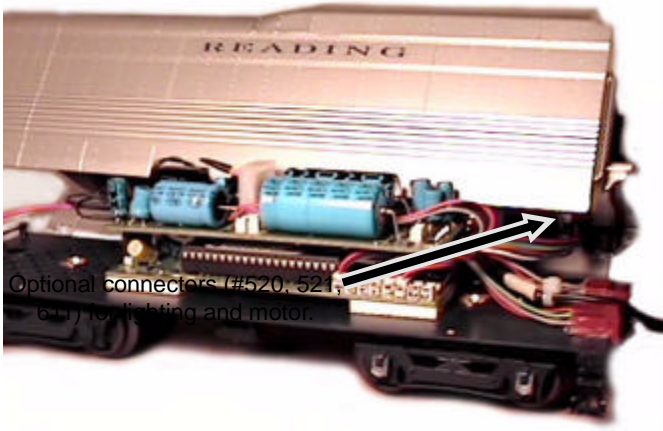
The front rollers should also be connected together. If the pin that holds the roller in place also rotates in the hole, pene or solder it to prevent it from rolling. A rolling pickup roller pin adds to intermittent operation. If the tender also has pickup rollers, connect them to the front locomotive rollers.

Notes on this locomotive installation: Optional Oval Speaker, Item #664, installed. This oval speaker yields better low frequencies than the standard 2" speaker. Since exhaust chuffs contain a good amount of lows and the sound is always better coming from the front of the locomotive, it was elected to mount this speaker in the boiler front as shown. This particular locomotive yields to this installation easily and since it already has wire screens in the shrouding, leaves the sound emminate nicely. The smoke unit was removed to obtain clearances for this to be done. To allow the oval speaker to mount forward, the metal mounting ears were carefully trimmed. The wires are not shown in their final positions. They were glued against the body to prevent any stray wire pinching when closing the shell to the frame.

This locomotive had the headlight replaced with the supplied, brighter, lamp. The marker lights were rewired as shown on page 8.

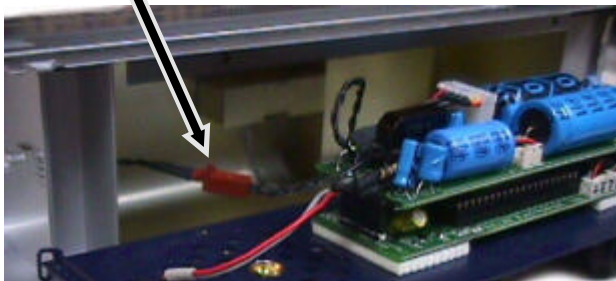
Connectors (item 520, 521) were used to provide for an easy disconnect between the locomotive and tender. The female ends were glued to the chassis. As can be seen at the bottom right of page 11, the tender shell clears these connectors with no problem. The ultra-miniature connectors could have also been used.

A coil coupler has also been added the the tender.



Optional connectors (#520, 521, 611) for lighting and motor.

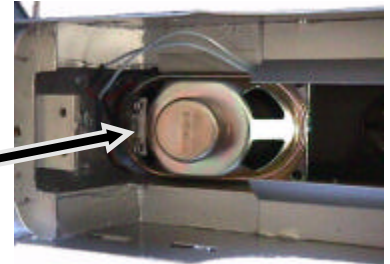
Optional rear marker light connector



Coil Coupler installed

Factory provided speaker location

Boiler front speaker mounting



Optional Coal Pile Speaker Mount



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.



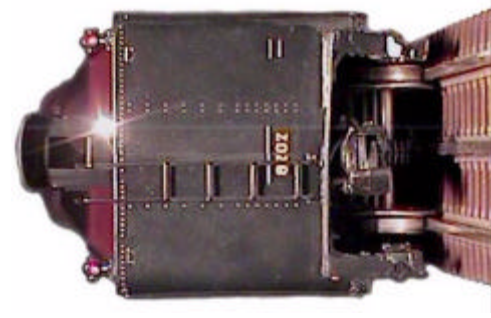
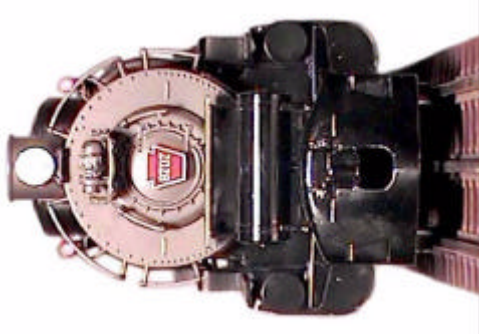
Mount the speaker with "Hot Melt" or glue. Be sure to cover all sides of the speaker so no air can escape.

no other air openings in this type of tender



Top view of tender with holes drilled. A careful job will yield a good appearance.

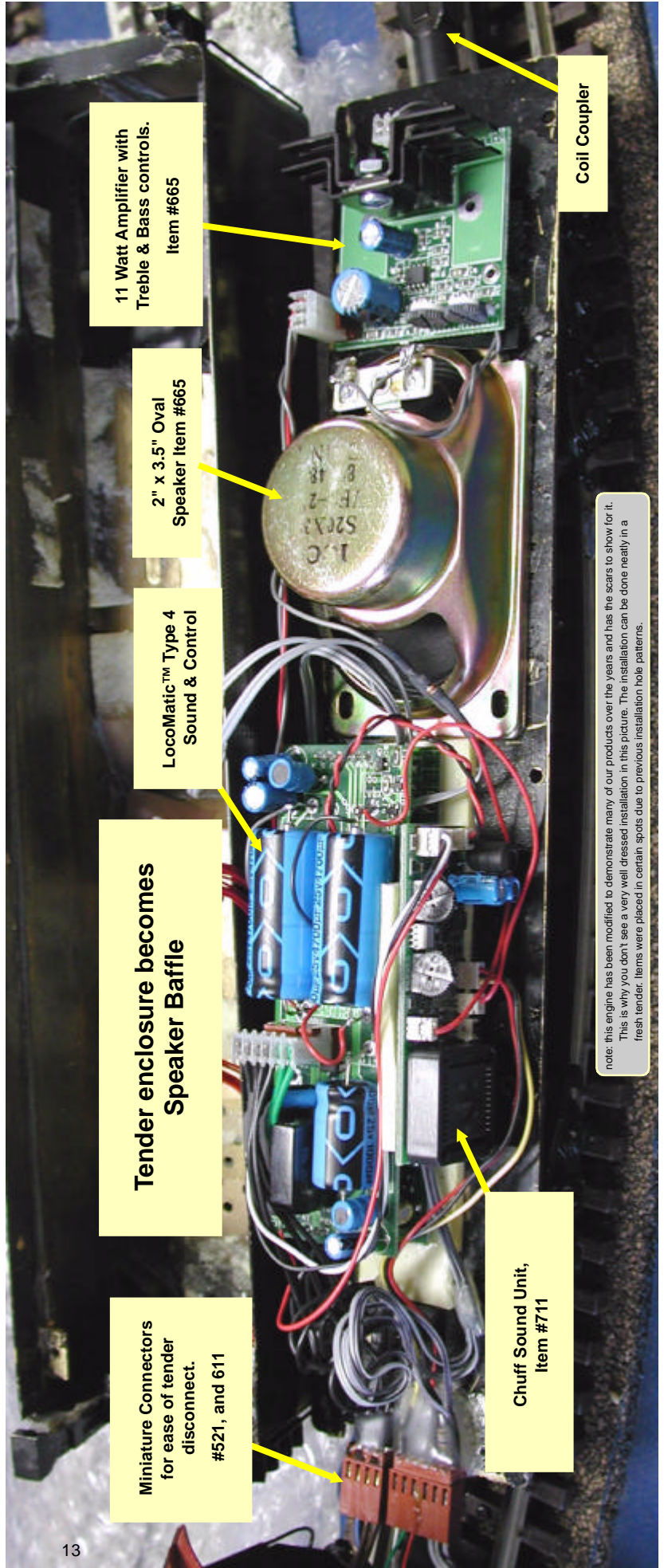
Weaver M1A



with synchronized exhaust chuff utilizing LocoMatic™ Sound & Control type 4 system (Item #804), Chuff Sound Unit (Item #711), Optical Synchronization (Item #583), 11 Watt amplifier with treble and bass controls (Item #671), and large Oval Speaker (Item #665).

Featuring front / rear headlights, front / rear markers, and rear coil coupler.

These items can be added to any large tender. For proper amplifier operation, a minimum of 12 volts of track power is required. This is ideally suited for LocoMatic™ type operation with full track power available.



Miniature Connectors for ease of tender disconnect. #521, and 611

Tender enclosure becomes Speaker Baffle

LocoMatic™ Type 4 Sound & Control

2" x 3.5" Oval Speaker Item #665

11 Watt Amplifier with Treble & Bass controls. Item #665

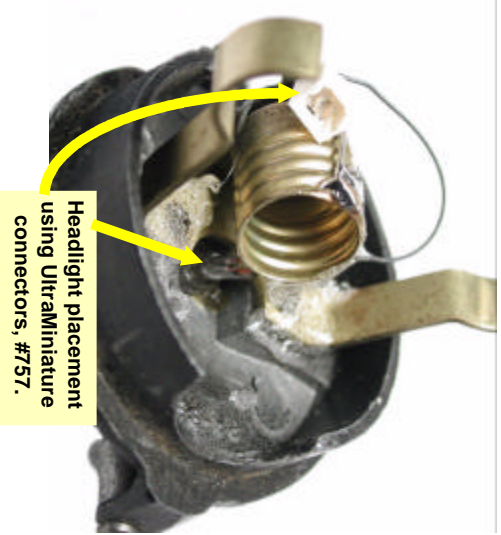
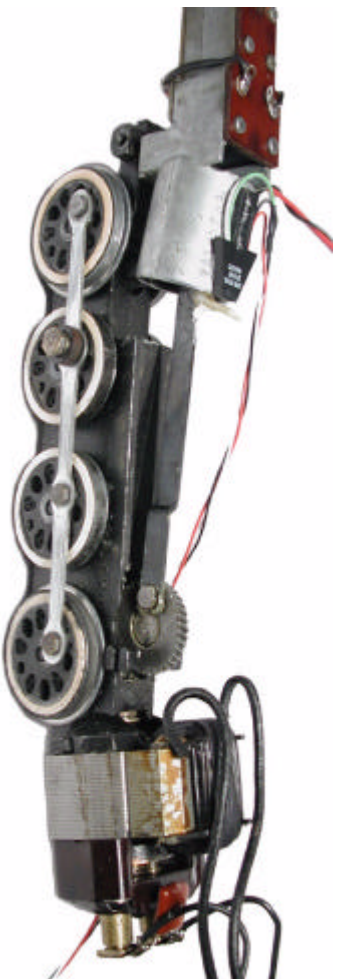
Chuff Sound Unit, Item #711

Coil Coupler

note: this engine has been modified to demonstrate many of our products over the years and has the scars to show for it. This is why you don't see a very well dressed installation in this picture. The installation can be done neatly in a fresh tender. Items were placed in certain spots due to previous installation hole patterns.

AF Northern Installation

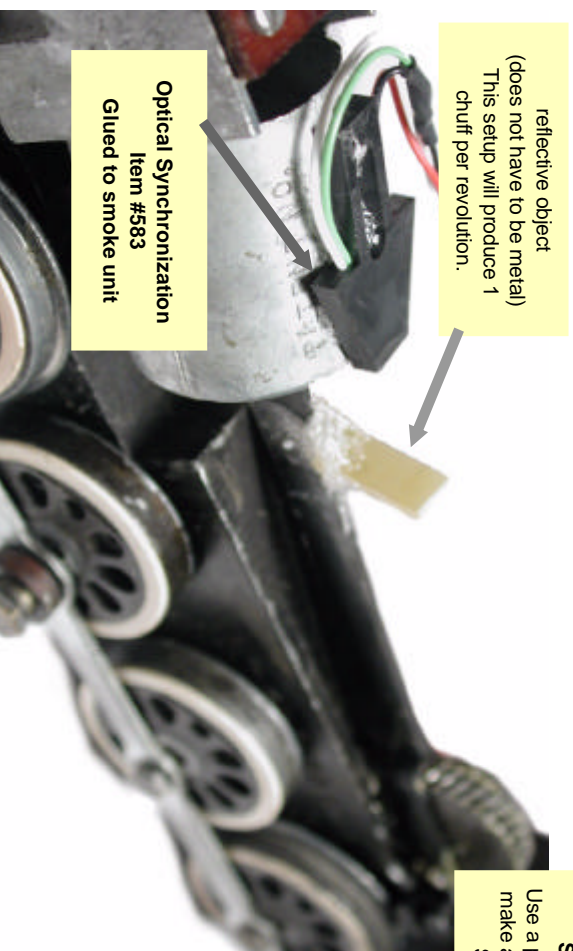
with synchronized exhaust chuff utilizing LocoMatic™ Sound & Control type 4 system (Item #817), Optical Synchronization (Item #583).
Featuring front / rear headlights and relay board #501 for smoke unit control via the LocoMatic™ controller.



Headlight placement using UltraMiniature connectors, #757.

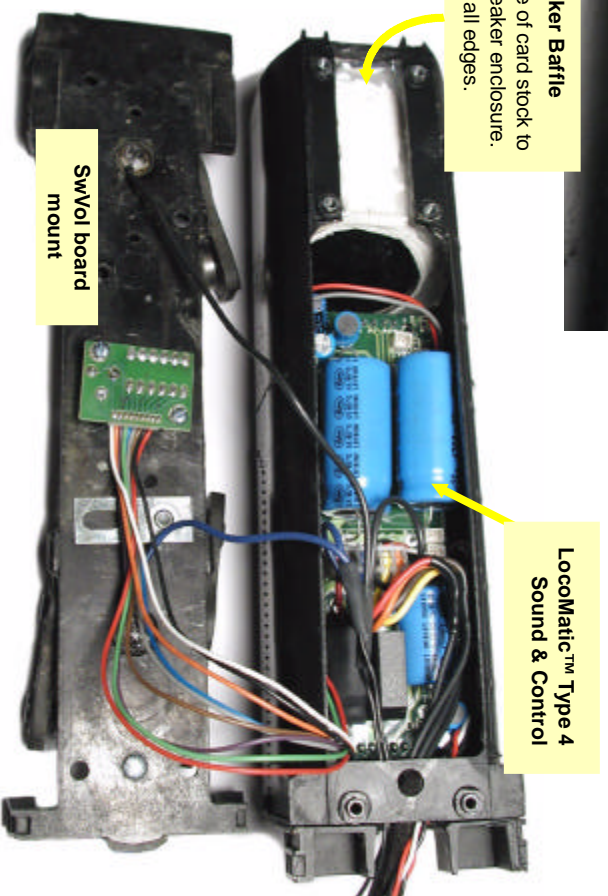


Speaker Baffle
Use a piece of card stock to make a speaker enclosure. Seal all edges.



reflective object
(does not have to be metal)
This setup will produce 1 chuff per revolution.

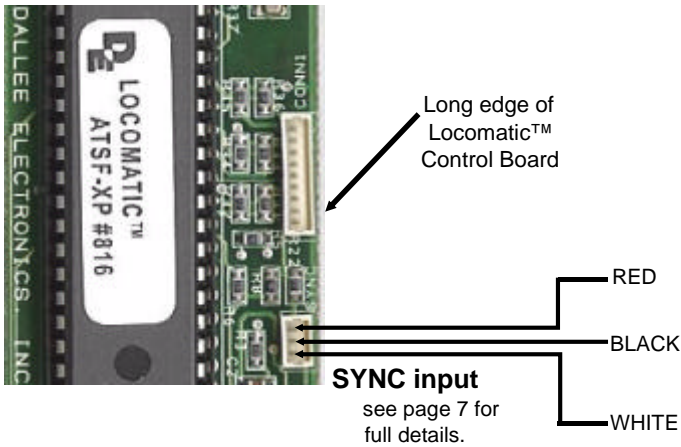
Optical Synchronization
Item #583
Glued to smoke unit



LocoMatic™ Type 4
Sound & Control

SWVol board
mount

Synchronized Chuff pickup installation



if synchronized CHUFF's are desired either connect optics or a switch to the SYNC input as described below.

Plug 3 pin connector, with wires, into the SYNC input. Wire colors shown, at left, reflect those supplied with the female connector. Connect these wires to the appropriate wires in the synchronization method of your choice.

When extending connections between the engine and tender, it is best if you install another connector between them. Select from Item 521 or 758 (ultra miniature) for this purpose. Be sure to properly insulate these connections.

Optical Synchronization

Optional reflective optical coupler (Item# 583) - mounts pointing to axle or any other rotating / moving item that moves in sync to the drivers. The optical pickup can read reflective tips of installed square cam (factory installed on some engines), or mount laser printed black / white stripes (supplied with item 583) quartered to drivers, or you can read the smoke unit crank / piston as it comes in and out of focus. Focus is 1/8" or more from end - up to almost 1/4".

Not shown actual size.

Measures 0.1" thick X 0.25w @ front, 0.5" deep & 0.6" wide @ main optical rear - before mounting slot, mounting slot is 0.5" long X 0.25" wide.

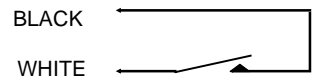


- 1 connect Black and Green optical pickup wires together, this then connects to the Black wire of the SYNC input.
- 2 connect Red optical pickup wire to the Red wire of the SYNC input
- 3 connect White optical pickup wire to the white wire of the SYNC input.

Installation Suggestions:


It is easiest to disconnect the drive linkage so that the axle is free spinning. Degrease the axle, mount the pattern, mount the axle back. Then apply power (6v) to the system (making sure that nothing shorts out) so that the motor is on. Rotate the axle so that the chuffs can be heard. Spin fast and slow to make sure no chuffs are missed due to improper alignment! Turn off the power and finish the installation. Be sure that when the optics are aligned to the axle that the axle is held in the proper position. Sometimes mounting a small block of wood and screwing the optics to that is easier alignment. If erratic reading occurs while running and alignment does not seem to be the problem, add a 0.1 mfd capacitor across the White and Black wires. This will help eliminate stray electrical spikes from false readings of the optical pickup.

Switch Synchronization

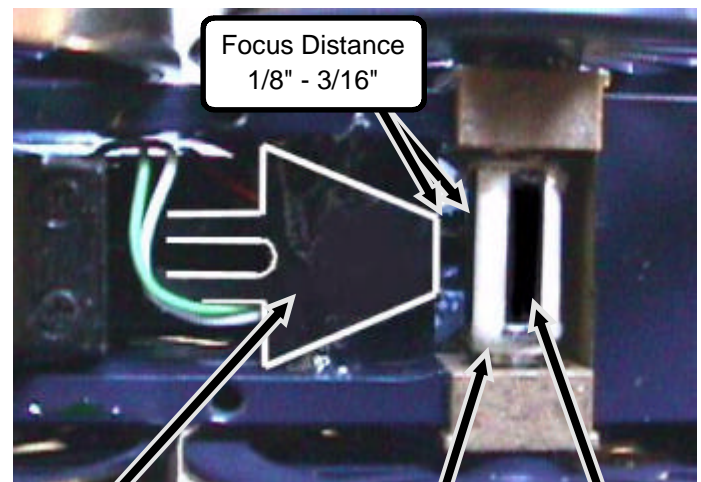


- 1 connect Common (C) of the switch (shown as a green wire) to the white wire from the SYNC input
- 2 connect Normally Open (NO) of the switch (shown as a black wire) to the Black wire from the SYNC input.

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.

Item #707, as shown,  is a subminiature micro switch for this purpose, in lieu of using optics (0.32"L X 0.1" W X 0.26" H).

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



Optical Coupler (hi-lighted for ease of viewing) glued 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.

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

Choke installation

When using other equipment on the same track with the LocoMatic™ system, it is necessary to install chokes in series with the other items drawing power. These other items could be lighted cars or other engines running in the consist. This is necessary to insure proper signal strength from the LocoMatic™ Controller. Without proper signal strength, the locomotive could receive improper instructions or no instructions at all when an operation is selected from the LocoMatic™ Controller.



To install the choke in other 2-rail lighted cars:

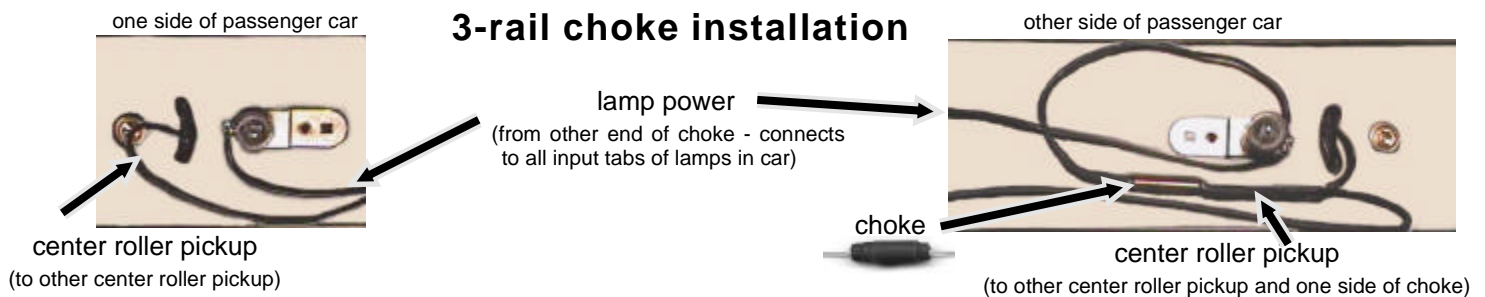
- 1locate right rail lamp power feed wire.
- 2.....inside the car, cut the power feed wire making two ends.
- 3.....connect one power feed end to one side of the choke and connect the other power feed end to the other side of the choke.
- 4.....be sure to electrically insulate all connections.

To install the choke in 3-rail passenger cars with multiple pickups:

- 1remove the existing center roller pickup wires.
- 2.....connect these wires together to form a common wire.
- 3.....place a new wire from one truck roller to the second truck roller. This will give you better pickup and should be done on all lighted cars.
- 4.....connect one end of the previous center roller pickup wire to one end of the choke.
- 5.....connect the center roller jumper wire (the new wire installed in step #3) to the other end of the choke.
- 6.....be sure to electrically insulate all connections.

To install the choke in 2-rail AF lighted cars:

- 1locate center lamp power feed wire.
- 2.....inside the car, cut the power feed wire making two ends.
- 3.....connect one power feed end to one side of the choke and connect the other power feed end to the other side of the choke.
- 4.....be sure to electrically insulate all connections.

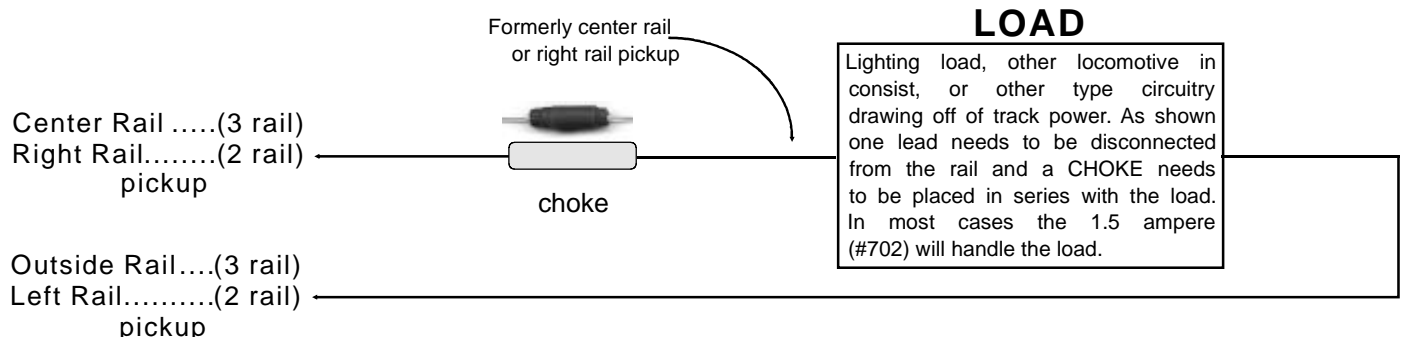


alternative lighting

you might also want to consider installing our Adjustable Regulated Lighting board. The RL-ADJ (item 379) comes with 4 lamps but is capable of driving eight lamps, as shown. You can set the intensity desired (1.25 - 5 volts). It maintains constant voltage to the lamps and has it's own choke so no other modifications are needed. Simply install the lamps where desired, connect the input power, and peel the tape to secure. The unit can be broken into smaller strip lengths where needed. Install in cabooses, passenger cars, or buildings. Measures only 1/2" wide. Extra, low voltage lamps, are available (item 383).



basic choke installation diagram



When installing in 2 rail equipment, use all Center Rail references as Right Rail and all Outside Rail as Left Rail.

for additional chokes order:

- Item 702 for up to 1.5 ampere load
- Item 703 for up to 5.0 ampere load