

Spectrum[®]

1:20.3 LARGE SCALE



BALDWIN 2-4-4 FORNEY LOCOMOTIVE
INSIDE AND OUTSIDE FRAME

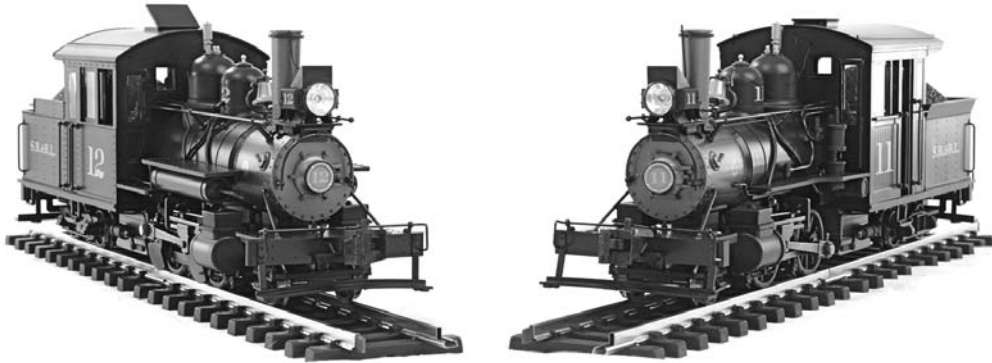
INTRODUCTION

Thank you for purchasing a Bachmann Large Scale Forney locomotive model. These 1:20.3 *Spectrum*[®] models replicate inside-frame and outside-frame Forney locomotives as built by the Baldwin Locomotive Company early in the 20th Century.

Features:

- a nonproprietary plug-and-play electronics interface to accommodate the control system of your choice including DC, NMRA, DCC and radio-control/battery operation
- easy access to five switches in the coal bunker to choose track or battery power pickup, operation according to NMRA or large scale track polarity practices, motor power on/off, DCC or DC operation of cab light and firebox flicker with a center “off” position and a choice of 2 or 4 chuffs per revolution
- switch behind the smokebox door with center “off” position to choose either DCC or DC operation of the smoke unit
- optical sensors to allow for the correct timing and count of steam chuffs that can be adjusted to achieve the desired prototypical chuff cadence
- realistic fire flicker in firebox and ashpan
- electrical pickup from all driver and trailing truck wheels
- constant lighting of the LED headlight and cab lights that illuminate at full intensity before the locomotive moves
- numerous prototype details including metal handrails and coupler lift bars, air pump, sand lines and other piping, reservoir air tanks, brass bell and whistle, electric generator, and scale rivet detail
- detailed locomotive cab including valves, water site glass, gauges, throttle, air brake stand, Johnson bar and piping
- operating doors, windows & roof hatch
- die-cast knuckle couplers on the locomotive front and rear, a spare set of die-cast offset shank couplers for use with other popular brands of narrow gauge couplers, and a set of body mount front and rear die-cast couplers
- die-cast idler gear box
- double lead metal worm gear
- die-cast metal frame, driving wheels and rear truck assembly
- a unique driver assembly suspension system that allows the locomotive to operate on short, medium or broad radius curves by employing truck locking mechanisms

Bachmann is proud to present this *Spectrum*[®] model. We have gone to great lengths to ensure that it will provide you with years of operating pleasure. Please read this manual carefully and follow all of the instructions.



HISTORY OF THE FORNEY LOCOMOTIVE

The Forney locomotive is named after its inventor, Matthias Forney. Born in Hanover, Pennsylvania in 1835, Forney demonstrated an aptitude for mechanics at an early age. As a result he was sent to Baltimore, Maryland for a high school education. After graduating, young Forney went to work at Ross Winan's railroad locomotive building plant in Baltimore. Forney next worked for the Baltimore & Ohio as a draftsman in the Mount Claire shops and was later employed by the Illinois Central Railroad.

In 1864, while at the Illinois Central, Forney applied for patents on an 0-4-4T locomotive design. His design featured a boiler placed directly above the drivers so the locomotive's tractive effort and adhesion would remain fairly constant. The cab was near the center of the engine to provide a smooth ride for the crew. The fuel and

water tank was located behind the cab and supported by a four-wheel swiveling truck.

Forney developed his design as a solution to the problem of how to power trains on the elevated and surface commuter railroads that were being proposed for America's rapidly growing cities such as New York, Brooklyn, Philadelphia, Boston and Chicago.

Forney's goal in designing his locomotive was to provide a compact engine that could pull five or six loaded coaches at 15 miles per hour while negotiating the tight curves necessary on inner city railroad lines. Since there were no turntables or wyes at the ends of these rail lines, it was also important that the locomotive track and run equally well in both forward and reverse. In fact, the first Forneys were set up as a 4-4-0. The main drive located directly in front of the cab was flangeless so that the little locomotives could easily make it around the sharp curves.



Matthias Nace Forney (1835-1908)



Manhattan Railway 1899

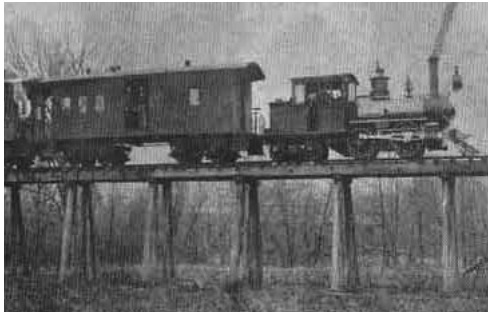
Forney locomotives made their debut on elevated railways in Manhattan and were an instant success. However, their success did not end there. Brooklyn and Chicago followed suit and soon there were over 500 Forney locomotives in service in these metropolitan areas. Other railroads such as the New York Central, The New Haven and the Rahway Valley used larger versions of the Forney design to power commuter trains on their surface lines.

The reign of the Forney was short lived, however, as early in the 20th Century many of the elevated and suburban commuter lines began to

explore the use of electric traction as the primary power for pulling their trains. In short order, hundreds of Forney locomotives operating in and around the big cities were out of work. Many, however, found new life on industrial and short line railroads around the country and even the world. They were put to work hauling stone in quarries, pulling log trains in California and Georgia, and harvesting rubber on Brazilian plantations.



In 1870 Matthias Forney took the position of Associate Editor of the Railroad Gazette. He specialized in covering locomotive and other motive power developments. He also used his influence as a member of the “fourth estate” to regularly point out the need for specialized city and interurban steam power. Another of his passions at the Railroad Gazette was debating the merits of narrow gauge railroading. Forney opposed the proliferation of narrow gauge railroads that was sweeping the country at the time. He frequently wrote editorials pointing out fallacies in the arguments being put forth in favor of narrow gauge railroading.



Emmitsburg Railway

It is ironic that the very qualities that made the Forney locomotive design well suited for use on elevated railways also made it an ideal form of motive power on narrow gauge railroads, many of which were built for short hauls, light trains, and sharp curves. In fact,

Forneys did serve on narrow gauge lines across the country. Narrow gauge Forney locomotives could be found hauling sugar cane in Louisiana and Hawaii, tourists on Nantucket Island, and freight and passengers on a network of two-foot gauge lines in Maine. Narrow gauge Forney engines toiled on for several decades after the demise of the design as the primary motive power for urban elevated railroads.

Whether standard or narrow gauge, the Forney locomotive proved to be ideally suited to the purpose for which it was designed: a versatile, compact locomotive that could pull moderate loads while tracking equally well in either direction. Unfortunately, only a few examples of the Forney have survived. Luckily some of these survivors can be seen operating on remnants of Maine's fabled two-foot gauge railroads.



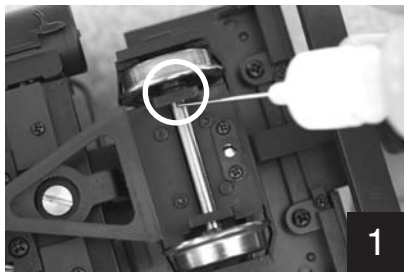
LUBRICATION

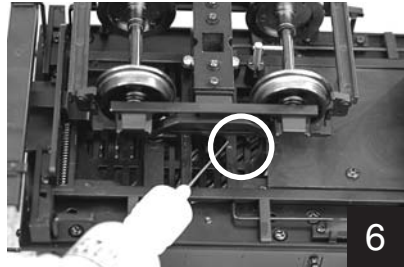
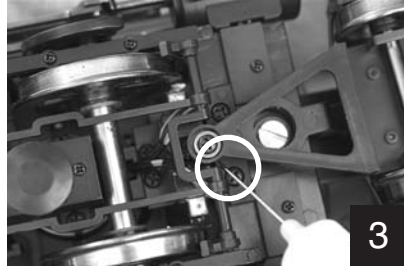
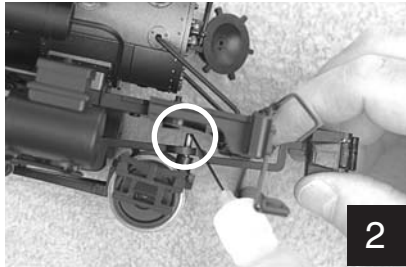
Just like the prototype, the key to optimum performance from your Forney locomotive is regularly scheduled maintenance and lubrication. The running gear and other parts will require lubrication before your locomotive goes into service for the first time on your railroad. Failure to perform this initial lubrication may result in damage to you locomotive and also poor operating performance. The product designers and engineers at Bachmann Trains have designed your new Forney so lubrication can be performed in a few simple steps. There are, however, many moving parts and metal-to-metal connections, so that it's important to take your time and lubricate all of them thoroughly.

PLEASE NOTE: We recommend that you use Bachmann's line of E-Z Lube® products. However, any plastic compatible lubricant designed for model railroad applications can be used. Contact your hobby retailer.

To properly service your locomotive you need to put it in a position that will allow you to easily access the wheels, axles and valve gear. You can place the foam top from your locomotive's packaging upside down on a flat surface and rest the locomotive on a towel placed over the top.

Starting with the front truck use **light gear oil** to lubricate the lead truck axle on both sides of the axle support brackets (figure 1). Next, apply a drop or two of oil to the tip of the spring-loaded support plunger where it contacts the bottom of the locomotive frame. The plunger is located directly on top of the front truck (figure 2).





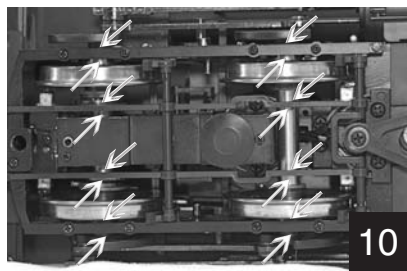
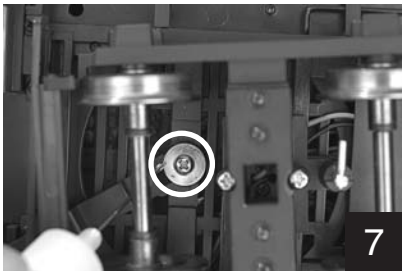
Now put a drop of oil on the pivot point where both the lead truck and the front coupler are attached to the frame (figure 3). Be sure that you lubricate the attachment points for both the lead truck and the front coupler.

Now it's time to move to the rear trailing truck. Notice that there is a pin attaching the truck to the sliding bolster (figure 4) as well as two semi-round support pads (figure 5). Put a small drop of oil on each of these points. If you are planning to operate your locomotive with the rear truck unlatched to allow maximum lateral movement, lubricate the bolster rails that are underneath the sliding bolster (figure 6).

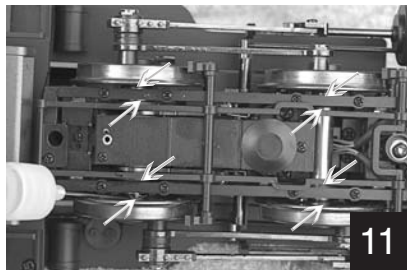
Move slightly further back towards the rear of the locomotive and lubricate the point where the rear couple shank is attached to the frame (figure 7). Using the **light gear oil** lubricate all axles where they enter the truck side frame journal boxes (figure 8).

Before you put the light oil away, put a small drop of oil on the threads in the storage hole for the driver assembly locking screw (figure 9). The storage hole is located on the rear of the frame in front of the ashpan.

Next it's time change to **heavy gear oil** and work on the drivers and valve gear. If you have an **outside frame locomotive** start by lubricating each of the drive wheel axles, where they pass through the locomotive frame and where they enter the gearbox (figure 10). Be sure to lubricate each axle on both sides of the outside frame.

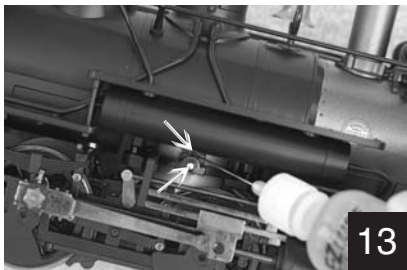


If you purchased an *inside frame model* lubricate the driver wheel axles where they pass through the locomotive frame and where they enter the gearbox. Be sure you put a drop of oil on the axle on both sides of the frame (figure 11). Next remove the round cap located at the front of the gear box (figure 12) and add 3 to 4 drops of oil to the gears located inside the hole. This will help to evenly distribute the factory applied grease. **Heavy duty grease** should be applied to these gears as needed after this initial lubrication.



Next for both locomotive models lubricate the support rollers located on the bracket surrounding the motor where it is exposed between the boiler and the frame. Also put a small drop of oil on the support roller axles where they are fastened to the bracket support (figure 13).

Now it's time to lubricate the valve gear. Start with the driver crank pins. Be sure to get a small drop of oil between all of the moving parts that are attached to the crank pins (figure 14). Next put a small drop of oil on the rest of the moving valve gear parts including the valve

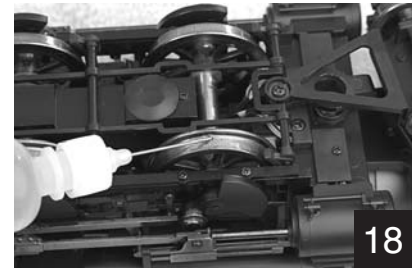
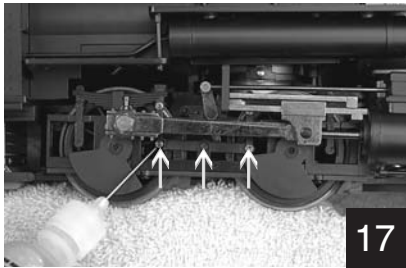
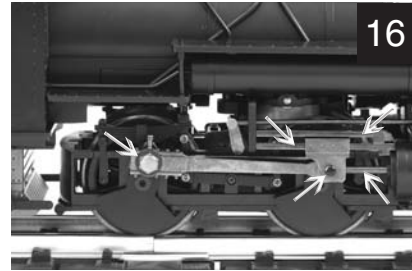
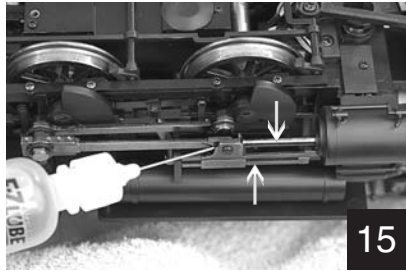


Be sure to put a drop of oil on all places where metal parts rub against each other.

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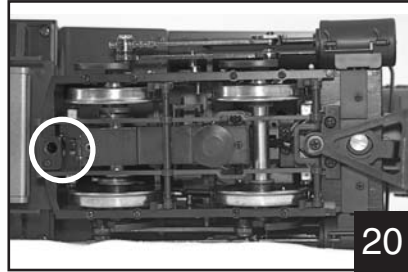
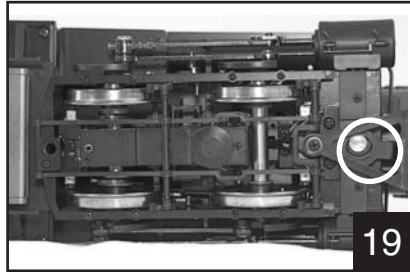
guide and valve guide rods, the piston rod, and the rest of the valve linkage (figure 15 & figure 16). Finally put a small drop of oil on each of the joints on the equalized driver springs (figure 17). Be sure to perform these lubrication procedures on both sides of the locomotive.

The last step in preparing your locomotive for operation is to put a small drop of conductive lubricant on each of the driver tires and each of the lead and trailing truck wheel treads (figure 18).

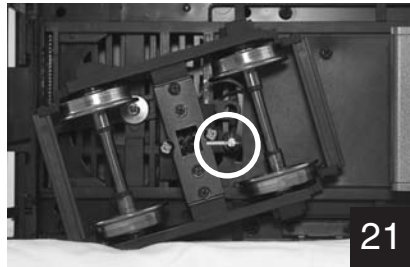


SETTING UP THE FORNEY FOR OPERATION ON YOUR LAYOUT

Bachmann's engineers recognize that some large-scale model railroaders do not have the space for wide radius curves. To accommodate the Forney on layouts with tighter radius curves they have come up with a solution that will allow operation on track diameter as little as four feet.



As it comes from the factory, your Forney locomotive's drivers will be locked into place and rigid. The rear truck will be unlocked and will slide from side to side as well as swivel around the king pin in the rear frame bolster. The locomotive will run on most larger radius curved track in this configuration. However, if your layout

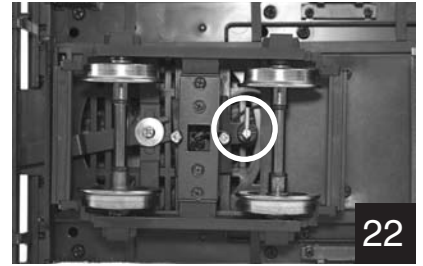


has tight curves that are four foot diameter, you can unlock the driver assembly so that it will swivel under the boiler. To do this remove the screw in the front of the frame under the cylinders (figure 19). After you remove the screw store it in the storage hole located in the rear of the frame in front of the ash pan (figure 20).

The rear truck can be locked into place. To lock the rear truck into place center the truck, pull up on the pin located behind the center of the front axle on the rear truck (figure 21), turn the pin 90 degrees and let it

go easily into the locator hole (figure 22). Operation on curves between 4 foot and 12 foot diameter may require unlocking the rear frame only. You should experiment to find the best combination for optimal performance on your layout.

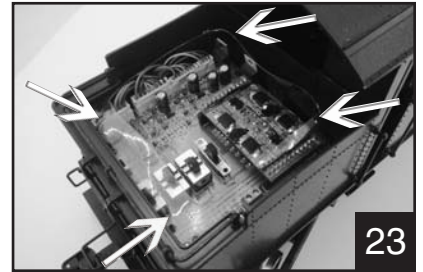
Note: Operation on curves less than 8 foot in diameter is not possible if you choose the option of mounting your couplers on the locomotive end beams using the supplied coupler boxes.



ELECTRONICS

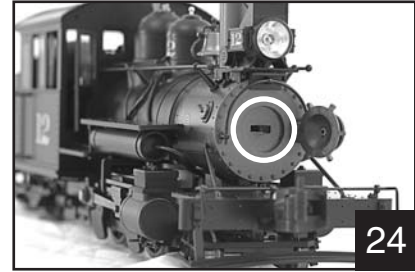
Your Forney locomotive features totally isolated electronics, which allow for easy installation of the control system of your choice. Switches are found in two locations.

Note: The Forney comes equipped with a clear protective shield to prevent moisture from damaging the electronics board (figure 23). The remaining images in this instruction brochure are shown without the shield to provide better viewing clarity.



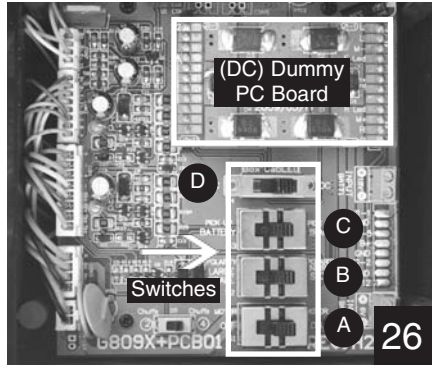
Smoke Box Switches

There is a switch behind the smoke box door that controls how the smoke generator functions (figure 24). The switch has three positions: DCC, OFF, and DC. In the DCC position, the smoke generation function is controlled through the plug-and-play socket. In the DC position, the smoke unit is on whenever power is supplied to the locomotive.



Control Switches in the Coal Bunker

To access these switches, you must first remove the coal load in the coal bunker. To remove this load, pull up and back on the water filler pipe and hatch (figure 25). When the coal load is removed you will see the switches on the main PC board in the bunker (figure 26).



Motor Switch (A): This switch controls the motor. When “Off” the locomotive will not move, but the other features of the locomotive (such as smoke or lighting) will continue to function when power is supplied to the locomotive.

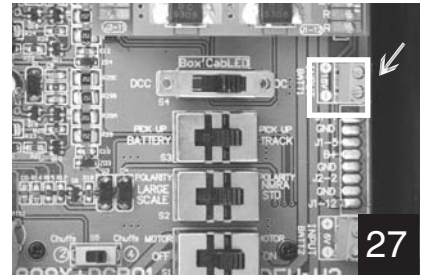
Track Polarity Switch (B): In Large Scale, there are two conventions used to control the direction of the locomotive. For left rail positive control (the most common in use), move the polarity switch to the “Large Scale” position. For right rail positive control, switch the polarity switch to the “NMRA” position. If your locomotive operates in the reverse direction to other locomotives on your layout, place the polarity switch in the opposite position.

Pickup Switch (C): In the “Track” position, track power is fed from the tracks to the electronics inside the locomotive. In the “Battery” position, all track connections are removed and all the power is fed through the two screw terminals labeled **INPUT BATT1** (figure 27) just to the right of the pick up switch.

Box Cab LED switch (D): This switch controls the cab light and firebox flicker. There are three positions: DCC, OFF, and DC. In the DCC position, the cab light and the firebox flicker function are each controlled individually through the plug-and-play socket. In the DC position, both functions are on whenever power is supplied to the locomotive.

Plug-and-Play Socket

The Bachmann Forney locomotive comes equipped with a nonproprietary plug-and-play electronics socket. This socket is designed to accommodate aftermarket plug-and-play products (contact your hobby retailer for more information). As delivered, the Forney is set up for DC operation.

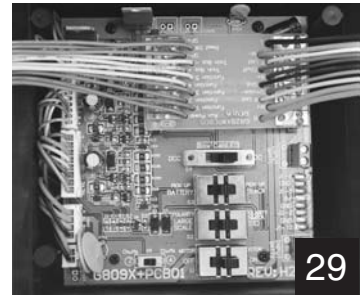
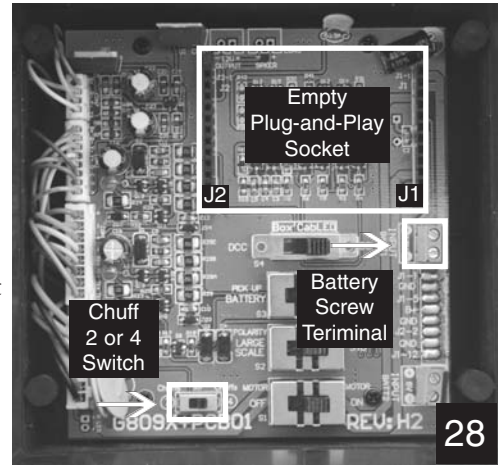


Track Powered DC Operations

Each Forney locomotive is factory-equipped with a (DC) Dummy PC Board plugged in the plug-and-play socket. To operate your Forney via track power, leave the (DC) Dummy PC Board in place, make sure that the motor switch is “On,” the pick up switch is in the “Track” position, and the track polarity switch is set in its desired position (normally the “Large Scale” position). In this mode, the locomotive headlight will be direction dependent.

Replacing the (DC) Dummy PC Board

To replace the (DC) Dummy PC Board with a plug-and-play system of your choice, simply lift out the (DC) Dummy PC Board and carefully insert the replacement plug-and-play PC board in the empty socket (figure 28). The J1 row of pins (toward the engineer’s **right** side of the locomotive) and the J2 row of pins (toward the fireman’s **left** side of the locomotive) on the socket must be aligned properly with the replacement plug-and-play PC board. If your aftermarket control system product does not support plug and play, a separate dummy plug with attached wires is provided to make it easy to attach an aftermarket device that comes equipped with screw terminals (figure 29).



Pin Definitions

Each pin on the plug-and-play socket has a defined purpose and is labeled on the socket under the (DC) Dummy PC Board. Each pin is also connected to a solder pad for use with systems that do not support plug-and-play. The following table provides the purpose for each pin. The J2 row of pins has a blank key on either end of the row to help ensure that a plug-and-play device can not be incorrectly inserted. *See chart below for pin locations.*

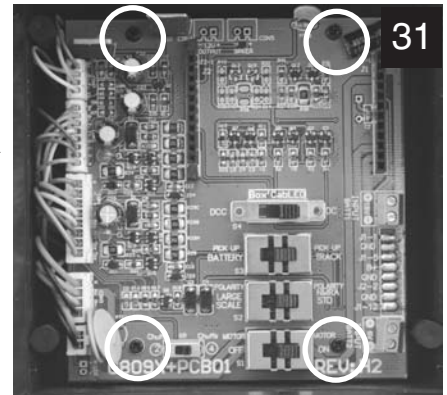
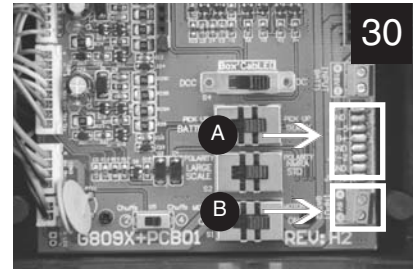
Pin number J1	Purpose	Pin number J2	Purpose
12	Rail +	12	Solid Key
11	Rail +	11	Not used
10	Motor +	10	Firebox Flicker
9	Not used	9	Not used
8	Smoke Unit	8	Cab Light
7	Locomotive Ground	7	Not used
6	Locomotive Positive	6	Not used
5	Chuff Trigger 1	5	Train Bus -
4	Front Locomotive Headlight	4	Train Bus +
3	Motor -	3	Speaker -
2	Rail -	2	Not used
1	Rail -	1	Speaker +
			Solid Key

Adding an Aftermarket Sound System

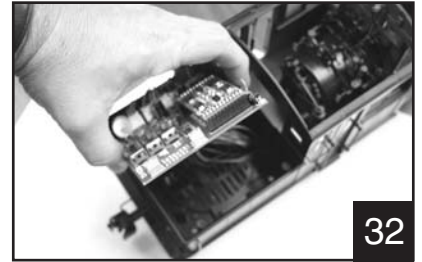
Your Bachmann Forney is designed so that the lighting and chuff circuits are active before the locomotive moves. If your sound system is designed for plug-and-play operation, remove the (DC) Dummy PC Board, plug in your sound system, and install a 3" speaker in the speaker location beneath the main PC board. To aid in this installation, a pair of wires from the speaker connection on the main PC board to the speaker is provided. If your sound system does not provide plug-and-play operation, continue to use the (DC) Dummy PC board and connect the sound system track connection wires to solder pads J1 and J2 at the right side of the main PC board (figure 30a). To use the locomotive's internal chuff, connect the sound board chuff connections to the main PC board solder pads J1-5 and GND. If desired, your sound system's "+ -" inputs can also be used to directly power the locomotive's chuff circuits using the "INPUT BATT 2" screw terminals at the right rear of the board (figure 30b). These terminals have a voltage input range from 5 to 14 volts DC. Refer to your sound system for more instructions on properly connecting it to the Forney.

Speaker Installation

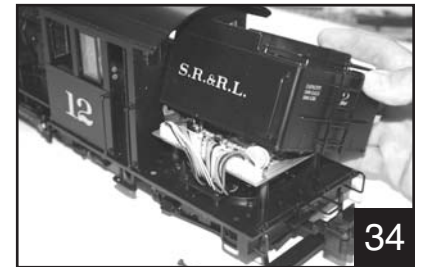
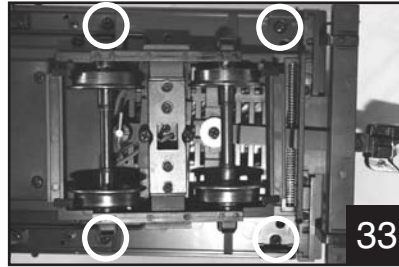
The Forney is designed to accommodate a 3 inch low profile speaker. The speaker is intended to be mounted underneath the main PC board. To access this area, first remove the coal load. If you have



purchased an *inside frame locomotive* you will remove the clear weatherproofing plastic and the four screws that are located on the corners of the PC board then carefully lift the main PC board up and to one side (figure 31 & figure 32). If you have purchased an *outside frame locomotive* you must first remove the four screws on the underside of the chassis that hold the coal bunker in place (figure 33) and remove the coal bunker in order to remove the weatherproofing plastic and the screws from the PC board (figure 34).

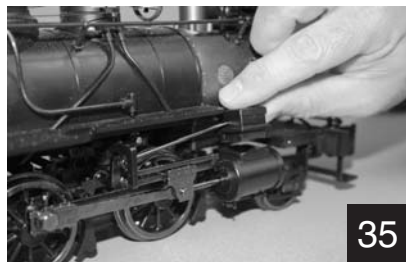


To install the speaker, solder the speaker connector wires to the speaker's terminals (the J2-1 wire is connected to the speaker's "+" terminal and the J2-3 wire is connected to the speaker's "-" terminal) and use the four mounting screws to secure the speaker.



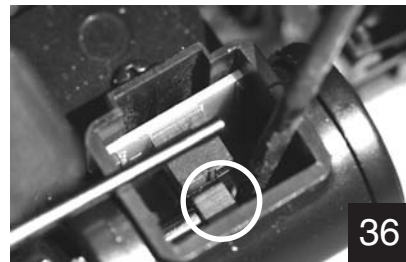
To avoid short circuits, the speaker SHOULD NOT TOUCH the main PC board when - reinstalled in the locomotive. If the height of the speaker is greater than 21mm, it may be necessary to place spacers between the mounting posts and the main PC board to provide clearance.

Once the speaker is installed, replace the four screws on the main PC board, plug the speaker into the connection on the main PC board, and reinstall the coal load.



Adjusting the Chuff

The exhaust or “square” of a prototype locomotive is normally adjusted after an overhaul. A freshly outshopped locomotive has a very uniform and even sounding chuff. As the locomotive is used, normal wear of the locomotive can result in a slightly uneven chuff that is most commonly recognized by one chuff being louder than the other chuffs.

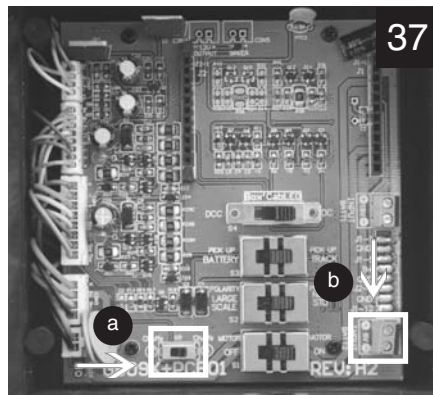


ward as needed (figure 36).

A simple switch is used to select the use of one or both sensors to allow for 2 chuffs or 4 chuffs per revolution. This switch is located in the left rear of the main circuit board in the coal bunker (figure 37a).

When used with DC track power, the optical sensors are electronically

The Bachmann Forney has an optical chuff sensor in each cylinder to provide a prototypically correct chuff sound. Each sensor can be adjusted to provide a wide variety of in or out of “square” chuff sound effects. To adjust the chuff, carefully remove the top of the steam chest above the cylinder (figure 35) and using a screw driver nudge the sensor activation pin slightly forward or back-



activated before the locomotive begins to move. If desired, the sound system's "+ -" inputs can also be connected directly to the chuff circuits using the designated screw terminals at the rear of the board (figure 37b). These terminals have a voltage input range of from 5 to 14 volts DC.

Adding Aftermarket Track-Powered NMRA DCC Operation

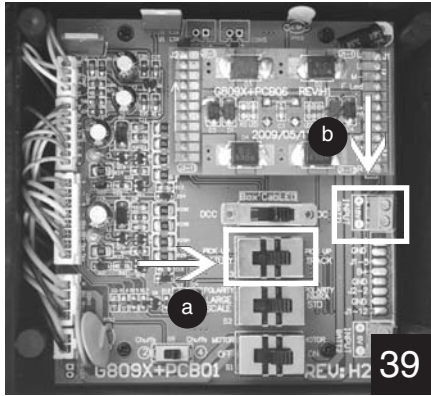
If your NMRA DCC decoder is designed for full plug-and-play operation with the plug-and-play socket, remove the (DC) Dummy PC Board and replace it with your plug-and-play decoder.

If your decoder is not designed for full plug-and-play operation, use the supplied dummy board with wires and attach the wires on the dummy plug to your decoder following the instructions that came with your decoder (figure 38).



Adding Aftermarket On-Board Battery/RC Operation

If your Battery/RC or DCC Direct system supports plug-and-play using the plug-and-play socket, remove the (DC) Dummy PC Board and replace it with the plug-and-play board of your choice. Install the batteries underneath the main PC board in the coal bunker or in a trailing car. Connect the batteries to the battery screw terminals on the plug-and-play socket, and move the Pick Up switch to "Battery" (figure 39a).

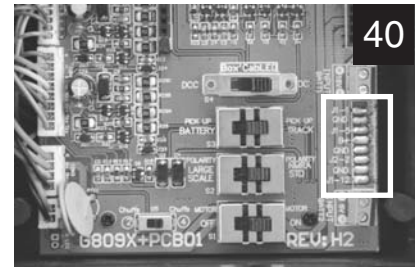


If your Battery/RC system does not support plug-and-play operation, then the simplest conversion is to connect the motor outputs of your RC system to the battery screw terminals (figure 39b). Should you wish to control the locomotive's individual lighting and smoke functions, follow the specific manufacturer's instructions for connection of the Forney's lighting functions to the control system's function outputs.

Hybrid Drive Operation

Some control systems use a combination of on-board primary or back-up power to provide the locomotive with the control signal being transmitted either through the track or via radio control. To install

such systems, connect the onboard power ground terminal to (GND) and the onboard power positive terminal to (B+) on the solder pads on the right hand side of the mother board (figure 40). The remaining connections are through the plug-and-play socket. These systems also allow for the control signal to come either from the track or from a radio receiver. If using such a system, connect the radio receiver outputs to the battery screw terminals, and use the pick up switch to select "Track" for track signal or "Battery" for radio signal.



GENERAL MAINTENANCE AND SERVICE

By establishing a regular lubrication and general maintenance schedule, you can have a lifetime of fun, performance, and satisfaction with this locomotive model. Do not use any liquids or solvents to clean this locomotive; use a soft, lint-free cloth or cosmetics brush. Also, do not leave your locomotive unattended outdoors overnight or in inclement weather.

Thank you for purchasing the Bachmann *Spectrum*® 1:20.3 Baldwin Forney Locomotive.

Be sure to fill out and send in your warranty card. You can check out all of Bachmann's other large scale products at your local hobby retailer or at www.bachmanntrains.com.

If your locomotive should need service, please note that our service department is not responsible for repairs to locomotives with aftermarket products installed in the Baldwin Forney's plug-and-play socket. Any locomotive requiring service should be returned to us as delivered, *entirely in the original packaging AND with the factory-supplied (DC) Dummy PC Board plugged in the plug-and-play socket.*

Contact our service department at:

**Service Department
Bachmann Industries, Inc.
1-800-356-3910**

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