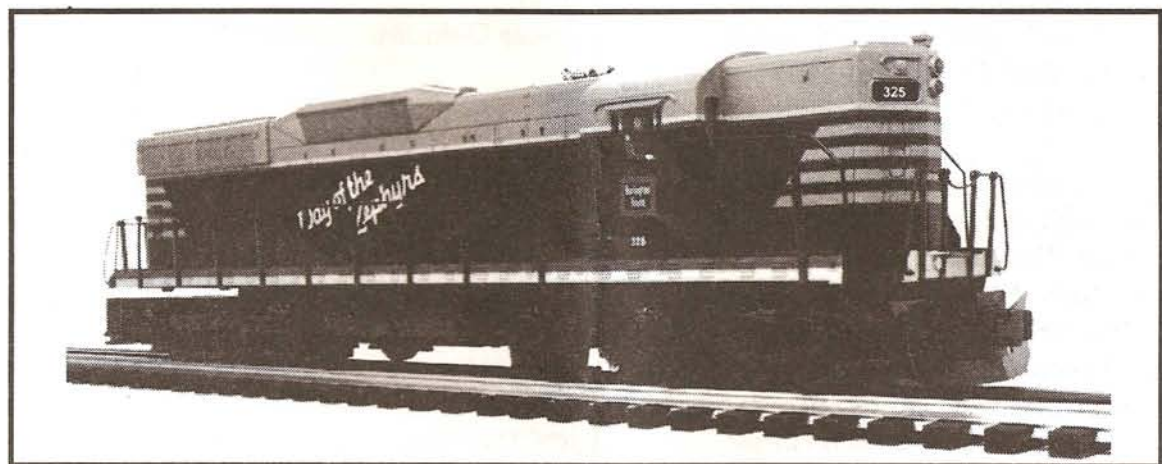




EMD SD-9 DIESEL ENGINE OPERATING INSTRUCTIONS (2 and 3-Rail Models)



Thank you for purchasing the MTH Electric Trains EMD SD-9 diesel engine. This 1/4" scale reproduction of the famous EMD workhorse measures almost 16 inches in length and weighs almost six pounds. Despite its scale size and intricate detailing, it can operate for years on O-31 3-Rail track with any compatible standard AC transformer (see the chart on page 18) and is completely compatible with most 3-rail locomotives, rolling stock and accessories. If you purchased the 2-rail model, the engine should negotiate 36 inch radius curves and is compatible with any DC power source.

The locomotive is equipped with several deluxe features that are simple and fun to operate. Each feature is described among the following pages which should be read before the engine is operated. For those of you who can't wait to get started, the **Quick Start Basic Operating Instructions** found on Pages 2 and 3 should be read so that you understand the basics of the operating system. Those features marked for 2 and 3-rail are found in all model types. Features not marked as such are only available in 3-rail ProtoSound equipped models.

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QUICK START - BASIC OPERATION

(2 and 3-Rail Models)

The MTH SD-9 contains state-of-the-art electronics with several built-in automatic features for incredibly realistic operation. Despite these advanced features, the 3-rail SD-9 is easy to operate with any compatible standard AC transformer (see the compatibility chart on page 18). The 2-rail model will operate with any DC power source. All models are equipped with an operating smoke system that **should be primed with smoke fluid before operating**. Adding 10 - 15 drops of fluid through the smoke stack should be sufficient. **If you choose to not prime the unit with fluid**, turn the smoke unit switch located under the leading drive truck to the OFF position. For more information see the section on page 4 on Smoke Unit operation.

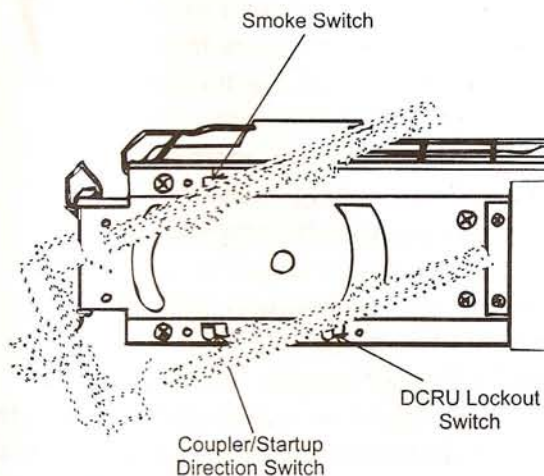


Figure 1: DCRU Lockout and Smoke Unit Switch Location

Both 3-rail models are controlled by a DCRU™ electronic reverse unit. The reverse unit operates in the same manner that all reverse units function by using forward, neutral and reverse states that are entered each time the throttle is turned on and off or by using the transformer direction switch (if so equipped). The 2-rail models' direction is controlled through the polarity of the DC power source and operate the same as all 2-rail DC engines.

The reverse unit is designed to ignore dirty track, dead spots on switches or minor short circuits without disrupting the engine operation, even at slow, prototypical speeds. Once the 3-rail engine is placed on the track, the throttle on the transformer can be advanced. You will see that only the engine's lights come on and that only two dings of the ProtoSound bell occur followed by the diesel start-up sounds (on ProtoSound equipped 3-rail models). The engine does not run. This is known as the RESET state and is explained in more detail beginning on Page 5. The DCRU™ will not power the motors until the throttle is turned OFF and then ON again. At this point, the engine will now function just like any other electronic or mechanical E-unit. On ProtoSound-equipped engines, the diesel engine sounds will begin to increase in speed as the engine moves and the horn can be activated by pressing the whistle button on the transformer just as any horn would be activated. See the sections later in this guide, beginning on page 5, for more information on activating the horn and bell sounds.

SMOKE UNIT OPERATION (2 and 3-Rail Models)

The SD-9 diesel contains a self-powered diesel smoke system that outputs a steady stream of smoke through the smoke stack on the roof of the SD-9. The ON/OFF switch located above the leading drive truck must be in the ON position in order for the smoke unit to function. See Fig. 2 below.

The smoke unit is essentially a small heating element and wick which soaks up and then "cooks" a mineral oil-based fluid that omits a harmless smoke. The smoke is then forced out of the stack via a small electric fan which runs at a constant speed. However, the smoke intensity can be varied by increasing the transformer voltage setting. The higher the setting, the more intense the smoke output.

For best results, we recommend that you add 10 - 15 drops of SuperSmoke fluid from the vial included with your engine before you run the engine. If you don't choose to add the fluid, then the smoke unit switch should be turned off. Failure to either add the fluid or turn the switch off could lead to damage to the smoke unit heating element and or wicking.

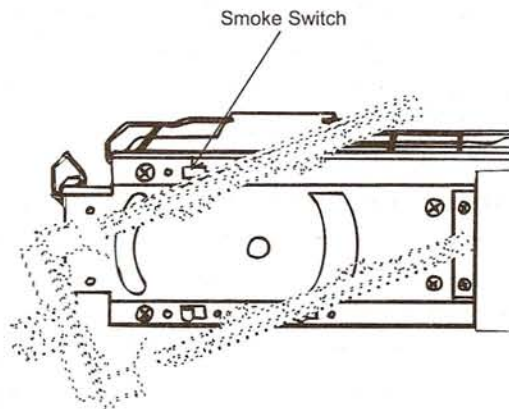


Figure 2: Smoke Unit Switch Location

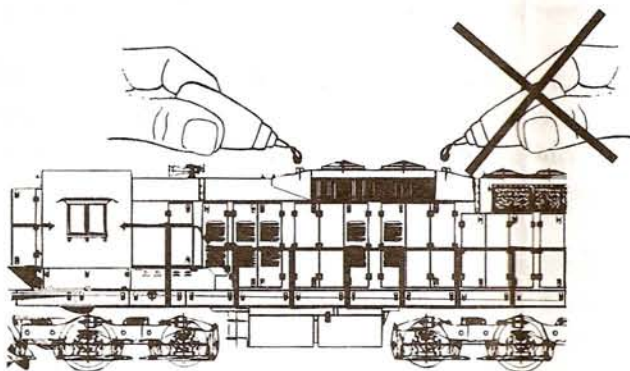


Figure 3: Adding Smoke Fluid Through The Roof Stack

After adding the fluid, gently blow into both the front and rear smoke stacks to eliminate any air bubbles. Do not overfill the unit as overfilling can cause the fluid to block the rear smoke stack fluid tube. When the smoke output begins to diminish while running the engine, an additional 10-15 drops of smoke fluid should be added or the smoke unit switch should be turned off.

When storing the engine for long periods of time, you may want to add at least 15 drops of fluid to keep the wick soaked with fluid and prevent it from drying out. After removing the engine from storage, it is advisable to add another 25 drops of fluid, letting the wick soak up the fluid for 15 minutes prior to operation.

SMOKE UNIT MAINTENANCE

CAUTION: Operating the engine without smoke fluid and with the smoke unit switch in the ON position can damage your smoke unit wick, causing the wick to become hard, blackened and unabsorbant around the heating element. When this occurs, it may be difficult for the wick to soak up the SuperSmoke fluid resulting in poor or no smoke output. If that occurs, we recommend using a lighter weight smoke fluid, such as LGB fluid. Once the engine is run with the lighter weight fluid, it may regain some of its absorbency and the SuperSmoke fluid can be used again. You can inspect the wick to see if it needs replacement by removing the smoke unit inspection cover as seen in Fig.4. After removing the screws lift the inspection plate away and inspect the wick. If the wick is darkly discolored and hard, it should be replaced.

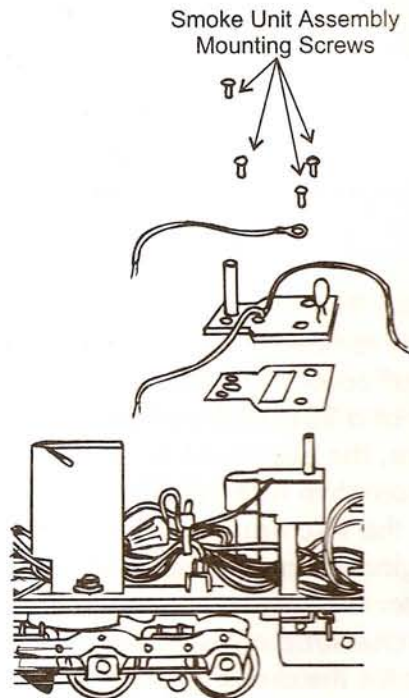


Figure 4: Inspecting The Smoke Unit Wick

NOTE: Replacement bottles of SuperSmoke are available at most hobby shops. Replacement smoke unit wicks and SuperSmoke can be purchased directly from MTH Electric Trains.

PROTOSOUNDS™ OPERATING INSTRUCTIONS

The MTH ProtoSound™ digital sound and train control system provides the operator with unprecedented realistic operation on your model railroad. In addition to actual EMD SD-9 engine, CD-equivalent 16-bit digital sounds, you get the following features:

- Built-In DCRU Reverse Unit
- Authentic EMD Horn Sound
- Authentic EMD Bell Sound
- Operating Remote Controlled ProtoCoupler™
- Self-Recharging Battery Back-Up System With Automatic Battery Shut-Off
- Remotely Controlled Reverse Unit Lock-Out
- Remotely Adjustable Diesel Engine Volume
- Upgradeable Microprocessor Options
- Authentic Diesel Engine Start Up & Shut Down Sounds

DCRU™ REVERSE UNIT AND PROTOSOUNDS OPERATION

(All 3-Rail Models)

As mentioned in the Basic Operating section, the engine is controlled by a DCRU™ reverse unit that contains the standard forward-neutral-reverse states found on most reverse units. However, as described earlier, when power is first applied to the track, the reverse unit begins in RESET or what seems like a neutral state. Power must be interrupted again to get the locomotive to enter the forward state. It is this first RESET state that gives ProtoSound™ its unique, remote controlled functions. The system will enter RESET whenever power to the track is off for three or more seconds. NEUTRAL will be referred to as the state between Forward and Reverse.

ProtoSounds™ is equipped with a microprocessor, that, depending on the amount of memory it is allotted, allows the user to utilize several remotely activated functions. In the simplest terms, ProtoSounds™ has its own "Computer" controlling these functions. In fact, the power of this microprocessor is the same as that of a 286 desktop computer! In order to access many of these remotely controlled functions, the user must be in the RESET state to do so. RESET is entered anytime power to the locomotive has been off for more than 3 to 5 seconds. When the engine first enters RESET, the microprocessor initiates a system check to determine if the system, transformer and engine are operating correctly. This takes approximately 2.2 seconds during which you will hear the engine's startup sounds begin. In order for ProtoSounds to properly initiate the system check, do not advance the transformer throttle past 10 volts when you first enter RESET, wait for the diesel startup sounds to begin and then slowly turn the transformer throttle to the off position and then back on again to enter the forward phase. Interrupting the power too quickly may cause the system to re-enter RESET (signaled by two dings of the bell). **Should this happen, wait longer before interrupting the power to enter the Forward phase.**

ProtoSounds™ comes with several programmable functions, including Diesel Engine Volume Adjustment, Separate Bell Button Operation (pre-programmed at the factory), Cab Chatter On/Off Control, ProtoCoupler On/Off Control and Horn-In-Neutral Operation. Each of these features are described in more detail later. (Additional features will be available at additional prices from MTH ProtoSound Electronics) You will notice that when in RESET, your engine will not respond to the whistle button with a horn blast or continuous bell ringing. In fact, when in RESET and the whistle button is depressed, only one single bell chime will be heard each time the whistle button is pressed. If you don't want to configure or change your locomotive using any of these programmable features, simply leave RESET and wait 2.2 seconds before interrupting the power to put the engine in forward. After you leave RESET, your engine will operate normally in all the direction states of forward, neutral and reverse.

DCRU MANUAL LOCKOUT (3-Rail w/o Sound)

3-Rail engines not equipped with ProtoSounds can be manually locked into forward, neutral or reverse by sliding the lockout switch to the off position after entering the desired reverse unit state. (See Figure 1 on page 3). To operate in automatic mode again, simply slide the switch back to the ON position. **Note:** *Once the unit is locked out and an hour or more of non-use has past, the reverse unit may cycle into any of three states. The on/off switch should be reset to the ON position to regain normal operation.*

HORN OPERATION

Your SD-9 ProtoSound-equipped engine is equipped with a digital recording of an EMD horn. The horn sound can be activated anytime the engine is in forward or reverse by pressing the whistle button on your transformer. The horn will continue to blow as long as the whistle button is depressed. The horn will not function in RESET and must be configured through a RESET option to allow the horn to work when the engine is in neutral. See page 10 for information on horn programming in the **Using RESET To Program ProtoSounds™** section of this manual.

BELL OPERATION

Your SD-9 ProtoSound-equipped engine is equipped with a digital recording of an actual EMD bell. Unlike previous versions of ProtoSounds, the bell can be turned on or off with any separate bell button, like the Lionel® Railsounds™ No. 5906 Bell Button, by simply pushing the button. If you don't have a separate bell button, the bell can be controlled through your transformer's whistle button whenever the engine is in NEUTRAL. The bell will never ring continuously in RESET (Remember NEUTRAL is the state between Forward and Reverse). Once the bell is turned on, it will continue to ring when the engine is cycled into forward or reverse until you press the bell button or re-enter NEUTRAL and turn the bell off with the whistle button.

In fact, because of ProtoSounds™ state-of-the-art design, the microprocessor remembers its last command. Therefore, unless you turn the bell off before you quit running your train, the next time you run the engine, the bell will come on. No matter whether you come back an hour later or a year later, the bell will begin chiming once the engine enters one of the three directional states.

To turn the bell on using the transformer's whistle button, turn on power to the track and cycle the engine into NEUTRAL. Turn the throttle to 8 volts or less (any higher voltage will arm the coil coupler) and press the whistle button. The bell should begin chiming. To turn the bell off, press the whistle button again. If you want to keep the bell on while running the engine, simply interrupt the power with the transformer throttle or the transformer directional switch and enter forward or reverse. If you do own a separate bell button controller, you can program ProtoSounds to blow the horn in Neutral instead of ringing the bell. See page 10 for information on programming in the **Using RESET To Program ProtoSounds™** section of this manual.

PROTO-COUPLER OPERATION

Your SD-9 ProtoSound-equipped locomotive has two coil-wound ProtoCouplers™ mounted on each power truck for remote controlled coupler operation. Because it is controlled through ProtoSound's microprocessor, it doesn't require an uncoupling track section or modification to your layout to function. The three simple steps below are required to operate the coupler.

- A. Put your engine in NEUTRAL and turn the throttle all the way up.
- B. Press the transformer whistle button to "Arm" the coupler. (You will hear a "Clank")
- C. After arming the coupler, press the whistle button again to open the coupler.

When the knuckle fires open you will hear the buzzing of the coil energizing and the sound of the air lines coming apart. It can best be described as a CHA-CHUSHHH sound. The coupler doesn't have to be fired in NEUTRAL. Once the coupler is armed it can be fired in Forward, Neutral or Reverse. However, you may find that the coupler doesn't open when firing the coupler at high speeds. Reduce the voltage setting on your transformer if this occurs and run your engine at a slower speed before firing the coupler. If the coupler continues to open erratically, try lubricating the knuckle with light oil as indicated in Fig. 5.

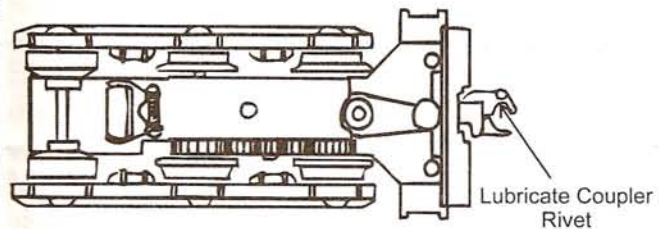


Figure 5: Lubricating The Coupler

SELF-RECHARGING BATTERY BACKUP SYSTEM

ProtoSounds™ state-of-the-art design includes a self-recharging battery backup system for improved performance at any speed. Unlike past ProtoSound-equipped locomotives, the self-recharging battery backup system is automatically turned on or off whenever track power is turned on or off. There are no switches to turn on or off to enjoy the benefits of the automatic battery backup system. The battery ensures that power to the sound system will remain on during directional changes, setting RESET options, or when traveling over dirty track and switches. No longer will sound abruptly shut off if there is a momentary interruption in track power.

REPLACING THE PROTOSOUND BATTERY

The battery is a rechargeable NiCad type which is continually charged from the track when power is applied. NiCad batteries are a dry battery and should not leak or cause any damage to your locomotive. They last up to five years before needing replacement.

If you notice that the sounds seem distorted or garbled at low voltages or become silent when power from the transformer is shut off, the battery may be going bad. Before replacing the battery, you should put the engine in NEUTRAL and leave the transformer throttle at about 12 volts for fifteen minutes. This should temporarily recharge the battery. If the garbled or distorted sounds are reduced, then your battery charge has worn down. You can give your battery a full charge by leaving the engine ON in NEUTRAL for 16 to 18 hours. (Make sure the smoke unit switch is in the OFF position to prevent any harm to the smoke unit or smoke unit wick).

The ProtoSound battery is a special NiCad 7-cell, 8.4v battery - NOT the 6-cell, 7.2v battery found in most convenience stores. The 6-cell NiCad is NOT recommended for use with ProtoSound applications. Replacement ProtoSound batteries are available from MTH ProtoSound Electronics at 9693-A Gerwig Lane, Columbia, MD 21046. A standard 9v alkaline battery can be substituted as a temporary fix, but since alkaline batteries can't take a charge, it will eventually wear down. Regardless, it should give you a week to a couple of months use while you wait for your replacement ProtoSound battery to arrive.

PROTOSOUND™ VOLUME ADJUSTMENT

Your ProtoSound™ system has two types of volume adjustment. A manual turn knob on the bottom of the chassis (See Fig. 6 below) allows you to control all the sounds in the system and a remote control "RESET" option (Option # 6), allows you to control the volume level of the diesel engine sounds remotely from the transformer. Turning the volume adjustment knob clockwise will increase the volume and counterclockwise will lower the volume of all sounds; bell, horn, diesel engine sounds, Cab Chatter, etc.

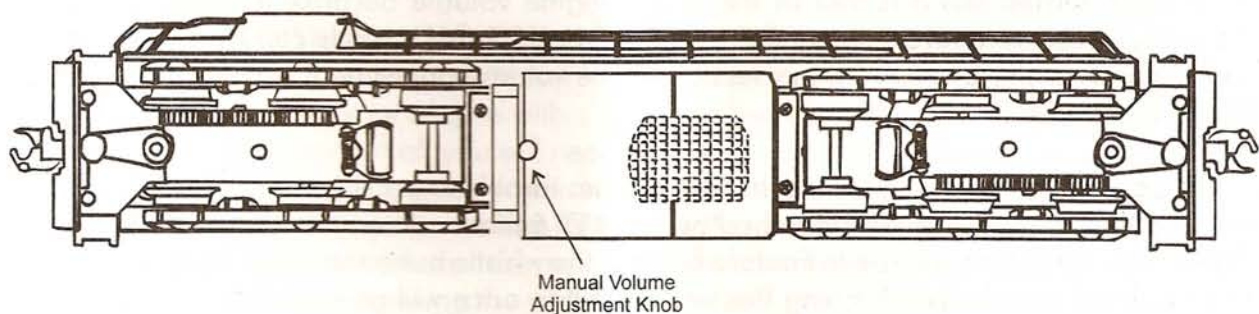


Figure 6: Manual Volume Adjustment Screw

USING "RESET" TO PROGRAM PROTOOUNDS™

As mentioned earlier, there are several programmable options in each ProtoSound-equipped engine that can be remotely set from any compatible standard AC transformer equipped with a whistle button. For a list of compatible transformers, see the chart on page 18. This hands-off approach gives you unprecedented control of your railroad empire's motive power never before seen in model railroading. Each programmable feature can be accessed whenever your engine is in the RESET state as described earlier on page 6. By following the instructions below you will find the programming easy and straight forward.

ENTERING RESET OPTIONS

While ProtoSound™ is equipped with only a few programmable features, additional memory chips can be obtained to "Upgrade" the system in the future. Programmable features are accessed in the RESET state by moving the transformer throttle up and down between full voltage and low voltage (6 to 8 volts) without shutting the transformer off completely. Each time this is done you advance, one feature at a time, through the available options. An air-release sound is heard each time the throttle is advanced. In addition, there are special sounds to tell you what RESET position you are in.

For example, if you want to select Feature 2 (an optional memory feature that sets an ID number on your engine), you put the engine in RESET, and move the throttle up and down from full throttle to low two times. After the second advance, you will hear two "clinks" indicating that the computer is now in Feature 2. Advance the throttle again and you will hear three "clinks" for Feature 3. Advance it two more times and you will hear a "clank" indicating that you are now in Feature 5. Advance the throttle two more times and you will hear a "clank" and two "clinks" indicating Feature 7. ((5 throttle advancements = 1 clank) + (2 throttle advancements = 2 clinks)). "Clank + "Clink" + "Clink" = Feature 7. You can advance the throttle as quickly as you like (though you may not hear the air-release sounds) and the computer will still remember the number of times the throttle is advanced by playing back the number of "Clinks" and "Clanks" to confirm the feature you've selected.

SETTING THE DIESEL ENGINE VOLUME

Of all the sounds that come with each ProtoSound-equipped diesel locomotive, the one most often turned down is that of the diesel engine volume because it is the one sound normally heard whenever the engine is running and is what usually can become tiresome to the ear over prolonged running sessions. The volume adjustment is controlled through RESET Feature 6.

To access the feature, advance the transformer throttle to put the engine in RESET. Move the throttle up and down, as described on page 7, 6 times. After you hear the "clank" and "clink" indicating that you are in Feature 6, press the whistle button to select the diesel engine volume level you desire. Pushing the whistle button once will give you full diesel volume, which is the factory setting. Pushing the whistle button a second time will give you 50%

diesel volume, pushing it a third time will give you 25% diesel volume and pushing it a fourth time will give you no diesel volume. The microprocessor will immediately play the sound level each time the whistle button is pushed so that you can decide if it is acceptable. You can recycle through the four choices by simply continuing to press the whistle button.

Once you have decided on the appropriate volume level, turn the transformer throttle off and on again or press the transformer direction switch to lock in your selection. The volume adjustment will remain set at the level you have chosen until you change it again. Regardless of the diesel volume setting, the horn, bell, compressor and Cab Chatter sounds will function normally. In fact because only the diesel volume is affected by selections in Feature 6, when you select 0 diesel volume, you can still hear the horn, bell and Cab Chatter sounds when the engine is running or in neutral.

PROGRAMMING FOR A SEPARATE BELL BUTTON CONTROLLER

To operate ProtoSounds with a separate bell button controller, like the Lionel No. 5906 bell button, you will need to wire up the controller to your transformer and track as shown in Fig. 7. Once the button is wired, ProtoSounds comes preprogrammed to allow you to operate the bell by simply pushing the bell button once. To turn the bell off, push the button again. If the bell doesn't function when you press the button, you may need to re-program ProtoSounds to operate with a separate bell button controller. To do this enter RESET and go to Feature 20. (See the section **Using RESET To Program ProtoSounds™** on page 10.) Once in Feature 20, press the whistle button and wait for the module to sound a bell ding(s). Continue pushing the whistle button until the module plays back two dings (signifying that the module has been programmed for a bell button). Simply turn the throttle off and then on again to "Lock-In" the new setting. To reset the computer to its original factory (default) setting (no separate bell button operation), repeat the above procedure but keep pushing the whistle button until the computer only responds with one bell ding.

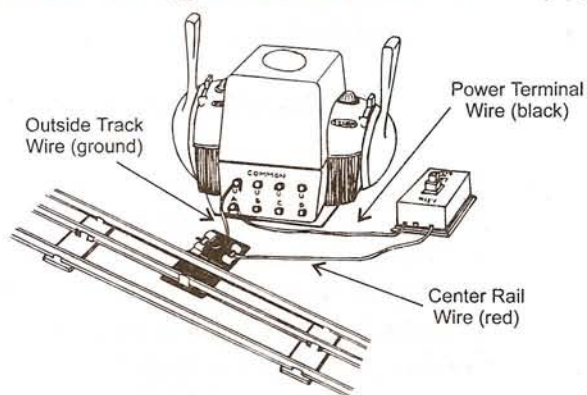


Figure 7: Wiring Up A Separate Bell Button

PROGRAMMING FOR HORN IN NEUTRAL OPERATION

If you are operating your engine with a separate bell button and want to blow your horn when your engine is in neutral, you will need to program ProtoSounds to do so as the factory setting only allows the horn to blow in forward or reverse. To do this, enter RESET and go to Feature 25. (See the section **Using RESET To Program ProtoSounds™** on page 10.) Once in Feature 25, press the transformer whistle button and wait for ProtoSounds to sound a bell ding(s). Continue pressing the whistle button until ProtoSounds sounds two bell dings (signifying that ProtoSounds has been programmed to sound the horn in neutral). Turn the

throttle off and then on again to "Lock-In" your selection. Now, whenever you are in neutral, you can blow the horn with the transformer whistle button. To reset ProtoSounds to its original factory setting of no horn in neutral, repeat the above procedure but keep pressing the whistle button in Feature 25 until ProtoSounds only dings once instead of twice.

Note: When "Horn In Neutral" is set, the bell will only operate with a separate bell button and the horn will not sound in neutral if the transformer throttle setting is over 11 volts. At 11 volts or higher, ProtoSounds may arm the coil coupler for operation whenever the whistle button is pressed and the engine is in neutral.

TURNING OFF CAB CHATTER SOUNDS

"Cab Chatter" sounds occur in the neutral position every 2 to 30 seconds. There are four "Chatter" messages which play at random times. This helps to eliminate repetitive and boring messages. While the sounds are selected to play randomly by the unit's computer, there is no guarantee that you won't hear the same message repeated twice or more times. If you don't want to hear the Cab Chatter sounds, they can be turned off through Feature 23. To turn off the Cab Chatter sounds, enter RESET and go to Feature 23. (See the section **Using RESET To Program ProtoSounds™** on Page 10.) Once in Feature 23, press the transformer whistle button and wait for ProtoSounds to sound a bell ding(s). Continue pressing the whistle button until ProtoSounds sounds two bell dings (signifying that the module has been programmed to turn the Cab Chatter off). Simply turn the transformer throttle off and then on again to lock in your selection. To turn the Cab Chatter sounds back on again, repeat the above process, but keep pressing the transformer whistle button in Feature 23 until ProtoSounds only sounds one bell ding.

PROGRAMMING FOR PROTOCOUPLER OPERATION

ProtoSounds now comes with a new RESET feature that allows the operator to remotely turn off the coil coupler functions. This is especially useful when double or triple-heading ProtoSound equipped engines since every engine equipped with a ProtoCoupler will fire when prompted to by the operator. By turning off the ProtoCoupler operation on certain engines, you can fire the couplers open on the other engines without uncoupling the engines from each other. To turn the ProtoCoupler function off, enter RESET and go to Feature 10. (See the section on **Using RESET To Program ProtoSounds™** on page 10.) Once in Feature 10, press the transformer whistle button and wait for ProtoSound to sound a bell ding(s). Continue pressing the whistle button until ProtoSounds sounds two bell dings (signifying that the ProtoCoupler option has been turned off). Simply turn the transformer throttle off and then on again to lock in the new setting.

RESETTING ALL PROTOSOUND OPTIONS TO FACTORY DEFAULTS

ProtoSounds is equipped with a RESET feature (Feature 18) that resets all programmable options back to their original factory settings. This is a useful feature if you find your engine not operating the way you think it should and don't want to take the time to check each RESET feature one at a time. To reset all the RESET features back to their original factory settings, enter RESET and go to Feature 18. (See the section entitled **Using RESET To Program ProtoSounds™** on page 10). Once in Feature 18, press the transformer whistle button and wait for ProtoSounds to sound a garbled bell sound.

REVERSE UNIT LOCK-OUT OPERATION

ProtoSound's unique design eliminates the need for a lock-out switch on the locomotive by allowing the customer to lock the engine into any directional state (forward, neutral or reverse) from the transformer. This will allow users to run the engine on layouts equipped with block signals or stop stations which would normally cycle the engine back into neutral.

LOCKING THE ENGINE INTO FORWARD OR REVERSE

To lock the engine into Forward or Reverse, use the transformer throttle to enter Forward or Reverse (whichever state you want to lock the engine into) and while the engine is moving press the whistle button. **WHILE THE WHISTLE IS BLOWING TURN THE THROTTLE OFF AND THEN LET GO OF THE WHISTLE BUTTON.** After about one second, you will hear a short horn blast. **QUICKLY TURN THE THROTTLE BACK ON AGAIN.** Your engine is now locked into Forward or Reverse and it will remain so until you unlock the engine, even if you wait a year to run your engine again.

UNLOCKING THE ENGINE

Unlocking the engine is a similar procedure. **WHILE THE ENGINE IS MOVING, PRESS THE WHISTLE BUTTON. WHILE THE WHISTLE IS BLOWING, TURN THE THROTTLE OFF AND THEN LET GO OF THE WHISTLE BUTTON.** After three seconds without power you will hear one chime of the RESET bell. **TURN ON THE POWER AGAIN.** Your engine is now in RESET and will operate normally once you interrupt power and enter the forward direction.

LOCKING THE ENGINE INTO NEUTRAL

To lock the engine into the NEUTRAL position, **PUT THE ENGINE IN NEUTRAL AND WITH THE THROTTLE STILL ON, PRESS THE WHISTLE BUTTON. WHILE THE WHISTLE BUTTON IS BEING PRESSED, TURN OFF THE THROTTLE AND LET GO OF THE WHISTLE BUTTON.** After about one second, you will hear a short blast of the horn. **QUICKLY TURN THE POWER BACK ON AGAIN.** Your engine is now locked into NEUTRAL.

NOTE: When locking the engine in the Forward or Reverse positions, the whistle button will blow the horn. But when locking the engine into the NEUTRAL position, the whistle button may turn on or off sounds of the bell, coupler arming or coupler firing depending on the transformer throttle voltage settings prior to the user's attempt to lock out the engine. Remember, the horn doesn't blow in NEUTRAL (unless you programmed it to do so using Feature 25. See page 9 for details), only the bell rings or the coupler operates in NEUTRAL. While it doesn't make any difference on how the lockout function operates, you may hear one of the three different NEUTRAL-activated sounds.

To unlock the engine from the NEUTRAL position, follow the process to unlock the engine in the Forward or Reverse directions above.

OIL & LUBRICATION INSTRUCTIONS

(2 and 3-Rail Models)

In order for the engine to perform correctly and quietly, it is important that the locomotive be lubricated before operation. Lubrication should include all truck block bushings and pickup rollers to prevent them from squeaking. Use light household oil and follow the lubrication points marked "L" in Fig. 8 below.

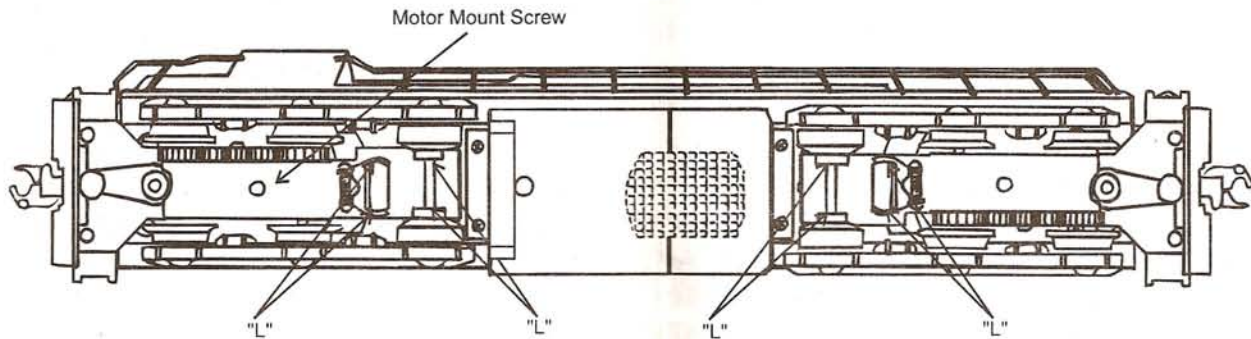


Figure 8: Lubricating The Chassis

The locomotive's internal gearing has been greased at the factory and shouldn't need additional grease until after 50 hours of operation or one year whichever comes first. Grease cannot be added to the internal gearing until the body is removed from the chassis which is held in place by six shouldered Phillips screws. There are two screws on each end of the chassis and two screws next to the fuel tank just under the rear of the front truck and are visible when the truck is turned from side-to-side. After removing the screws, lift the body away from the chassis and lay the body next to the chassis being careful not to break or harm the headlight wiring harnesses.

Next, remove the truck blocks from the chassis by unscrewing the large Phillips motor mount screw on the bottom of each truck block (See Fig. 8). Once the motor mount screw has been removed, pull the motor away from the truck block and lightly coat the motor worm gear and bronze drive gear (in the truck block) with grease. Reassemble the truck and motor, being careful not to pinch the pickup and ground wires between the truck block and motor mount. Repeat the procedure for the other motor and truck and then reassemble the chassis to the body. When reassembling the chassis and body, be very careful that the lighting wire harnesses are not caught between the body and chassis as this can lead to a short which may damage the electronic circuit boards beyond repair.

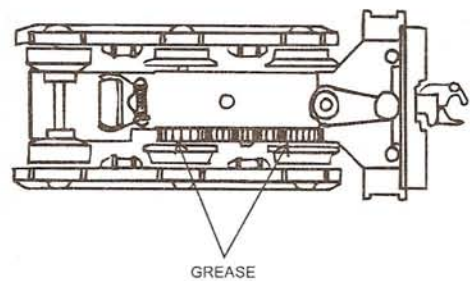


Figure 9: Greasing The Gears

In addition to the truck block internal gearing, it is a good idea to lubricate the outside truck block "idler" and "drive" gears with grease. Use the diagram shown in Fig. 9. above as a guide and add grease to the points marked with a "G".

TRACTION TIRE REPLACEMENT INSTRUCTIONS

Your SD-9 locomotive is equipped with four neoprene rubber traction tires. While these tires are extremely durable and long-lasting there may arise a time where they will need to be replaced. Should this occur, you will need to remove the trucks and trucksides on the truck block from the chassis in order to slip the new tire over the grooved drive wheel. We suggest you follow the disassembly instructions found in the Lubrication section on the preceding pages to disassemble the chassis and truck blocks from the body.

Before the new tire can be installed, you must make sure the old tire has been completely removed from the groove in the drive wheel. Use a razor blade or small flatblade screwdriver pry away any remains left from the old tire that may still be in the drive wheel groove. Once the old tire has been completely removed, slip the new tire onto the wheel. You may find it useful to use two small flatblade screwdrivers to assist you in stretching the tire over the wheel. Be careful to avoid twisting the tire when stretching it over the wheel. If a twist occurs, the tire will have to be removed and reinstalled or a noticeable wobble in your engine will occur when operating the locomotive. In addition, it is important to make sure that the tire is fully seated inside the groove. Any portion of the tire extending out of the groove can cause the engine to wobble. A razor blade can be used to trim away any excess tire that doesn't seat itself inside the groove properly.

Once the new tire(s) are in place, reassemble the trucksides to the truck blocks and then reassemble the chassis to the body.

HEADLIGHT REPLACEMENT (2 and 3-Rail Models)

The SD-9's headlights are directionally controlled by the electronic circuits in both ProtoSound and non-ProtoSound equipped locomotives. The headlights are attached to plugs which can be easily removed from the electronic boards should the bulbs expire. To remove the bulbs, follow the cab removal instructions found in the Lubrication section on the preceding pages. Once the cab has been separated from the chassis, gently pull the bulb's plug out of its socket on the electronic circuit board.

Next, carefully pull the wires away from the body roof without breaking the wire harness. The bulbs themselves are pressed into a plastic mounting bracket which is pressed into the body. Simply grasp the plastic mount with a pair of needle-nose pliers and pull it away from the body. Replacement bulbs and plastic mounts are available directly from MTH Electric Trains.

TROUBLE SHOOTING PROTO SOUND™ PROBLEMS

Although ProtoSound™ has been designed and engineered for ease of use, some questions may arise during initial operation. The following table should answer most questions. If you find that your problem can't be resolved with this manual, contact MTH ProtoSound Electronics (9693-A Gerwig Lane, Columbia, MD 21046, 410-381-2580) for additional assistance.

HORN PROBLEMS	REMEDY
<p>The horn seems distorted at low voltages</p> <p>When I press the whistle button, the bell comes on instead.</p> <p>I can't get the horn to blow when I press the whistle button.</p>	<p>Your battery may be undercharged or dead. Try recharging the battery as explained on page 6.</p> <p>You are trying to operate the horn in Neutral. The horn will only operate in Forward or Reverse unless you program ProtoSounds through Feature 25. See the programming instructions starting on page 9.</p> <p>You may be pressing the whistle button too quickly. Most older AC Transformers contain a two-step whistle button that releases a DC signal onto the track. It is this DC signal that tells the horn to blow. However, because the signal is weaker when the whistle button is depressed fully, the ProtoSound circuit may not recognize the signal. Try pushing the button slower, taking approximately 1 second to fully depress the button.</p>
BELL PROBLEMS	REMEDY
<p>When I press the whistle button to activate the bell, the whistle sounds.</p> <p>When I press the whistle button to activate the bell, I arm the coupler</p> <p>When I press the whistle button to activate the bell, the bell only rings once.</p> <p>I can't get the bell to ring when I press the whistle button.</p> <p>The bell won't work with a separate bell button.</p>	<p>You are trying to ring the bell in Forward or Reverse, the bell only operates in Neutral unless you have programmed ProtoSounds to recognize a separate bell button</p> <p>Reduce the voltage on the transformer before pressing the whistle button to activate the bell. The bell will only come on at 8 volts or less.</p> <p>You are trying to ring the bell in "Reset" instead of neutral. Interrupt the power twice to enter Neutral, set the voltage at 8 volts and press the whistle button to ring bell.</p> <p>You may be pressing the whistle button too quickly. See the the third remedy in the horn section above.</p> <p>ProtoSounds must be programmed in order for a separate bell button to function. Enter RESET function No. 20 (See the section "Using RESET To Program ProtoSounds" on page 8) and press the whistle button until the unit sounds two bell dings. Simply turn the throttle off and then on again to lock in the new setting.</p>
COUPLER PROBLEMS	REMEDY
<p>The ProtoCoupler won't let the engine uncouple on the "Fly".</p> <p>I can't get the coupler to arm or fire open when I press the whistle button.</p>	<p>The power required to fire the coupler open when the engine is on the "Fly" may be greater than the ProtoSound system is capable of providing. As a result, you may experience times when the coupler won't fire open. Unfortunately, the only solution is to stop the engine and fire the coupler in NEUTRAL rather than in Forward or Reverse. If that doesn't resolve the problem, try lubricating the coupler knuckle and rivet with light oil. See the lubrication instructions on Page 11.</p> <p>You may be pressing the whistle button too quickly. See the third remedy in the horn section above. Another possibility is that ProtoSounds has been programmed to turn the coupler function off. See the section "Programming For ProtoCoupler Operation" on page 9.</p>
DIESEL START/CAB CHATTER	REMEDY
<p>Sometimes the diesel start sounds don't occur when I first turn power on.</p> <p>Sometimes the cab chatter sounds don't play.</p>	<p>Occasionally the diesel engine start up sounds may not occur when power is turned back on within five seconds of having been shut off. The solution is to wait 10 to 15 seconds before turning the power back on.</p> <p>The cab chatter sounds only occur in neutral. You may be in RESET when you are expecting the sounds to play. In addition, the cab chatter sounds may have been turned off through the programmable RESET option of Feature 23. See the section on programming starting on page 9.</p>

LOCK-OUT PROBLEMS	REMEDY
<p>I can't get the engine to run after I power up the transformer. It sits still with the diesel compressor running.</p> <p>The engine won't lockout into Forward, Neutral or Reverse even after the short horn blast sounds.</p>	<p>The engine is Locked-Out into the neutral position. Follow the unlocking procedure on page 10.</p> <p>You are waiting too long to turn the throttle back on after the short horn blast sounds. The power must be turned back on immediately after the short horn blast or the engine will go back into RESET. See the lockout procedure in the Lock-Out section on page 10.</p>
VOLUME PROBLEMS	REMEDY
<p>When I try to run the engine, the diesel volume is OFF or very low.</p> <p>When I try to set the diesel volume, it resets itself to the original volume after I select the new volume.</p> <p>When I try to set the diesel volume to 0 Volume, I still hear the cab chatter sounds.</p> <p>The sounds seem distorted, especially when the whistle or bell is operated.</p>	<p>The diesel volume has been programmed at a reduced volume or to be silent. Go to "Reset" Feature 6 and adjust the volume. See the Diesel Volume section on Page 8.</p> <p>You are trying to set the volume with a poorly charged or dead backup battery. See the section on Battery Backup on Page 6.</p> <p>When the diesel volume is set to 0, you will hear the cab chatter sounds because setting the diesel engine volume only controls the sound of the diesel engine itself. All other sounds, including cab chatter, the horn and the bell sounds will continue to play at the volume level set by the volume control knob located on the bottom of the chassis (See Fig. 2 on Page 6).</p> <p>The overall ProtoSound volume has been set to high creating the distorted sounds. Try turning the volume control knob counter clockwise to reduce the overall volume level.</p>
BATTERY PROBLEMS	REMEDY
<p>I get no sounds when the engine shifts between the directional states.</p> <p>After I turn Off my transformer, my engine continues to make compressor sounds before quitting with a ding of its bell.</p> <p>The sounds distort at low voltages.</p>	<p>The battery may be dead or needs charging. See the Battery Backup section on page 6.</p> <p>ProtoSounds continues to omit sound for approximately 15 seconds after power to the track has been shut off.</p> <p>The battery is insufficiently charged or dead. Follow the recharging instructions of the battery backup section on Page 6.</p>
RESET PROBLEMS	REMEDY
<p>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.</p> <p>Whenever I interrupt the power from RESET to enter Forward, the engine goes back into RESET instead. I know this because the bell dings twice.</p> <p>No matter what I do, even after following the above instructions, I cannot get the engine to leave the RESET phase.</p>	<p>This is normal behavior. When power to the track is first turned on, ProtoSounds enters a "RESET" phase at which time the engine undergoes a system check. Power must be interrupted to get the engine into the forward phase. Refer to the instructions on page 4.</p> <p>Whenever ProtoSounds enters RESET after power has been off for more than 15 seconds, the microprocessor initiates a self-check to determine that everything is in working order. This self-check requires 2.2 seconds to complete during which time the engine will play the diesel start up sounds. We recommend that you don't interrupt power in RESET until the diesel start up sounds have been completed. This always takes longer than 2.2 seconds allowing the microprocessor plenty of time to complete its self-check. If the problem persists, we recommend that you operate the throttle with a slower movement as you interrupt the power in RESET and enter the Forward phase.</p> <p>You are probably using an incompatible transformer. Check the chart on Page 15 to see if your transformer is compatible. If it is, contact MTH Electric Trains for additional advice.</p>

TRANSFORMER COMPATIBILITY AND WIRING CHART

ProtoSounds™ is designed to work with any standard AC transformer that uses a "Pure Sine-Wave" format. The chart below lists the many Lionel® compatible transformers, such as the Lionel KW or ZW models. In addition, the chart details how the terminals on these compatible transformers should be attached to your layout. Finally, we have included a list of the latest transformers which are not compatible with ProtoSounds. If you have any one of these models, you will need to replace it with one of the compatible models listed below if you want your ProtoSound equipped engine to operate.

Transformer Type	Outside Rail	Center Rail	Min/Max Voltage	Power Rating
Lionel 1032	A	U	5-16v	90-Watt
Lionel 1032M	A	U	5-16v	90-Watt
Lionel 1033	A	U	5-16v	90-Watt
Lionel 1043	A	U	5-16v	90-Watt
Lionel 1043M	A	U	5-16v	90-Watt
Lionel 1044	A	U	5-16v	90-Watt
Lionel 1053	A	U	8-17v	60-Watt
Lionel 1063	A	U	8-17v	60-Watt
Lionel LW	U	A	8-18v	75-Watt
Lionel KW	U	A or B	6-20v	190-Watt
Lionel RW	A	U	9-19v	110-Watt
Lionel SW	A	U	Unknown	130-Watt
Lionel TW	A	U	8-18v	175-Watt
Lionel ZW	U	A-D	8-20v	275-Watt
Right of Way	Black	Red	0-25v	600-Watt
Lionel MW	Incompatible	Incompatible	Incompatible	Incompatible
Lionel RS-1	Incompatible	Incompatible	Incompatible	Incompatible
Lionel Trainmaster	Incompatible	Incompatible	Incompatible	Incompatible
ALL-Trol Walk-Around	Incompatible	Incompatible	Incompatible	Incompatible
All MRC Transformers	Incompatible	Incompatible	Incompatible	Incompatible
DALLEE Hostler Walk-Around	Incompatible	Incompatible	Incompatible	Incompatible