



# 4-8-4 Gs-2/Gs-4 Steam Locomotive

## OPERATOR'S MANUAL

### Compatibility

This locomotive is capable of operating on AC or DC output power supplies (see page 28 for a complete list of compatible transformers and wiring instructions) and indoors or outdoors. M.T.H. does not recommend operating the locomotive in inclement weather and strongly suggests that it not be left out in the elements. The locomotive will negotiate an R2 G-Gauge curve track or switch. Additional features may be utilized when controlling the engine with M.T.H.'s Digital Command System (DCS).



**PLEASE READ BEFORE USE**

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**CAUTION: ELECTRICALLY OPERATED PRODUCT:**

Not recommended for children under 10 years of age. M.T.H. recommends adult supervision with children ages 10 - 16. As with all electric products, precautions should be observed during handling and use to reduce the risk of electric shock.

**WARNING:** When using electrical products, basic safety precautions should be observed, including the following: Read this manual thoroughly before using this device.

- M.T.H. recommends that all users and persons supervising use examine the hobby transformer and other electronic equipment periodically for conditions that may result in the risk of fire, electric shock, or injury to persons, such as damage to the primary cord, plug blades, housing, output jacks or other parts. In the event such conditions exist, the train set should not be used until properly repaired.
- Do not operate your layout unattended. Obstructed accessories or stalled trains may overheat, resulting in damage to your layout.
- This train set is intended for indoor or outdoor use. Do not use if water is present. Serious injury or fatality may result.
- Do not operate the hobby transformer with damaged cord, plug, switches, buttons or case.

This product may be protected by one or more of the following patents: 6,019,289; 6,280,278; 6,281, 606; 6,291,263; 6,457,681; 6,491,263; 6,604,641; 6,619,594; 6,624,537; 6,655,640.

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# Set Up Checklist

- Install the tender coupler
- Lubricate the locomotive
- Prime the smoke unit
- Check to see whether the batteries need to be charged for full sound effects
- Apply power to run as described in the Basic Operating Section of this manual

## Installing The Tender Coupler

This RailKing One-Gauge locomotive can be equipped with three different types of G-Gauge couplers - an M.T.H. knuckle coupler, an M.T.H. hook & loop coupler or a 1/32nd Kadee coupler. For your convenience, the M.T.H. knuckle and the hook & loop couplers have been included with your locomotive. The Kadee type must be the 1/32nd size and can be purchased from a Kadee coupler retailer. Prior to installation, you will need to install the Kadee coupler base included inside your locomotive's packaging.

Both the standard knuckle and the hook and loop coupler designs attach to the tender chassis in the same manner as seen in Figures 1 and 2.

Knuckle Coupler  
In Standard Factory Position "A"



*Figure 1: Knuckle Coupler Position "A"*

Hook & Loop Coupler



*Figure 2*

## Installing The Tender Coupler (cont'd)

If the locomotive is to be mated up with a different manufacturer's G-Gauge locomotive, freight or passenger car, the knuckle coupler assembly may need to be relocated on the coupler armature as seen in Fig. 3. The second lower location or position "B" is on the bottom of the armature extending from the truck rather than the default top position "A" which is on top of the armature. Simply unscrew the coupler shaft from the armature, separate the coupler knuckle (attached by screw & nut) from this shaft and relocate to the bottom of the shaft. Reassemble.

Note: When the standard knuckle coupler is installed in position B, the knuckle pin must be cut off as shown in Fig. 3. The coupler pin has been "scored" so that it can be easily cut off with a pair of snippers.

The Hook and Loop coupler mounts to the truck armature in the same manner as the Knuckle Coupler. Note that the mounting screw is located behind the rear axle as seen in Figure 4.

If a Kadee Coupler is to be installed, remove the M.T.H. knuckle or hook & loop coupler and install the Kadee Coupler base included in your locomotive packaging as seen in Figure 5a. Once the coupler base is installed, attach the Kadee Coupler onto the mount (See Fig. 5b) by following the Kadee Coupler's installation guide.

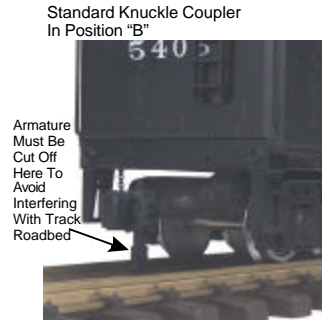


Figure 3  
Hook and Loop and Knuckle Couplers Attach To Truck Armature Via This Mounting Screw



Figure 4

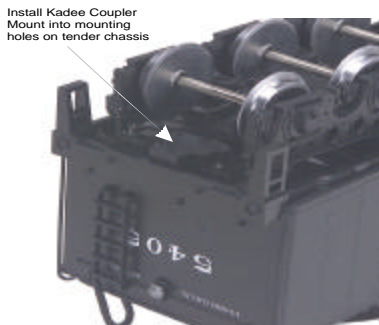


Figure 5a

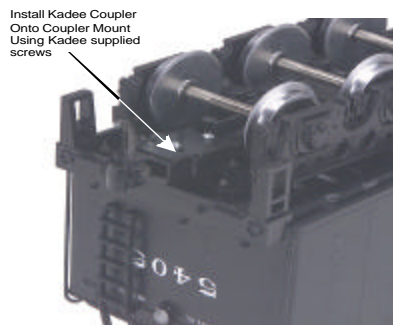


Figure 5b

## Lubrication

You should lubricate the engine to prevent it from squeaking. Use light household oil and follow the lubrication points marked “L” in Fig. 6. Do not over-oil. Use only a drop or two on each pivot point.



Lubricate Side Rods and Linkage (L) (Both Sides)

Lubricate Axle Bushings (L)

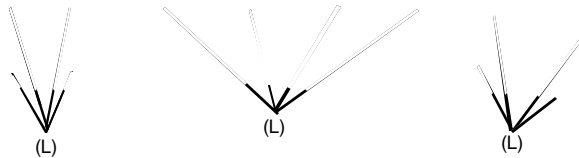



Figure 6: Lubrication Points on the Locomotive

## Priming The Smoke Unit

When preparing to run this engine, add 30-40 drops of smoke fluid through the smokestack. We recommend M.T.H. ProtoSmoke, Seuthe, LGB, or LVTS fluids. Do not overfill the unit or the fluid may leak out and coat the interior engine components.

If you choose not to add the fluid (or have already added the fluid but choose to run smoke-free), rotate the smoke unit knob located inside the boiler front (see Fig. 7) to the off position (rotate clockwise). If you wish to regulate the smoke output intensity, turn the knob between full counterclockwise and full clockwise until the desired smoke output is reached. **Failure either to add fluid to the unit or to turn it off may damage the smoke unit heating element and/or wicking material.**

 Running the engine without a primed smoke unit may cause damage

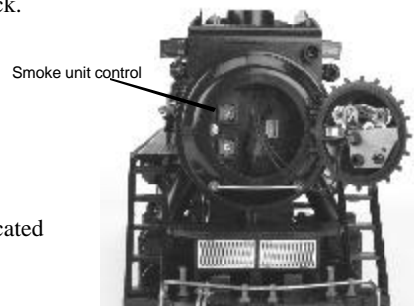


Figure 7: Smoke Unit Control

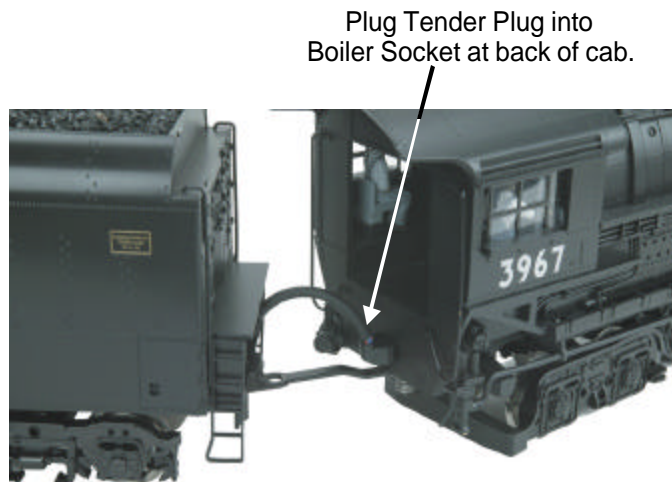
While M.T.H. does not recommend operating outdoors in inclement weather (in order to prevent possible damage to the electronics), we have included for your convenience, a smoke stack “cap” inside your locomotive packaging. This cap should be inserted on the smoke stack to prevent moisture from entering the smoke unit chamber.

## Placing The Engine On The Track

Place the engine on the track, then insert the reverse unit plug that extends out of the tender into the receptacle at the back of the boiler cab (Figure 8). **WARNING: DO NOT CONNECT THIS ENGINE TO A TENDER FROM ANOTHER ENGINE; IT MAY CAUSE SERIOUS DAMAGE.**

Connect the draw bar between the engine and tender.

At this point, you are ready to begin running your engine.



*Figure 8: Connecting Tender Harness*

## Checking The Battery

You may find, if your locomotive was built several months before you set it up, that the rechargeable batteries have run down and need to be charged before operating. If you notice that the sounds are garbled, test and charge the engine as described in the "Self-Charging Battery Back-Up" on page 23.

# Basic Operation

RailKing One-Gauge locomotives can be operated with AC or DC power output transformers. When using DC output power supplies, the user can only control the locomotive speed and direction. The locomotive will still make engine sounds but no bell or whistle control is possible when using a DC output power supply unless the user wishes to hook up the power supply to M.T.H.'s separately sold Digital Command System (see below).

As with all G-Gauge locomotives, the Throttle knob or handle controls how fast your train will travel.

## Activating Features Using DC Power

**Throttle** To increase or decrease track voltage, and therefore train speed, turn or slide the throttle control knob. Turning clockwise will increase voltage and speed, while turning counterclockwise will decrease voltage and speed. Because your RailKing One-Gauge locomotive is equipped with M.T.H.'s Proto-Speed Control feature, the engine will maintain the speed you set after you release the throttle until you turn it again to slow down or speed up the locomotive. This feature works very similarly to the cruise control system found in automobiles and allows the engine to maintain its speed even as it enters curves, traverses grades or coasts down inclines.

**Direction** - There are two ways to change a locomotive's direction when operating the engine with a DC power supply.

1. Slow the locomotive down using the throttle knob until the engine comes to a complete stop but power still remains on the track. Slide the direction switch on the power supply to the opposite direction and increase the throttle setting again to allow the locomotive to begin running in the opposite direction.
2. While the locomotive is running, slide the direction switch on the power supply to the opposite direction. The locomotive will slow to a gradual stop and then reverse direction and slowly gain speed until it is again travelling at its original speed prior to the direction switch change.

## Using DCS With DC Power

M.T.H.'s revolutionary Digital Command System, or DCS, allows users to control their RailKing One-Gauge locomotives in a command control environment. User's can remotely access hundreds of features inside each RailKing One-Gauge locomotive with the wireless remote control. Digital signalling and an easy-to-use interface make using DCS a snap. More information on DCS can be found on page 30 or by visiting [www.protosound2.com](http://www.protosound2.com).





## Activating Features Using AC Power

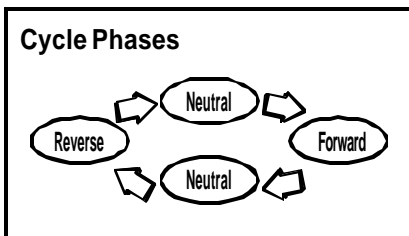
Using an AC output transformer equipped with a whistle and bell button will unlock dozens of features inside your RailKing One-Gauge locomotive. Operation is simple by following the simple steps below and on the following pages.

**Start Up** - Turn the throttle knob up ½-way, until the engine headlight shines bright.

Put the engine into motion by pressing the Direction button on your transformer once. (hold it for approximately 1 second)

If the engine does not begin to move as soon as you firmly press the Direction button, you may not have sent enough voltage to the track to make the train move. Turn the throttle up a bit higher until the train begins to move.

**Throttle** - To increase or decrease track voltage, and therefore train speed, turn the throttle control knob. Turning clockwise will increase voltage and speed, while turning counterclockwise will decrease voltage and speed. The engine will maintain the speed you set after you release the throttle until you turn it again to change the voltage and speed.

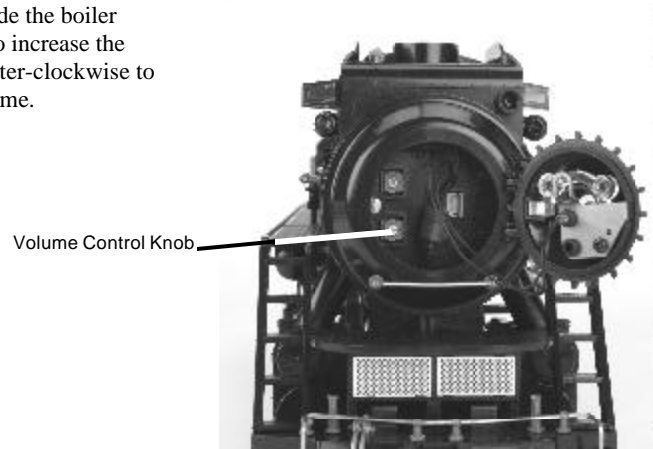


**Bell** - To sound the bell, in an engine equipped with a bell firmly press and release the Bell button. To turn the bell off, press and release the Bell button again. The bell will continue to ring from the time you turn it on until you press and release the button again to turn it off.

**Horn/Whistle** - To sound the whistle, firmly press the Horn/Whistle button. The whistle will sound for as long as you continue to depress the button. It will stop when you release the button. Three whistle/horn endings are available depending on how long the whistle/horn button is depressed. A short button push will cause the whistle/horn to quickly turn off. A 3 second or 6 second button push will create two distinct whistle/horn endings.

**Direction** - Your train is programmed to start in neutral. The train will always cycle neutral-forward-neutral-reverse with each press and release of the direction button. The engine is programmed to restart in neutral each time the track voltage is turned off for 25 seconds or more.

**Manual Volume Adjustment** - To adjust the volume of all sounds made by this engine, turn the master volume control knob located inside the boiler front clockwise to increase the volume and counter-clockwise to decrease the volume.



*Figure 9: Manual Volume Adjustment*

# Proto-Sound 2.0

## Operating Instructions

The following pages contain the operating instructions for Proto-Sound 2.0 RailKing One-Gauge locomotives when operated with AC output transformers in conventional mode only. Instructions for accessing DCS command mode features accompany the DCS Remote Control System equipment. These features are only available when using an AC Transformer equipped with a whistle and bell button.

Proto-Sound 2.0 features are activated by sequences of Bell and Horn button pushes described below. Please read the full descriptions of each feature before using it. To use these buttons to activate features rather than to blow the horn or ring the bell, you should tap the buttons very quickly with a 1/2-second pause between button presses. You may need to practice your timing to make this work smoothly.

### Activating Proto-Sound 2.0 Conventional Mode Features *(AC Operation Only)*

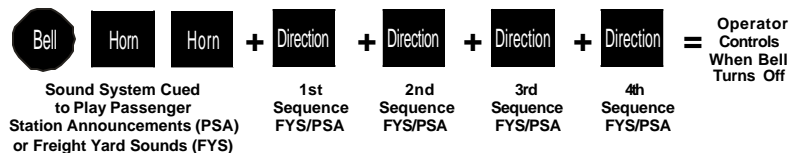
Timing Chart				
Press Horn Short & Firm	1/2 Sec. Pause	Press Bell Short & Firm	1/2 Sec. Pause	Press Bell Short & Firm
Total Time Lapse: 1 1/2 Seconds				

Feature to Be Activated	Button Code:
Freight Yard/Passenger Station Announcements	1 Bell, 2 Horns
Speed Control On/Off	1 Horn, 2 Bells (from Neutral only)
Lock into a Direction	1 Horn, 3 Bells
Reset to Factory Defaults	1 Horn, 5 Bells (from Neutral only)

## Freight Yard Sounds/Passenger Station Announcements(FYS/PSA)

Your engine is equipped with a sound package of freight yard sounds that you can play when you pull into a yard. Each sequence described below will play as long as it is left on, randomly generating sounds, but be sure to allow approximately 30 seconds between the button pushes described below to allow the FYS/PSA sufficient time to run through each sequence.

- To cue the sound system to play the FYS/PSA, quickly but firmly tap the Bell button once followed by 2 quick taps of the Horn button while the engine is moving. Tap the buttons quickly but allow approximately 1/2 second between each press.
- Press the Direction button once to stop the engine. This will trigger the first sequence of FYS/PSA. The reverse unit is temporarily disabled so that the train will not move as you use the Direction button to trigger the sounds, and Proto-Sound 2.0 has disabled operator control over the Horn and Bell buttons until the full FYS/PSA sequence is complete.
- After waiting about 30 seconds for that sequence to run, press the Direction button again to trigger the second sequence of FYS/PSA.
- After about 30 seconds, press the Direction button again to trigger the third FYS/PSA sequence.



#### **Tips on Using FYS/PSA**

- You can terminate FYS/PSA at any time by turning off power to the track for 15 seconds.
- You do not have to be in Forward to use FYS/PSA. At the conclusion of the full sequence, the train will pull away from its stopping point in whatever direction it was travelling when the feature was activated.
- You can use FYS/PSA even if you are double-heading with another engine. If the second engine is not equipped with Proto-Sound 2.0, you must remember not to leave the throttle at a high voltage level once you have stopped the engine to run the FYS/PSA. Otherwise, the engine without FYS/PSA will begin vibrating on the track as its motors strain to move the train, since they cannot be automatically disabled during the FYS/PSA cycle (or if an original Proto-Sound engine, FYS/PSA are triggered differently and that engine's motor-disable feature will not be active when you run FYS/PSA in Proto-Sound 2.0).
- FYS/PSA can be triggered from Neutral. It will operate the same as if triggered while in motion except that, at the conclusion of the FYS/PSA, the engine will depart in the next direction of travel, as opposed to the direction it was traveling before entering Neutral.

## Speed Control

M.T.H. engines equipped with Proto-Sound 2.0 are equipped with Proto-Speed Control which allows the locomotive to maintain a constant speed up and down grades and around curves, much like an automobile cruise control. You can add or drop cars on the run, and the engine will maintain the speed you set.

While the engine is programmed to start with the speed control feature activated, you can opt to turn it off. This means the engine's speed will fall as it labors up a hill and increase as it travels downward. It is also affected by the addition or releasing of cars while on the run. Because the engine will run more slowly at a given throttle voltage when speed control is on than when it is off, you should adjust the throttle to a lower power level for operation with speed control off to avoid high-speed derailments. When speed control is off, the sound volume will drop to allow for better low voltage operation.

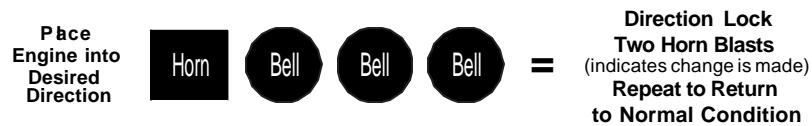
### To turn speed control on and off

Place the locomotive in neutral, then quickly tap the transformer's Horn button one time then quickly tap the Bell button two times, allowing approximately ½ second to lapse between each quick button press. Two horn blasts will indicate that the engine has made the change. Repeat the 1 horn, 2 bells code to return it to the other condition. You will want to do this during the initial neutral upon start-up if you ever couple this engine to another engine that is not equipped with speed control to avoid damaging the motors in either engine. Each time you shut down the engine completely, it will automatically turn speed control on.



## Locking Locomotive Into A Direction

You can lock your locomotive into a direction (forward, neutral, or reverse) so that it will not change directions. To do this, put the engine into the direction you want (or into neutral to lock it into neutral), run it at a very slow crawl (as slowly as it will move without halting), and quickly but firmly tap the Horn button once followed by three quick taps of the Bell button, allowing approximately ½ second to lapse between each quick button press. Two



## Reset To Factory Default

To override the settings you currently have assigned to the locomotive and reset it to its factory defaults, while in Neutral tap the Horn button quickly once, followed by five quick taps of the Bell button, allowing approximately ½ second to lapse between each quick button press. Two horn blasts will indicate that the engine has made the change.



## Automatic Sound Effects

Certain Proto-Sound 2.0 sound effects automatically play in programmed conventional mode conditions:

- Squealing Brakes play any time the engine's speed decreases rapidly.
- Cab Chatter plays at random intervals when the engine idles in neutral.
- Engine Start-up and Shut-down sounds play when the engine is initially powered on or is powered off for five seconds or more.

# Maintenance

## Lubricating and Greasing Instructions

The engine should be well oiled and greased in order to run properly.

You should regularly lubricate all side rods and linkage components to prevent them from squeaking. Use light household oil and follow the lubrication points marked "L" in Fig. 10. Do not over-oil. Use only a

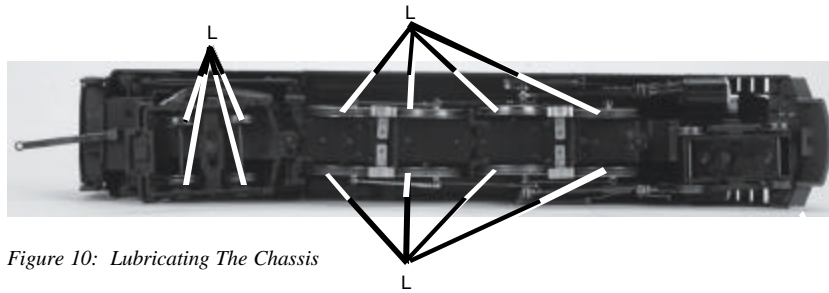


Figure 10: Lubricating The Chassis

drop or two on each pivot point.



Figure 11: Greasing the leading and trailing truck pivot points.



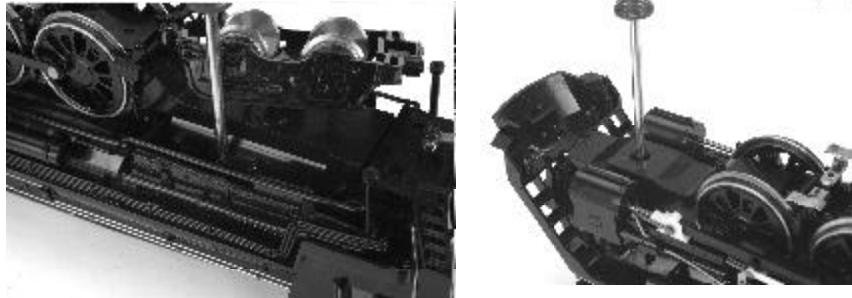


Figure 12: Removing The Body

You should also grease the leading and trailing locomotive truck tongues to enhance their ability to slide on the chassis. Follow the grease points shown on Fig. 11.

The locomotive's internal gearing was greased at the factory and should not need additional grease until after 50 hours of operation or one year, whichever comes first. To access the gear box and axles, do the following:

### Drive Train

1. Turn the engine upside down and place it in a cradle or brace so that it will not roll over.

2. Remove the 2 leading truck mounting screws and the body mounting screw under the leading truck. Then remove the 4 screws that attach the motor to the motor pivot. (See figure 13).



Figure 13

3. Separate the chassis from the boiler shell by lifting the chassis out and unplugging the connectors under the cab area. (See figure 14).

4. Remove the covers from the tops of the gearboxes. It is not necessary to remove the weights from the covers. However, as there is a pivot pin molded into the rear cover the rear cover must be removed first and replaced last. This pivot point must set into the socket in the front cover. There is also a pin and a socket at the bottom of the chassis

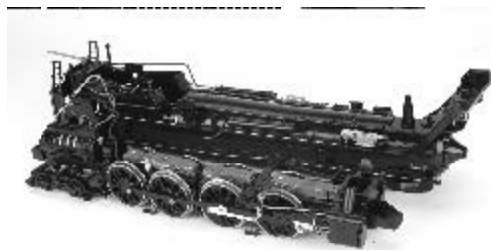


Figure 14: Remove gear box mounting screws

that must be in alignment when the covers are put back in place. This is critical for the articulation to operate properly. (See figure 15).

5. To remove the vertical gearbox, the motor mount screws in the bottom of the chassis that attach the motor mount to the chassis need to be removed. This will allow the dog bone joint to be easily removed and replaced. Remove the 4 screws attaching the vertical gearbox. Then pull straight up on the gear box. (See figure 16).

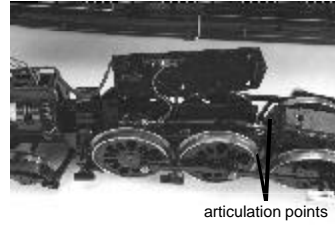


Figure 15

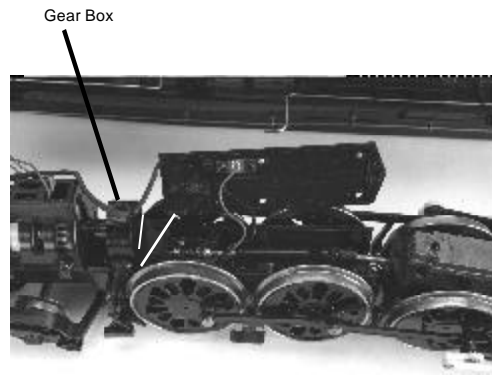


Figure 16

## Traction Tire Replacement Instructions

6. Apply a small amount of grease to the gears, reinstall the gear box, and then the gear box covers.

7. Reassemble the chassis to the boiler shell.

Your locomotive is equipped with two neoprene rubber traction tires on the rear set of flanged drivers. While these tires are extremely durable, you may need to replace them at some point.

1. Remove the side rods from the wheels in order to slip the new tire over the grooved drive wheel. Make sure to note the position of all rods before removing.

2. Make sure the old tire has been completely removed from the groove in the drive wheel, using a razor blade or small flathead screwdriver to pry away any remains.

3. Slip the new tire onto the wheel. You may find it useful to use two small flathead screwdrivers to stretch the tire over the wheel.

4. If you twist the tire while stretching it over the wheel, you will need to remove and reinstall the tire. Otherwise your engine will wobble while operating.

5. Make sure the tire is fully seated inside the groove. Use a razor blade to trim away any excess tire that doesn't seat itself inside the groove properly.

6. Reinstall the side rods in the same positions as noted. Failure to align rods may cause binding or damage to the drive system.

One set of replacement tires is packaged with your model. Additional sets are available directly from the M.T.H. Parts Department (order online: [www.mth-railking.com](http://www.mth-railking.com), e-mail: [parts@mth-railking.com](mailto:parts@mth-railking.com); mail: 7020 Columbia Gateway Drive, Columbia MD 21046-1532, FAX: 410-381-6122).

## Light Bulb Replacement Instructions

The locomotive and tender lights are controlled by a constant voltage circuit in the engine. They can be removed and replaced when they burn out by separating the boiler from the chassis as seen on page 17. Once the boiler has been separated, it will be necessary to trace the bulb wires back to the circuit boards mounted in the boiler and unplug the appropriate harness containing the bulb wires.

You can obtain replacement bulbs directly from the M.T.H. Parts Department (order online: [www.mth-railking.com](http://www.mth-railking.com), e-mail: [parts@mth-railking.com](mailto:parts@mth-railking.com); mail: 7020 Columbia Gateway Drive, Columbia MD 21046-1532, FAX: 410-381-6122).

### Headlight and Mars Light

The headlight and the Mars light can be replaced by opening the smokebox front. Remove the light bulb from the grommet, then unplug the wires. Install the replacement bulb by reversing the procedure.

### Firebox Glow and Cab Interior

To gain access to the firebox glow and cab interior Light bulbs remove the boiler shell from the chassis as described in the Maintenance Section on page 17.

### Lighted Number Boards

To replace the light bulb in the lighted number boards, remove the body from the chassis as described in the Maintenance Section on page 17. Then remove the power reverse detail and the feedwater pump detail.



Figure 17: Headlight & Mars Light

Next remove the 10 screws that attach the belly pan to the boiler shell and separate the belly pan from the boiler shell.

Remove the light bulb from the grommet, then unplug the wires. Install the replacement bulb by reversing the procedure.

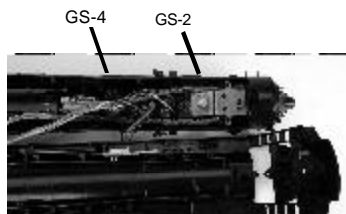


Figure 19:

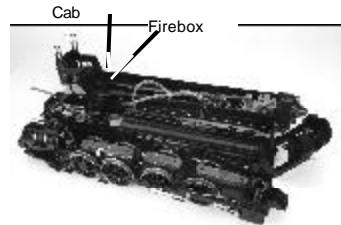


Figure 18

## Self Charging Battery Back-Up

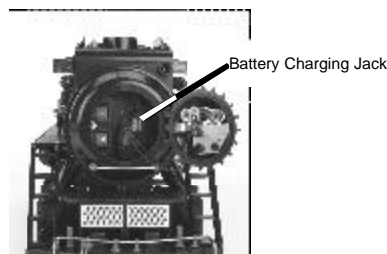
The special NiCad AA self-charging batteries recharge continuously during train operation and should last between one and five years. The batteries should not leak or cause any damage to your engine. Depending upon when your engine was built, it may need to be charged right out of the box. If engine sounds seem distorted or garbled at low voltages or become silent when power from the transformer is turned off, test the battery to determine whether it should be recharged or replaced.

**Test:** Put the engine in neutral and leave the track voltage at 10-12 volts (high enough for the lights to shine brightly and the engine to move steadily) for 15 minutes.

**Recharge:** If the sounds are improved at the end of the 15-minute test charge, the battery charge has run down and can be recharged. There are a number of ways you can do this:

- Leave the engine in neutral with track voltage at 10-12 volts for 6-7 hours so the battery can fully recharge (if your engine has a smoke unit, be sure it is turned off).
- Remove the batteries and recharge them in a NiCad battery charger.

**Replace:** If the sounds are not improved at the end of the 15-minute test charge, it is time to replace the batteries. Replacement batteries can be ordered through MTH. The batteries are located inside the locomotive boiler. See page 17 for instructions on removing the boiler from the chassis.



*Figure 20: Battery Charging Jack*

## ProtoSmoke® Unit Operation

This RailKing One-Gauge steam locomotive contains a self-powered smoke unit that outputs smoke through the smokestack on the roof of the engine. The smoke unit is essentially a small heating element and wick that soaks up and then heats a mineral oil-based fluid that emits smoke, which is then forced out of the stack by a small electric fan. Smoke volume is controlled by the Proto-Sound 2.0 system.

With a few easy maintenance steps, you should enjoy trouble-free smoke unit operation for years.

When preparing to run this engine, add 30-40 drops of smoke fluid through the smokestack (see Fig. 21). We recommend M.T.H. ProtoSmoke, Seuthe, LGB, or LVTS fluids. Do not overfill the unit or the fluid may leak out and coat the interior engine components.

If you choose not to add the fluid (or have already added the fluid but choose to run smoke-free), turn off the smoke unit switch located inside the boiler front door (see Fig. 22). **Failure either to add fluid to the unit or to turn it off may damage the smoke unit heating element and/or wick material.**

When the smoke output while running the engine begins to diminish, add another 10-15 drops of smoke fluid or turn the smoke unit off.

When storing the unit for long periods of time, you may want to add about 15 drops of fluid to prevent the wick from drying out.

After removing the engine from storage, add another 25 drops of fluid, letting the wick soak up the fluid for 15 minutes prior to operation.



Figure 21

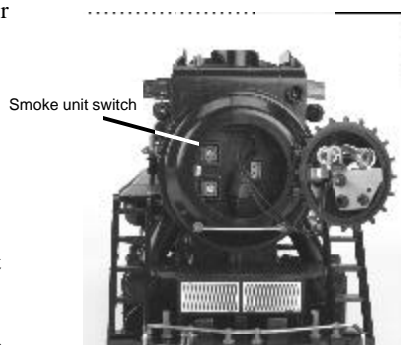


Figure 22

## Troubleshooting Proto-Sound® 2.0 Problems

Although Proto-Sound 2.0 has been designed and engineered for ease of use, you may have some questions during initial operation. The following table should answer most questions. If your problem cannot be resolved with this table, contact M.T.H. for

<b>Starting Up</b>	<b>Remedy</b>
When I first turn the power on, the engine will not begin to run. I have to turn the throttle off and then on again to get the engine to operate.	This is normal behavior. To prevent accidental high-speed start-ups, Proto-Sound 2.0 is programmed to start up in neutral anytime track power has been turned off for several seconds. See the "Basic Operation" section for more details.
<b>Horn</b>	<b>Remedy</b>
When I press the whistle button, the bell comes on instead.	Reverse the transformer leads.
I can't get the horn to blow when I press the whistle button.	You may be pressing the button too quickly. Try pressing the whistle button more slowly, taking approximately one full second to fully depress the button.
<b>Bell</b>	<b>Remedy</b>
When I press the whistle button, the bell sounds.	Reverse the transformer leads.
I can't get the bell to ring when I press the bell button.	You may be pressing the button too quickly. Try pressing the bell button more slowly, taking approximately one full second to fully depress the button.
The bell won't work on a separate bell button.	Check the wiring of the separate button.

<b>Cab Chatter</b>	<b>Remedy</b>
Sometimes the Cab Chatter sounds don't play.	Cab Chatter plays only in neutral at random intervals.
<b>Lock-out</b>	<b>Remedy</b>
I can't get the engine to run after I power up the transformer. It sits still with the engine sounds running.	The engine is locked into the neutral position. Follow the procedure in the "Lock into a Direction" section.
The engine won't lock into forward, neutral, or reverse.	Engine speed must be below 10 scale mph (approx. 10 volts or less in conventional mode).
<b>Volume</b>	<b>Remedy</b>
The sounds seem distorted, especially when the whistle or bell is activated.	Proto-Sound 2.0 volume is set too high. Turn the volume control knob on the bottom of the chassis counter-clockwise to reduce the volume.
<b>Battery</b>	<b>Remedy</b>
The engine will not leave the initial neutral setting.	Check to be sure the battery is installed and fully charged. See the "Self-Charging Battery Back-Up" section.
I get no sounds when the engine shifts between directions.	The battery may be dead or need to be charged. See the "Self-Charging Battery Back-Up" section.
After I turn off my transformer, my engine continues to make sounds before quitting.	Proto-Sound 2.0 is designed to continue to sound for a few seconds after power to the track has been shut off.
<b>FYS/PSA</b>	<b>Remedy</b>
The FYS/PSA sounds occasionally repeat themselves.	Proto-Sound 2.0 has a built-in random number generator that randomly selects each sound clip to play. Because there are a limited number of sound clips available in each FYS/PSA sequence, it is probable that some of these sound clips will be repeated from time to time.



FYS/PSA	Remedy
Once in FYS/PSA, the engine doesn't go into reverse.	So that FYS/PSA effects can be as realistic as possible,Proto-Sound 2.0 disables the reversing unit whenever FYS/PSA is enabled. This way the engine remains still at its stop as the operator cycles through the FYS/PSA sequences.
When the FYS/PSA enters its last sequence the bell automatically comes on.	FYS/PSA is programmed to start ringing the bell at that point. After approximately 12 seconds, it will automatically turn off.
When FYS/PSA is enabled, pressing the whistle and bell buttons has no effect.	Because FYS/PSA must control various effects in each sequence, Proto-Sound 2.0 takes control of these sound effects until you exit FYS/PSA.
I push the direction button but the next sound clip in the sequence does not play or the engine does not come out of FYS/PSA after fourth press of the direction button.	Each FYS/PSA clip must play for approx. 30 seconds before FYS/PSA will advance to the next step in the FYS/PSA cycle. Wait at least 30 seconds in each FYS/PSA sound clip before pressing the direction button.

## Transformer Compatibility and Wiring Chart

Proto-Sound 2.0 is designed to work with most standard DC power supplies and AC transformers. The following charts lists the recommended DC and AC transformers. Note that many of the AC operational commands described in these instructions require a bell button, so if your AC transformer does not have its own bell button, you should consider adding one to get the full benefit of the system. In addition, the chart details how the terminals on these transformers should be attached to your layout. DC transformers employing PWM (pulse width modulation) should not be used with the separately sold DCS system.

### Recommended DC Power Supplies

Transformer Model	Min/Max. Voltage	Power Rating	Transformer Type
MRC Controlmaster 20	0-20v	100 Watt	Electronic
PHobbies PS5	0-20v	100 Watt	Electronic
PHobbies PS10G	0-20v	180 Watt	Electronic
BridgeWorks Magnum 15	0-24v *	300 Watt	Electronic
BridgeWorks Magnum 200	0-24v *	300 Watt	Electronic
BridgeWorks Magnum 400	0-24v *	300 Watt	Electronic
BridgeWorks Magnum 1000	0-24v *	300 Watt	Electronic
LGB Jumbo 50101	0-24v *	240 Watt	Electronic

\*Use 22 volts maximum track voltage when operating a MTH locomotive equipped with Proto-Sound, Loco-Sound, or Proto-Sound 2.0

## Recommended AC Transformers

<b>RECOMMENDED AC TRANSFORMERS</b>					
<b>Transformer Model</b>	<b>Center Rail</b>	<b>Outside Rail</b>	<b>Min/Max. Voltage</b>	<b>Power Rating</b>	<b>Transformer Type</b>
MTH Z-500	Red Terminal	Black Terminal	0-18v	50-Watt	Electronic
MTH Z-750	Red Terminal	Black Terminal	0-21v	75-Watt	Electronic
MTH Z-1000	Red Terminal	Black Terminal	0-21v	100-Watt	Electronic
MTH Z-4000	Red Terminal	Black Terminal	0-22v	390-Watt	Electronic
Lionel 1032	U	A	5-16v	90-Watt	Standard
Lionel 1032M	U	A	5-16v	90-Watt	Standard
Lionel 1033	U	A	5-16v	90-Watt	Standard
Lionel 1043	U	A	5-16v	90-Watt	Standard
Lionel 1043M	U	A	5-16v	90-Watt	Standard
Lionel 1044	U	A	5-16v	90-Watt	Standard
Lionel 1053	U	A	8-17v	60-Watt	Standard
Lionel 1063	U	A	8-17v	60-Watt	Standard
Lionel LW	A	U	8-18v	75-Watt	Standard
Powermaster	U	A	8-18v	135VA	Electronic
All-Trol	Left Terminal	Right Terminal	0-24v	300-Watt	Electronic
Dallee Hostler	Left Terminal	Right Terminal			Electronic
Lionel LW	A	U	8-18v	75-Watt	Standard
Lionel KW	A or B	U	6-20v	190-Watt	Standard
Lionel MW	Outside Track Terminal	Inside Track Terminal	5-16v	50V.A.	Electronic
Lionel RS-1	Red Terminal	Black Terminal	0-18v	50V.A.	Electronic
Lionel RW	U	A	9-19v	110-Watt	Standard
Lionel SW	U	A	Unknown	130-Watt	Standard
Lionel TW	U	A	8-18v	175-Watt	Standard
Lionel ZW	A,B,C or D	U	8-20v	275-Watt	Standard
Lionel Post-War Celebration Series ZW	A,B,C or D	Common	0-20v	135/190 Watt	Electronic

\* Conventional Mode Only

## **Additional Features Accessible With The DCS Remote Control System**

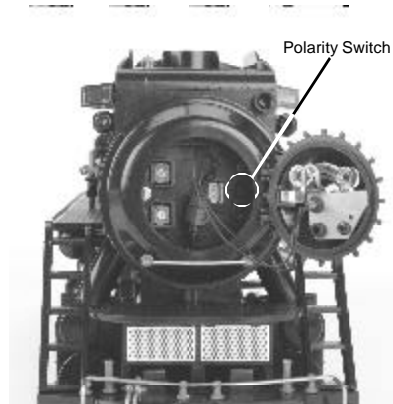
(Additional equipment required)

While conventional mode operation of a Proto-Sound 2.0 engine yields wonderfully realistic sound and several train control features, command mode operation allows the user to access a world of command functions never before available to G Gauge railroaders. With the addition of the DCS Remote Control System (including a DCS remote handheld and Track Interface Unit) users gain many advanced features, including:

- DCS Proto-Speed Control - Establishes desired locomotive speed in scale miles per hour increments via a thumbwheel control and allows operator to set maximum speed and acceleration/deceleration rates
- ProtoSmoke® Variable Output Control - Controls how much smoke each engine outputs and matches smoke to locomotive speed
- Locomotive Lighting Control - Controls locomotive headlights, marker and interior lights, beacon lights, ditch lights, and MARS lights
- Emergency Stop-Single button push stops all Proto-Sound 2.0 trains but does not turn off the power
- One Touch Global Mute/UnMute-Single button mutes or unmutes all DCS-controlled locomotives' user-defined actions, including sound, lights, and smoke
- Proto-Dispatch Operation-Public Address-like feature allows users to speak through locomotive speaker during operation
- Proto-Cast-Allows users to play audio recordings through locomotive speaker during operation
- Proto-Doppler Sound Effects Set Up-Users can configure locomotive for Doppler Operation, including setting distance points for Doppler start, repeat, and stop modes
- Independent Volume Control of Engine Sounds, Bell, Horn & Whistle for each Locomotive
- Control up to 50 different DCS-Equipped Locomotives at one time with multiple TIUs
- Proto-Effects™ Set Up-User can select individual Proto-Effects™ operations to be active or inactive, including cab chatter, train wreck sounds, coupler sounds, and wheel clickety-clack sounds
- Direction Control Set Up-User can set initial individual start-up direction (start in forward or reverse) for double-heading operations

## Addendum- Polarity Switch

Failing to properly configure the polarity will result in the locomotive starting in reverse instead of forward or not receiving the DCS signal. Should this occur, it is not necessary to swap the wires from the transformer to the track or reverse the locomotive's orientation on the track itself. Instead, simply slide the polarity switch shown in the photograph below.



*Can not find the engine using the DCS system? Move the polarity switch to the opposite position and try adding the engine into the DCS system again.*

# Service & Warranty Information

## How to Get Service Under the Terms of the Limited One-Year Warranty

For warranty repair, follow the instructions below to obtain warranty service.

First, e-mail, write, call or fax an Authorized M.T.H. Service Center in your area or M.T.H. Electric Trains to obtain Repair Authorization. You can find the list of Authorized Service Centers on the M.T.H. website, [www.mth-railking.com](http://www.mth-railking.com). Authorized Service Centers are required only to make warranty repairs on items sold from that store; all other repairs may or may not be done at the store's own discretion. Otherwise, contact M.T.H. (fill out the Service Contact form in the Service Section of [www.mth-railking.com](http://www.mth-railking.com); send US mail to the address listed below; tel: 410-381-2580; fax: 410-423-0009), stating when the item was purchased and describing the problem. If you contact M.T.H., you will be given a return authorization number to assure that your merchandise will be properly handled upon its receipt.

**CAUTION:** Make sure the product is packed in its original factory packaging including its foam and plastic wrapping material so as to prevent damage to the merchandise. The shipment must be prepaid and we recommend that it be insured. *A cover letter including your name, address, daytime phone number, e-mail address (if available), Return Authorization number, a copy of your sales*

## Limited One-Year Warranty

All M.T.H. products purchased from an Authorized M.T.H. Train Merchant are covered by this warranty. See our website at [www.mth-railking.com](http://www.mth-railking.com) or call 1-888-640-3700 to identify an Authorized M.T.H. Train Merchant near you.

M.T.H. products are warranted for one year from the date of purchase against defects in material or workmanship, excluding wear items such as light bulbs, pick-up rollers, batteries, smoke unit wicks, and traction tires. We will repair or replace (at our option) the defective part without charge for the parts or labor, if the item is returned to an Authorized M.T.H. Service Center or M.T.H. Electric Trains within one year of the original date of purchase. This warranty does not cover damages caused by improper care, handling, or use. Transportation costs incurred by the customer are not covered under this warranty.

Items sent for repair must be accompanied by a return authorization number, a description of the problem, and a copy of the original sales receipt from an Authorized M.T.H. Train Merchant, which gives the date of purchase. If you are sending the item to M.T.H., call 410-381-2580, fax 410-423-0009, or e-mail the Service Department at [service@mth-railking.com](mailto:service@mth-railking.com) to obtain a return authorization number. If you are sending this product to an Authorized Service Center, contact that Center for their return authorization.

This warranty gives you specific legal rights, and you may have other rights that vary from state to state.