

# Installation Instructions For Engineer On Board (E.O.B) Cruise Control

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## Introduction

Congratulations on the purchase of one of the most technologically advanced on board train control systems to ever be introduced into the TMCC market. EOB Cruise Control will provide you with the most precision speed control of your locomotives in history. The EOB board is unlike any TMCC conversion previously released from TASTudios. The advancements made by this board incorporate many of our add-on upgrades such as Puff N Chuff and Diesel Accell for steam and diesel locomotives with existing fan driven smoke units. In addition, the EOB board is 100% compatible with all of our TMCC upgrades previously released.

Since there are so many new options offered in the EOB board we ask that you thoroughly read through the instructions prior to beginning the installation process. If you encounter any problems or have questions you can contact our technical assistance line at 330-533-7181 Mon-Fri 9a-5p EST or email us at [info@tastudios.com](mailto:info@tastudios.com).

The driver components on the EOB Board are rated at 45 Amps. While this may seem high we want to caution you. It is okay to use EOB to run up to 4 DC can motors, however, do not, under any circumstances, attempt to run more than 4 motors on the EOB board.

## Contents of the kit

Each EOB kit is designed for a wide range of locomotives from all manufacturers. While some locomotives will differ slightly in appearance and construction the architecture of the installation is the same. To help the installation process we have included several items that you may or may not use during your installation. The contents of the kit are shown below. If you feel you are missing anything, please contact TASTudios at 330-533-7181 Monday thru Friday 9am-5pm EST.

- EOB Motherboard
- EOB Flywheel sensor board
- Thick and thin double sided tape
- Assortment of styrene
- Flywheel sensor spacer (0.030" styrene)
- 5 flywheel tape strips (MTH, K-Line, Sunset 1, Sunset 2 and Williams)
- 2 Mounting Screws
- Two SPDT slide switches w/ mounting hardware and 2-pos. harnesses
- Installation Instructions
- Six 2-position harnesses
- One 8 Ohm 0.2 Watt speaker w/ 2-position harness
- One copper foil antenna w/ 2-position harness
- One 4-position harness
- Quick reference placard

## Installation Requirements

Before you begin this installation you need to verify your locomotive is equipped with a DC can motor with a flywheel. If your locomotive is not equipped with a flywheel the EOB board will not work in your locomotive. You can however, purchase either a flywheel separately or an entirely new motor with a flywheel from Frank Timko of Timko's Train Repair. His contact information is below;

Timko's Repair Depot  
349 Grange Hall Road  
Beavercreek, OH 45430  
937-429-1461  
[Ftimko@aol.com](mailto:Ftimko@aol.com)

The lighting output of the EOB board is a constant voltage 12VAC. This voltage will burn out bulbs with lower voltage ratings. Such as those commonly found in MTH diesel and steam locomotives and brass steam locomotives. We do offer 12 volt grain of wheat bulbs for \$1.50 each (TAS-1018). These smaller bulbs are perfect for replacing existing lighting.

For steam locomotives we recommend replacing the front lights with 18 Volt Grain of Wheat bulbs (TAS-1019, \$1.50 each). Since all 8 wires are used between the locomotive and tender when installing EOB. The front light will simply be run off the track voltage.

## Overview

On the back of this installation manual are diagrams of the EOB board. These diagrams show all the pin outs on this board along with their function. You will find it very useful to remove these sheets to refer to during the installation process. Please locate these sheets now and remove them for future reference.

There are 2 sections provided for installation; Steam and Diesel. Please refer to the section that best pertains to your specific locomotive.

## Diesel Locomotive Installation

The installation for diesel locomotives is not manufacturer specific. You will see notes throughout the instructions that pertain to specific manufacturers locomotives. Please follow these notes, as they will help the installation process go more smoothly.

Remove the shell of the locomotive, save all the mounting screws and set the shell off to the side. You should now have the frame in front of you with all the original electronics. Begin by removing the original electronics. Try to clip the wires as close to the original electronics as possible to prevent having to lengthen wires throughout the installation process.

If the locomotive is equipped with a smoke unit, leave it alone, simply disconnect the wires and leave it in place (as it will ultimately affect the mounting position of the EOB board).

***NOTE: If your locomotive is an MTH Premier, DO NOT remove any of the small constant voltage boards mounted to the frame. These small boards control lights such as the marker lights and/or cab lights. Leave the red and black wires tied to the wire nuts, this board will remain to control the intensity of these small lights.***

***Do not remove the manual volume potentiometer yet. If it is located somewhere other than between the motors you can leave it in place. If it located between the motors you should remove it to make room for the EOB board. The volume on the EOB board is set to full, but the potentiometer can be reused if you wish, providing it does not take up excess space.***

Once you have completed removing the original electronics you should be left with a bare locomotive frame. The motors, constant voltage light boards (attached to the frame) and/or smoke unit should all have leads on them.

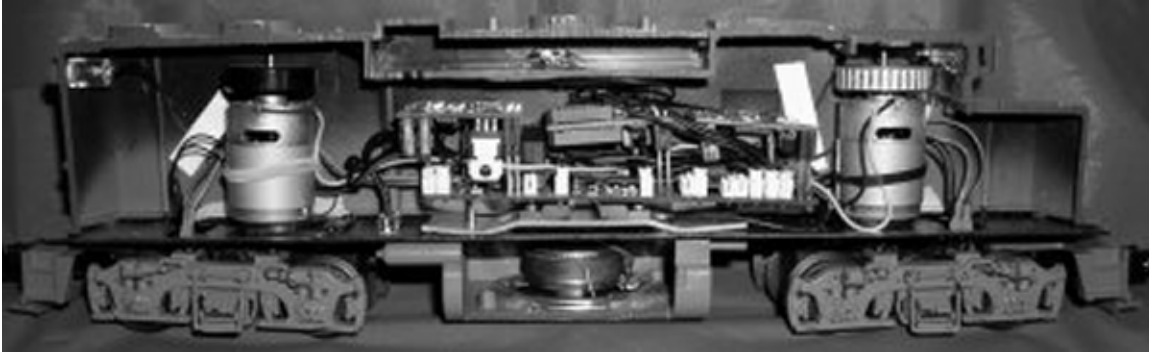
### Mounting the speaker

More often than a speaker is mounted in the fuel tank of diesel locomotives (excluding Williams). If your speaker is mounted in the fuel tank and you want to replace the original with the speaker included in the upgrade kit, do so now. If your locomotive is not equipped with a speaker and there is space in the fuel tank go ahead and mount the speaker at this time. If your fuel tank will not accept a speaker continue with the installation. The mounting of the speaker will be covered later on.

You will notice there are slots cut in the heat sink of the EOB board. These slots are included to allow you to route the speaker wires through to help save space. Be sure to route the speaker wires through these slots when you mount the EOB board.

### Mounting the EOB Board

Locate the EOB motherboard along with the two #6 x 3/8" self-tapping mounting screws. Set the EOB motherboard on the frame between the motors. Orient the board so the edge with the 24-pin connector is facing the front of the locomotive. This will prevent you from having to lengthen wires during the installation. See the diagram below for reference.



Determine where you want the EOB board to sit. Ensure there is enough space under the heat sink to properly mount the heat sink to the frame. Once you have determined the desired mounting position mark the frame so you know where to drill holes to accommodate the mounting holes in the heat sink. Remove the EOB board and drill the holes in the frame using a 9/64" drill bit (or slightly larger). Once the holes have been drilled make sure the metal turnings are clear of the workspace (these will bind gears and ruin drive systems if not properly discarded now).

Locate the flywheel sensor board in the installation kit. It will have 3 color-coded wires terminating into a 3-position plug. Before you screw the heat sink to the frame set the EOB board back onto the frame. Now determine which motor you want to mount the sensor board to. (***NOTE: We highly recommend mounting the sensor board to the rear motor, where the sensor board will be clear from ambient light.***) Once you have determined the position in which you plan to mount the sensor board proceed to section 2 for complete instructions on how to mount the sensor board and flywheel tape strip to the motor. Once you complete that step return to this page to continue the installation.

Now that the sensor board is securely attached to the motor you can mount the EOB board to the frame. Using the holes you drilled earlier mount the board with the #6 self-tapping screws. **It is absolutely imperative the heat sink is screwed to the frame.** While the heat sink is large enough to dissipate the heat created under normal operating conditions we require it to be mounted to the frame anyway, just as extra insurance in the event the locomotive is put through it's paces.

### Mount the Program/Run switch

Locate one of the SPDT slide switches with a 2-position plug from the installation kit. Find an appropriate location on the frame to mount the switch. Using the hardware provided (2 small #2 screws w/ nuts) mount the switch to the frame in a relatively easy-to-access position. Place the switch so the two wires on the switch are facing the front of the locomotive and the unsoldered lug is facing the rear of the locomotive. This will ensure that the program position will be towards the front of the loco and the run position will be towards the rear of the loco. Plug the 2-position plug into the spot labeled "Program/Run Switch" on the reference diagram.

## Mount the Conventional Cruise On/Off switch

Locate the remaining SPDT slide switch with a 2-position plug from the installation kit. Find an appropriate location on the frame to mount the switch. Using the mounting hardware provided (2 small #2 screws and nuts) mount the switch to the frame in the same manner as you mounted the program/run switch. Plug the 2-position plug into the position labeled “Cruise On/Off Switch” on the reference diagram.

If you do not plan on running this locomotive in a conventional mode you do not need to install this switch. In the command mode you can select the cruise modes from the remote, this switch is only for conventional operation.

## Wiring the Pickups

Locate a 2-position wire harness from the installation kit. Plug the connector into the plug labeled “AC Power In” on the reference diagram. Connect the outermost wire in the harness to the center rail pickup rollers (most often a red wire). Connect the innermost wire in the harness to AC ground (most often a black wire attached to either the truck or the frame). ***(NOTE: MTH locomotives will have a red wire from the pickup rollers terminating into a wire nut, the same goes for the black wire. These wire bundles contain wires from both trucks as well as any constant voltage boards. Connect the 2-position wire harness to the red and black wires from these wire nuts to save some time.)***

## Wiring the Motors

Locate a 2-position wire harness from the installation kit. Plug this harness into the plug designated “Motor (M1, M2)” on the reference diagram. When connecting the motors you have a 50/50 chance of the locomotive starting in forward. Connect one of the Motor leads from the harness to one side of the motors (motor leads are most often blue and yellow or yellow and white). You should connect 2 motor wires of the same color to one of the Motor leads from the harness. Repeat this step for the remaining motor leads and wire from the harness. (If the motor leads are backwards, you can easily reverse them during the testing phase.)

## Connect the Sensor Board

Locate the white 3-position plug at the end of the sensor board wires. Plug this into the position labeled “Flywheel Sensor (sig - +)” on the reference diagram. It will only plug in one way. The red wire will be closest to the outside edge of the board.

## Wiring the front and rear lights

Locate two 2-position harnesses from the installation kit. Plug one harness into the plug labeled “Front Light (- +)”. Plug the remaining harness into the plug labeled “Rear Light (- +)”.

The light output of the EOB board is a constant 12VAC. If your locomotive is equipped with lower voltage bulbs than 12 Volt we highly recommend changing them to a 12 Volt bulb. We sell a 12 VAC Grain of Wheat bulb (TAS-1018) for \$1.50 each. You may also be able to find other 12 V bulbs at your local hobby shop.

The pin outs of the EOB board differ from our previous SAW boards. The outermost pins in the plug are ground and the innermost pins are AC hot. Connect the Front Light harness to the front lights and the Rear Light harness to the rear lights.

***NOTE: All MTH Premier locomotives have 1.5-6 Volt bulbs. These bulbs will need to be replaced, otherwise they will burn out when power is applied.***

***NOTE: Williams locomotives use a 14 VAC bulb. You only need to connect the AC Hot lead to the light, as the bulbs receive Ground through the frame.***

### Wiring the Front and Rear Coil Couplers

If you have purchased coil couplers through TASTudios all you need to do is mount the couplers to the trucks and plug the front coupler plug into the plug labeled “Front Coupler” on the reference diagram. Repeat the process for the rear coupler using the “Rear Coupler” designation on the reference diagram.

If you are connecting the original coil couplers to the EOB board you will need to locate two 2-position wire harnesses. Plug one harness into the “Rear Coupler” and one into the “Front Coupler” designations on the reference diagram. Connect the rear coupler harness to both wires on the rear coil coupler. Repeat this step for the front coil coupler.

***NOTE: MTH locomotives that were originally equipped with Protosounds will already have coil couplers. Simply locate the front coupler wires (both wires) and trace them back to the coupler selector switch. Cut the wire from the selector switch and attach both wires to the “Front Coupler” harness. Repeat this step for the rear coupler.***

***With EOB the front and rear couplers can be activated by the remote and need not be connected to the coupler selector switch.***

### Connecting the speaker

At the beginning of the installation you were instructed to install the speaker in the fuel tank if it fit there. If you did this locate the 2-position 2-wire plug at the end of the speaker leads. Plug this harness into the plug labeled “Speaker (8 Ohm, 0.2 Watt)” on the reference diagram.

If you were unable to mount the speaker in the fuel tank locate the speaker now. Find an accommodating position inside the shell on the frame where you could mount the speaker. If the original speaker included a baffle try to reuse it. The baffle will increase the overall volume of the sounds and provide a much more pleasing volume. Mount the



speaker where it will not interfere with reattaching the shell and mount it firmly in place using the thick double sided tape included in the installation kit (you may also want to use some hot melt glue or similar adhesive in addition to the double sided tape).

Plug the 2-position 2-wire harness into the plug labeled “Speaker (8 Ohm. 0.2 Watt)” on the reference diagram.

### Optional Potentiometer

The EOB board is equipped with a built in potentiometer that keeps the Railsounds 4.0 at the highest possible level. If you decide you want to add a potentiometer to the EOB board you will need to remove two small surface mount resistors to allow a 10K ohm potentiometer to function properly. If you want to add the potentiometer we ask that you call our technical assistance line at 330-533-7181 Mon-Fri 9a-5p EST. We can provide the instructions over the phone.

### Optional Battery Connection

If you plan to operate your locomotive in a command control mode all the time you do not need to add the battery back up. However, if you decide it is necessary to include the battery you can, but you will need to supply the battery harness. Locate a 2-position 2-wire harness from the installation kit. Plug the harness into the plug labeled “9 Volt Battery (- +)” on the reference diagram. The outermost wire is the negative side of the battery (black lead). The innermost wire is the +9VDC lead (red lead). Securely mount the battery to the frame using the thick double-sided tape provided in the kit.

If you plan to operate the locomotive conventionally you will need the battery backup to prevent the sounds from cutting out when the track voltages drops out (while changing directional states).

### Optional Signalsounds/Railsounds Switch

The EOB board is equipped with an optional Signalsounds/Railsounds selection. This allows you to select between the full-blown sound system and only a horn and bell. While we do not include a switch for this feature any SPDT slide switch can be used.

### Connecting the smoke unit

The smoke unit is the only device that has not yet been connected. We will cover connecting the smoke unit after the initial testing phase. Please disregard the smoke unit at this time, as it will be covered later in the instructions.

### Installing the Antenna

Locate the copper foil antenna with a 2-position 1-wire harness. Plug this harness into the plug labeled “Antenna” on the reference diagram. Leave the antenna hang in the

air for the initial testing. Make certain it does not come in contact with any of the electronics or touch the frame or outside rails, otherwise a short may occur which will void the warranty and potentially damage the electronic circuit(s).

## Initial Testing

Please refer to section 3 for complete initial testing procedures. Return to this page once you have completed the testing to complete the installation.

## Connecting the smoke unit

If your diesel locomotive is equipped with a fan driven smoke unit you can connect it to the EOB board. Not only can you turn the smoke unit on and off from the remote, but you can also connect the smoke unit fan to the EOB board to add a special effect to the operation of the smoke unit; Diesel Accell.

With Diesel Accell the smoke unit will loft smoke out of the stack whenever it sits at idle. Once the locomotive begins moving the smoke volume will increase. When it returns to idle the volume will go low again. The smoke unit can still be turned on and off from the remote whether this feature is used or not.

If the diesel is equipped with a smoke unit locate the 4-position 4-wire harness included in the kit. Plug this harness into the plug labeled “Smoke Unit” on the reference diagram. Connect the outermost wire from the harness (shown on the reference diagram as “gnd”) to the ground side of the smoke unit (usually a black wire). Connect the second wire from the outermost edge of the harness (shown on the reference diagram as “smoke”) to the red wire (or hot wire) from the smoke unit.

***NOTE: If your loco is an MTH Premier loco the red wire of the smoke unit will connect to an on/off switch. The switch will have another red wire that connects to the wire nut bundle of pickup wires. Remove the smoke switch wire from the bundle and connect it to the second wire from the outermost edge of the harness. You can leave the ground wire from the harness disconnected if the black wire from the smoke unit is attached to the wire nut bundle of ground wires.***

If you plan to include the Diesel Accell feature you will need a voltmeter to determine which side of the smoke unit fan motor is +5VDC. This will need to be done now, after the smoke unit hot lead and ground lead has been connected to the EOB board.

Set the locomotive on the track, apply 18 Volts of AC power to the track. Using the Cab-1 remote press the following keys;

**ENG + 1 + AUX1 + 9**

**(The sounds will come on and the smoke unit will turn on as well.)**

Using a voltmeter set on DC using the probes touch one probe to one of the fan motor leads. Use the other probe to touch the other motor lead. Your voltmeter will read anywhere between 4.5 to 5.0 VDC. The voltmeter should show a reading in the positive (Meaning the negative sign will not be on if it is a digital meter. The needle will not be on the left side of the 0 mark if it is an analog meter.) if the red probe is touching the +5VDC lead of the fan motor. If the reading is shown as negative, reverse the probes so the reading is shown as positive. The red probe will be touching the +5VDC lead.

Turn the track power off and return to the bench with the locomotive. Clip the +5VDC motor lead from the smoke unit. Connect this lead to the 4th wire in the smoke harness (shown on the reference diagram as “Fan”). The remaining 3<sup>rd</sup> wire can be clipped at the connector, as it is not used.

You can retest the locomotive to verify the smoke unit fan is working properly. Place the locomotive on the track, apply 18 Volts of AC power. Using the Cab-1 remote press the following keys;

**ENG + 1 + AUX1 + 9**  
**(The sounds will come on and the smoke unit will turn on.)**

Once the smoke unit begins producing smoke press the BOOST key once, the locomotive will begin moving forward. You will notice a difference in the speed in which the smoke comes out of the smoke unit. Press the BRAKE key once. The volume will drop. Press the BOOST key one time and you will see the volume increase. Turn the track power off and return to the bench with the locomotive.

### Mounting the antenna

At this point every connection in the locomotive should be made. Locate the shell you removed at the beginning of the installation. Set it beside the frame with the shell on its roof. Remove the protective cover on the back of the copper foil antenna and apply the adhesive side of the antenna on the inside roof of the shell. Cover the copper foil antenna with a strip of electrical tape. This will prevent a short from occurring if the antenna should ever come off the shell.

If you have an electric locomotive, such as a GG-1 that has a die cast shell you will want to use the isolated pantographs for the antenna. Simply cut the copper foil off the end of the wire. Connect the antenna wire to both pantographs inside the shell. The pantographs will be electrically isolated from the shell, which will be grounded when screwed to the frame.

### Reinstalling the shell

Carefully place the shell onto the frame, ensuring no wires are pinched between the shell and the frame. Make sure the trucks have a full range of motion and that no wires are too short or hung up on anything inside the shell. Once you are satisfied the

shell is mounted firmly against the frame and there are no pinched wires, reinstall the screws. Once the shell is reattached to the frame refer to the final testing in Section 4.

## Steam Locomotive Installation Instructions

These instructions are intended to cover all makes of steam locomotives. You will notice certain sections that have notes that are designed to provide tips for various manufacturers locomotives. Please follow these tips when you can. They are designed to help the installation go more smoothly. If you have questions about any part of these instructions, please call our technical assistance line at 330-533-7181 Mon-Fri 9a-5p EST.

To begin the installation, remove the shell from both the locomotive and the tender. Set the locomotive shell aside for now along with the mounting screws.

***NOTE: If you have a brass tender shell you will need to electrically isolate the shell from the frame so the shell becomes the antenna. This is done with electrical tape and nylon screws. The nylon screws we provide in the kit are #4 screws, which fit into a 1/8" hole. It is a good idea to drill the original holes oversized on both the shell and the frame to accommodate the nylon screws. Do this now before you begin installing the electronics. The instructions below illustrate how this is accomplished.***

### Drilling holes to accommodate the nylon screws

Drill the holes in the tender shell over using a 7/64" drill bit. These holes should be tapped, but the same affect can be accomplished with a self-tapping metal screw. Ideally a screw from an MTH tender shell works the best, but a any 1/8" coarse thread screw will work, or a tap. Once the tender shell holes are drilled over you need to oversize the holes in the tender frame. Drill the tender frame holes oversized using a 9/64" drill bit. The large hole will give you some room to move the nylon screw around in when reinstalling the shell.

Set the tender shell aside along with the mounting screws (the original metal mounting screws will not be reused) but keep them in the box for the locomotive just in case you ever return the locomotive to the stock configuration.

Begin by removing the original electronics from the tender, if the circuit board is equipped with a tether you can leave the tether connected to the circuit board, as it will be replaced by the new 8-pin tether. You can also remove the rear light(s), but leave the marker lights in place if applicable. If the tender frame was originally equipped with a speaker you could leave it in place, or replace it with the new speaker provided in the kit. You should be left with a bare tender frame (expect for perhaps the speaker) once completed.

Leave the locomotive side alone as we'll cover that later in the instructions.

## Mounting the speaker

If the tender frame was not originally equipped with a speaker you will need to mount the speaker to the frame at this time. If the tender frame is equipped with holes in the floor, try to mount the speaker over those holes, so the maximum amount of volume is heard. Just before you mount the speaker to the frame read the next block of instructions to verify the speaker does not interfere with the mounting of the EOB board.

Locate the EOB motherboard now. Set the motherboard onto the tender frame with all the plug-in boards in place. Check to make sure the location of the speaker does not prohibit the mounting position of the motherboard. Also be sure to check the headroom of the tender shell to ensure the shell will fit without touching the tender shell. NOTE: Please keep in mind that the heat sink **MUST** be securely screwed to the frame. So ensure the heat sink sits flatly on the frame with the speaker in position.

Once you have verified the fit of the motherboard go ahead and mount the speaker to the frame using an adhesive such as hot melt glue, Walthers Goo®, or similar adhesives. Position the speaker so the speaker leads are facing the rear of the tender.

## Mounting the EOB Motherboard

Place the EOB motherboard onto the frame again. Once you have found an acceptable mounting position make the necessary marks on the frame to facilitate drilling the holes in the frame to mount the heat sink. It is absolutely **IMPERATIVE** that the EOB board be securely screwed to the frame.

Remove the EOB board and drill at least one if not two holes in the frame at the positions marked. The holes should be 9/64" or larger to accept the #6 self-tapping mounting screw. Once the hole(s) have been drilled discard the metal or brass turnings before proceeding. A small piece of metal or brass can make isolating the tender shell a real nightmare if they get between the tape and the shell.

Once you have discarded and cleaned the frame up from the turnings go ahead and mount the heat sink to the frame using the two #6 x 3/8" self-tapping screws provided in the installation kit.

## Mounting the Program/Run Switch

Locate one SPDT slide switch with a 2-position wire harness from the kit. Plug the harness into the plug labeled "Program/Run" on the reference diagram. Find a space on the tender frame that will accept the switch. (Most tender frames have a space provided for a slide switch.) If your frame does not have a position to mount the switch you have two options;

- 1.) You can mount the switch to the bottom of the tender frame using a small piece of thin double-sided tape provided in the kit.

- 2.) You can drill 3 holes in the tender frame, two 1/8" holes and one 1/4" hole. The diagram below shows the spacing for this method.

Diagram of holes spacing for slide switches.

Mount the slide switch in position using the hardware provided (two #2 x 1/4" screws and nuts) in the installation kit. Position the switch so the two wires are towards the front of the locomotive and the single unsoldered lug is towards the rear of the tender. (This will ensure that the program position will be towards the front of the loco and the run position will be towards the rear.)

### Mounting the Conventional Cruise On/Off Switch

Locate the remaining SPDT slide switch with a 2-position plug from the installation kit. Find an appropriate location on the frame to mount the switch (or follow the instructions above for creating a new hole in the frame). Using the mounting hardware provided (2 small #2 screws and nuts) mount the switch to the frame in the same manner as you mounted the program/run switch. Plug the 2-position plug into the position labeled "Cruise On/Off Switch" on the reference diagram.

***NOTE: If you do not plan on running this locomotive in a conventional mode you do not need to install this switch. In the command mode you can select the cruise modes from the remote, this switch is only for conventional operation.***

### Preparation for the Wire Tether

At this point the tender frame should have both switches installed, the speaker mounted and the EOB heat sink securely mounted to the frame. Locate the 8-Pin tether that was included with your upgrade kit. (An 8-Pin tether MUST be used between the engine and tender, as all 8 wires will be used.) We have established a universal wiring method for the tether connection, since every EOB equipped locomotive will have the same wiring connections this is possible.

***NOTE: Follow the wiring orientation closely DO NOT deviate from this system. If you ever need to test a tender from one locomotive with the loco from another locomotive the wiring will be exactly the same and make this feasible.***

## Wire Orientation for the 8-Pin Tether

The diagram below illustrates where each wire between the loco and tender is connected. Do not deviate from this method; follow the diagram exactly.

Tender Side Tether (Male Side)

Red Pickup Roller AC Hot	Black Motor Lead M1	Black Sensor Signal (red wire on sensor board)	Black Smoke Unit +
Black Loco Frame Ground	Black Motor Lead M2	Black Sensor +5VDC (blue wire on Sensor board)	Black Smoke Fan +5 VDC

\*\* This view is looking at the connector, wires behind\*\*

Locomotive Side Tether (Female Side)

Black Smoke Unit +	Black Sensor Signal (red wire on sensor board)	Black Motor Lead M1	Red Pickup Roller AC Hot
Black Smoke Fan +5 VDC	Black Sensor +5VDC (blue wire on Sensor board)	Black Motor Lead M2	Black Loco Frame Ground

\*\* This view is looking at the connector, wires behind diagram\*\*

## Wiring the Tender

We will begin by connecting all the wires on the tender side. To complete this, use the male side of the 8-pin tether (the side with all the prongs sticking out).

## Wiring the Pickup and Ground

Locate a 2-position 2-wire harness from the installation kit. Plug this harness into the plug labeled “AC Power In” on the reference diagram. Connect the outermost wire (shown on the ref. Diagram as +) to the red wire of the tether.

Connect the innermost wire of the harness (shown on the ref. Diagram as -) to the black wire under the red wire in the tether. (The Wiring orientation diagram illustrates this position clearly.) The pickup and ground connections should now be completed.

## Wiring the Motor Leads

Locate a 2-position 2-wire harness from the installation kit. Plug this harness into the plug labeled “Motor (M1, M2)” on the reference diagram. When wiring motor leads you have a 50/50 shot at making the connection so the locomotive starts in forward. (If the locomotive starts in reverse, we can swap the wires after the initial testing phase with ease.) Connect one of the Motor harness leads to the wire in the tether labeled “M1”. Connect the remaining Motor harness lead to the wire in the tether labeled “M2”. The motor leads are now connected.

## Wiring the Sensor Board (on the tender side)

Locate the Flywheel Sensor board, which has 3 color-coded wires terminating in a 3-position plug. Currently, the Sensor board has 3 wires connected between it and the plug. (However, you will only be connecting 2 of the 3 wires to the tether. The wire you won't be connecting is ground. The ground for the sensor board will be connected to the ground on the locomotive side.) Using a pair of wire cutters clip all 3 wires approximately 2 inches away from the white connector. This is done so you can add wire to the cut wires on the tender side, yet have enough wire to connect to the tether on the locomotive side.

Using the wire cutters clip off the center wire **in the connector** (black wire) (DO NOT CUT THE BLACK WIRE OFF THE SENSOR BOARD!). Clip it off so there is no excess wire hanging out of the plug that could potentially short out on anything. Set the Sensor board aside for now. Plug the 3-position (now a 2-wire) harness into the plug labeled “Flywheel Sensor (sig - +)”. Connect the 2” blue wire to the wire labeled “Sensor +5 VDC” in the tether wiring diagram. Connect the 2” long red wire to the wire labeled as “Sensor Signal” in the tether wiring diagram. The Flywheel Sensor is now wired.

## Wiring the Smoke Unit

Locate the 4-position 4-wire harness from the installation kit. Plug this harness into the plug labeled “Smoke Unit (gnd, smoke, chuff, fan)” on the reference diagram.



NOTE: The EOB board includes two special effect modes for operating your original **fan driven smoke unit**. (If your locomotive is not equipped with a fan driven smoke unit you can add a TASTudios Turbo Smoke unit for \$69.95, see our website for more details!).

These modes are Puff N Chuff and Diesel Accell. Both modes can be triggered from the remote while the locomotive is stationary, or on the fly. The descriptions below illustrate the features of the two different special effects.

**Puff N Chuff**; This mode will pulse the smoke unit fan motor in sync with the chuffing (regardless of whether it is 1, 2 or 4 chuffs per revolution). When the locomotive sets at idle the smoke will loft out of the stack. Once it begins moving the smoke will puff in sync with the chuffing.

**Diesel Accell**; This mode will loft smoke out of the stack at idle. Once the locomotive begins moving the volume of the smoke is full blast. Once the train returns to idle the smoke volume decreases again.

These special effects can be toggled between from the remote, as well as the smoke unit can be turned on and off from the remote independent of the smoke fan operation. If you choose to connect your smoke unit fan to the EOB board to take advantage of these special effects follow the instructions below. If you do not want to take advantage of these special effects simply skip this step and proceed to the next phase. However, if you have a TASTudios Turbo Smoke unit you will need to follow the last block of instructions labeled “Connecting a TASTudios Turbo Smoke Unit to EOB”.

To connect the fan motor for use of the special effects refer to the reference diagram, specifically the plug labeled “Smoke Unit”. You will see in parentheses the following; “gnd., smoke, chuff and fan”. Gnd. Will not be used in the tether connection, clip it off at the connector. Smoke will be connected to the wire in the tether labeled “Smoke +” (refer to the tether wiring reference diagram ). The 3<sup>rd</sup> wire, labeled “chuff” will not be used. Clip the 3<sup>rd</sup> wire as close to the connector as possible. The 4<sup>th</sup> wire, labeled “fan” will be connected the wire in the tether labeled “Smoke Fan +5VDC”.

### Connecting a TASTudios Turbo Smoke Unit to EOB

If your locomotive is equipped with a TASTudios Turbo Smoke fan driven smoke unit you will need to connect the smoke power lead and the chuff input lead to the tether. To connect the Turbo Smoke unit, refer to the reference diagram, specifically the plug labeled “Smoke Unit”. You will see in parentheses the following; “gnd., smoke, chuff and fan”. Gnd. Will not be used in the tether connection, clip it off at the connector. Smoke will be connected to the wire in the tether labeled “Smoke +” (refer to the tether wiring reference diagram). The 3<sup>rd</sup> wire, labeled “chuff” will be connected to the wire in tether labeled “Smoke Fan +5VDC. The 4<sup>th</sup> wire, labeled “Fan” will not be connected, clip it off as close to the connector as possible.

## Wiring the Rear Coil Coupler

If your tender is equipped with a coil coupler, or if you purchased a coil coupler to add to your locomotive locate it now. After mounting the coupler to the rear truck route the wires up into the interior of the tender (the top of the tender frame). If you purchased a coupler from TASTudios the coupler already has a connector at the end of the wires. Plug this connector into the plug labeled “Rear Coupler (- +)” on the reference diagram.

If you are reusing the original coil coupler locate a 2-position 2-wire harness from the installation kit. Plug the harness into the plug labeled “Rear Coupler” on the reference diagram. Connect one wire from the harness to one wire from the coupler. Connect the remaining wire from the harness to the remaining coupler wire. There is no polarity between the coupler wires.

## Wiring the Rear Light

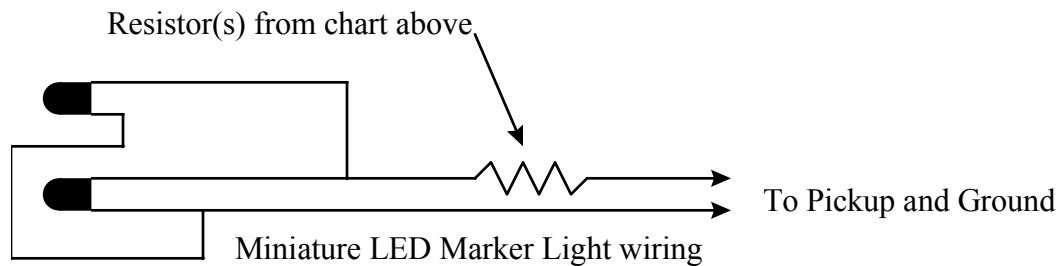
Locate a 2-position 2-wire harness from the installation kit. Plug the harness into the plug labeled “Rear Light (- +)”. The outermost wire in the harness is the ground. The innermost wire in the harness is the hot lead. (Both polarities are illustrated on the reference diagram). We recommend replacing the original light bulbs with 12 Volt Grain of Wheat bulbs (TAS-1018, \$1.50 each). You can also find these bulbs at your local hobby shop as well. The light output of the EOB board is 12 VAC, any bulbs of a lower rating will burn out when the direction button is pressed on the Cab-1.

## Wiring the Rear Marker Lights

<b>Resistor Value</b>	<b>Digi-Key Part #</b>	<b>Mouser Part #</b>
560 Ohm ½ Watt	560H-ND	293-560
390 Ohm ½ Watt	390H-ND	293-390
270 Ohm ½ Watt	270H-ND	293-270
220 Ohm ½ Watt	220H-ND	293-220
390 Ohm 1 Watt	P390W-1BK-ND	294-390

If your locomotive is equipped with marker lights you will need to add a resistor in series with one set of leads. The resistor is required because the marker lights will be connected to pickup and ground, which in command control is 18 VAC. They will be connected to the pickup and ground so that they stay illuminated all the time.

Most marker lights run at approximately 1.5 Volts. Since the track voltage is 18 VAC some sizable resistors will be required to drop the voltage down by 16.5 volts. To do this you will need to add up to two 560 ohm ½ watt resistors (catalog numbers are in the chart above) in series with BOTH hot leads of the marker lights. The diagram below illustrates how the resistor installs.



Once you have the resistor installed you can check to make sure the lights are the right intensity on 18 volts of track power by simply connecting one lead to the center rail and the other lead to the outside rail and applying 18 volts to the track. If the marker lights do not illuminate remove one 560 ohm ½ watt resistor and replace it with a 390 ohm ½ watt resistor. The same rule applies if they are too bright; simply add an additional 390 ohm ½ watt resistor to the existing two 560 ohm ½ watt resistors.

Once you are satisfied with the intensity of the marker lights you can set the shell aside. When you are ready to reinstall the shell simply connect one lead to the pickup roller (or AC hot) lead (the red wire on the wire tether) and the remaining marker light lead to the ground lead (the black wire directly under the red wire in the tether).

### Installing the Antenna

Locate the copper foil antenna with a 2-position 1-wire harness. Plug this harness into the plug labeled “Antenna” on the reference diagram. Leave the antenna hang in the air for the init being. (You will need the antenna during the initial testing phase later in the instructions.) Make certain it does not come in contact with any of the electronics or touch the frame or outside rails, otherwise a short may occur which will void the warranty and potentially damage the electronic circuit(s).

### Tender Completion

At this point the tender should be completely wired, with the exception of electrically isolating the shell onto the frame. We will cover mounting the tender shell later in the instructions. Set the tender aside for now, we will wire up the locomotive side of the electronics, perform an initial test and complete the installation.

### Locomotive side wiring

The most critical part of wiring up the locomotive side is the mounting of the Flywheel Sensor. Please refer to Section 2 for complete instructions on mounting the sensor board to the motor. Once you have completed wiring the sensor board please return here to complete the locomotive side wiring.

**NOTE: Try to route the wires under the motor for brass locomotives. Do everything in your power to keep the wires from rubbing against the flywheel tape strip. Over time, if the wires and flywheel rub, the tape strip will become marred, which will affect the Flywheel Sensor's ability to read the stripes.**

### Connecting the Pickup Rollers

Locate the female side of the 8-pin wire tether. Connect the red wire from the tether to the center rail pickup roller wire. ***NOTE: If the locomotive does not use a constant voltage board to control the front headlight be sure to include an additional lead in the pickup roller connection. This additional lead will be to power an 18 Volt Grain of Wheat bulb (TAS-1019, \$1.50 each).***

Connect the black wire, directly under the red wire (from the tether) to the locomotive ground (most often a screw and solder lug on the locomotive frame). If the locomotive does not already have a ground lug positioned on the frame try to fabricate one out of a washer or a commercially available solder lug (available from Radio Shack). It is very important that you provide a good solid ground connection on the locomotive frame.

You will need to leave at least 3 additional wires connected to the locomotive frame (ground lug). These connections will be used for the ground connections to the smoke unit, front light (if a constant voltage board is not used) and the Flywheel Sensor.

### Wiring the Motor

Locate the motor leads (most often these are either red and black or blue and yellow or yellow and white, but not always). Visually follow the wires and verify they connect to the motor. Connect one motor wire to the wire labeled "M1" in the wire tether reference diagram. Connect the remaining motor lead to the wire labeled "M2" on the wire tether reference diagram.

### Wiring the Flywheel Sensor

Locate the Flywheel Sensor wires. Connect the red wire to the wire labeled "Sensor Signal" in the wire tether reference diagram. Connect the blue wire from the Flywheel Sensor to the wire in the tether labeled "Sensor +5VDC" on the tether reference diagram. Finally, connect the black sensor wire to one of the additional three ground leads you connected in the previous step. The sensor board is now wired.

**NOTE: It is EXTREMELY important that the sensor wires be wired correctly to the tether. If the polarity is applied backwards the sensor board will short out and not function. (Sensor boards are sold separately for \$15.00 each when an exchange is returned.)**

## Connecting the Smoke Unit

If you plan to connect the smoke unit fan motor to the EOB board you will have to wait until you complete the initial testing phase in Section 3. You will need to determine which wire from the smoke unit fan is +5VDC. To do this you will need to apply power to the smoke unit. This will be much easier to accomplish once the smoke unit is connected to the motherboard and you can turn it on and off from the remote.

If your locomotive has a Seuthe style smoke unit, DO NOT connect it to the wire tether. Leave the wires alone. Due to the low voltage the Seuthe units operate with the 12 Volt output of the EOB smoke plug will burn out the Seuthe units. We highly recommend leaving the Seuthe units connected to the smoke on/off switch and not connecting them to the EOB board.

If you have a fan driven smoke unit, locate the smoke unit on/off switch. There will be a wire from the on/off switch that connects to the center rail pickup roller. Clip this wire from the center rail pickup roller and connect it to the wire in the tether labeled "Smoke Hot" on the tether reference diagram. Locate the ground wire for the smoke unit. (The smoke unit ground wire may already be connected to the locomotive frame. If this is the case, leave it alone.) Connect the smoke unit ground wire to one of the 3 additional wires you installed on the locomotive frame ground. (The ground for the smoke unit DOES NOT connect to the tether.)

## Initial Testing

Please refer to Section 3 for the initial testing procedures. Once you have completed the initial test, please return to this section to complete the installation.

## Connecting the Smoke Unit Fan Motor to the Tether

If you plan to include the special effects for the smoke unit fan feature you will need a voltmeter to determine which side of the smoke unit fan motor is +5VDC. This will need to be done now.

Set the locomotive on the track with the tether connected between the locomotive and tender. Apply 18 Volts of AC power to the track. Using the Cab-1 remote press the following keys;

**ENG + 1 + AUX1 + 9**

**(The sounds will come on and the smoke unit will turn on as well.)**

Using a voltmeter set on DC using the probes, touch one probe to one of the fan motor leads on the smoke unit. Use the other probe to touch the other motor lead on the smoke unit. Your voltmeter will read anywhere between 4.5 to 5.0 VDC. The voltmeter should show a reading in the positive (Meaning the negative sign will not be on the screen if it is a digital meter. The needle will not be on the left side of the 0 mark if it is an analog meter.) if the red probe is touching the +5VDC lead of the fan motor. If the reading is shown as negative, reverse the probes so the reading is shown as positive. The red probe will be touching the +5VDC lead. Cut this lead off the circuit board (leaving the length of wire still connected to the motor).

Turn the track power off and return to the bench with the locomotive. Connect the +5VDC lead from the smoke unit motor to the wire in the tether labeled “Smoke Fan +5VDC” as shown on the tether reference diagram.

You can retest the locomotive to verify the smoke unit fan is working properly. Place the locomotive on the track with the tether connected between the loco and tender. Apply 18 Volts of AC power. Using the Cab-1 remote press the following keys;

**ENG + 1 + AUX1 + 9**

**(The sounds will come on and the smoke unit will turn on.)**

Once the smoke unit begins producing smoke verify the smoke is being forced out of the stack. The volume will be low, but that is okay for now. (This step is just to verify the smoke unit fan is in fact spinning and all is working properly.) Turn the track power off and return to the bench with the locomotive to complete the installation.

**NOTE: You will not see any puffing occur at all. This is because the chuff rate has not yet been established. This will change once the Master Chuff Reset code is determined in Section 5.**

## Conclusion

At this point you should have verified the locomotive and tender run properly and smoothly. The flywheel sensor is reading properly and there is no annoying jerk in the motion of the locomotive in either direction. The sounds work, the lights all work, etc. If all of these features are functioning proceed with reinstalling the shells and refer to section 5 for programming the Master Chuff Reset code and learning all the features of your new EOB board.

## Reinstalling the Locomotive Shell

Locate the locomotive shell you removed at the beginning of the installation. Carefully reattach the shell to the frame making sure the shell does not interfere with the Flywheel Sensor mounted to the motor. Also make sure the wires routed under the motor

are not rubbing against the flywheel tape strip. Finally, make sure there are no wires hanging out of the shell or pinched between the shell and the frame. Carefully reinstall the screws and set the locomotive aside. It is a good idea to check the locomotive and tender one final time before installing the tender shell. This quick test will verify the loco shell is not touching the sensor board and causing a problem.

## Reinstalling the Tender Shell

At this point you are ready to tackle the most time consuming and potentially frustrating part of the installation. Reinstalling the tender shell. The reason this can be the hardest part of the installation is because the tender shell must be electrically isolated from the tender frame in order for the SAW board to receive a clear radio signal from the command base. The tender shell will become the antenna. The antenna cannot touch ground, otherwise the signal will be lost and the engine will revert back to conventional mode. We can assure you that once the shell is isolated the signal reception will be fantastic!

The reason this is so difficult is two-fold. First you cannot see the radio signal. The device that allows you to see the radio signal sells for approx \$25,000.00, so neither of us will be running out to buy one tomorrow. Second, a slight hairline tear in the electrical tape can allow the shell to touch the frame and totally defeat the isolation. So, please be patient with this segment of the installation process. We would not expect you to do this if it could not be accomplished. It may take a few tries, but it will work. We've been using this method for over four years now with great results.

Set the shell next to the frame of the tender up side down. If you have not already installed the rear light do so now. We recommend using hot glue or a similar adhesive to hold it in place. Locate the copper antenna you connected previously. Carefully remove the paper strip on the backside of the copper antenna and adhere it to the inside center roof of the shell (make sure that any excess paint is scraped away so the copper strips makes an electrical connection with the die cast or brass shell). Cover the exposed copper with electrical tape to prevent a short circuit from occurring in the event the antenna should ever sag. Finally, make sure you have connected the marker light leads to the pickup and ground leads in the "AC Power" harness so they are illuminated all the time.

Begin by using black electrical tape to tape off the perimeter of the tender frame (basically everywhere the shell comes into contact with the frame). We recommend you leave an excessive amount of overhang with the tape. This will look tacky at first, but once the shell is sealed and the nylon screws are installed you can carefully cut the tape with a sharp X-Acto knife. Be certain that the electrical tape covers both the top of the tender frame and the sides of the tender frame, be especially careful to ensure the corners are covered. Once you are satisfied the frame is covered adequately carefully set the shell onto the frame and *gently* push the frame into the shell until it is properly seated.

Before you install the nylon screws we highly recommend you run a quick test to ensure the tape did not tear. If, when you power up the track the sounds come on immediately and the locomotive does not respond to any commands you will know the tape has torn somewhere. If the sounds do not come on when power is applied then the tape may not have torn. If this is the case (no sound at power up) press the BOOST key one time (the locomotive will begin moving). (If you do not hear any chuffing, don't worry, we will correct this in Section 5. Try different commands such as whistle, bell, Tower Com, etc. Be sure to run the engine in both directions while trying various commands. If the locomotive receives the commands without hesitation return to the bench and install the nylon screws. If the locomotive behaves erratically the tape is torn. Return to the bench and remove the old tape and install new tape. Repeat the above process until it works properly. (This is the frustrating part we mentioned earlier.)

When installing the nylon screws you may be required to cut the screws down in length, this is okay, the nylon screws are very durable. Once you have the nylon screws installed take the locomotive back to the track and perform the above test again. If the locomotive responds flawlessly, Congratulations, you got it on the first try! If the locomotive does not respond and the sounds come on at power up, head back to the bench and start over, the tape obviously tore somewhere between the frame and the shell when you installed the screws.

As we mentioned above this may take several tries. Do not lose hope! It will work! If you get frustrated put it down and walk away for a while, sometimes this is the best solution. If all else fails, give us a call.

## Wrap Up

Your EOB Board is now installed. The shell on both the locomotive and tender should be on and the locomotive should resemble something that actually looks like a train, instead of a disemboweled electronic experiment gone wrong!

Please refer to Section 5, specifically the section titled "Setting the Chuff Rate for Steam Locomotives". This section will provide exact instructions on setting the chuff rate of your locomotive. Section 5 covers all the features of your new cruise equipped locomotive. Please read Section 5 thoroughly to discover what your locomotive is capable of doing.

## Section 2

### Mounting the flywheel sensor and flywheel tape strip

*(This step is done now to allow you plenty of room for working inside the locomotive.)*

This is the **most critical step** in the installation. Please follow these directions closely. The flywheel tape strip and the sensor board, if not mounted correctly, will affect the overall performance of EOB. **We cannot stress the importance of the sensor board in the overall performance of cruise!**



Included in your installation kit are 5 different striped flywheel tape strips. The strips are marked “Sunset 1, Sunset 2, MTH, Williams and K-Line. Using a pair of sharp scissors carefully cut the strips from the paper. Ensure the strips are cut evenly along the edges and that no strips of white are showing on either edge.

You will also want to ensure that your flywheel is clean and free of any grease or slippery substance, which will prevent the tape strip from permanently adhering to the flywheel. You should use a small rag or Q-Tip with rubbing alcohol or Goo-Gone® cleaning solvent. Clean the flywheel with a wet rag and dry it with a dry rag. Make certain the flywheel is clean and dry!

Prior to removing the protective backing on the strips you want to determine which strip best fits your flywheel. Wrap the strip(s) around the flywheel until it mates with itself. You want a smooth transition where either side of the strips overlap each other. It is absolutely imperative that the black stripes align with the mating black stripes and provide a perfect seamless transition. The same goes for the white stripes. The transition must be perfect otherwise a jerky motion will appear in the operation of your locomotive. Try each tape strip. When you find the strip that best matches at the transition for your flywheel remove the adhesive back and apply the tape strip to the flywheel. Make sure the strip is evenly spaced between both edges of the flywheel. It is okay to overlap the ends, just be certain the stripes align with each other seamlessly.

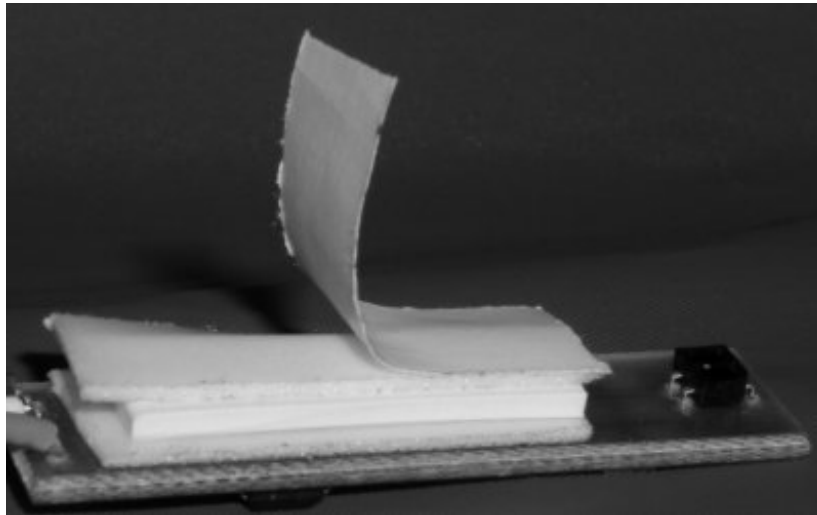
Once the tape strip is securely adhered to the flywheel locate the 0.030” styrene spacer tool, the thin double-sided tape and the bag of assorted styrene. Lay the styrene out on the workspace. You will notice the pieces range in size from 0.005” to 0.060”. Arrange them from thinnest to thickest. Using the thin tape cut a piece approximately 1” long. Apply the exposed adhesive side to the unpopulated side of the sensor board (the side with only a small black rectangle opposite the end with the wires). Place the thin tape in the position shown below.



Once you have the tape in place locate the 0.030” flywheel sensor spacing tool. Place the sensor board against the side of the motor with the spacer tool between the black sensor and the flywheel. Using the various thickness styrene included in the kit, determine the combination required so the sensor board mounts flat against the motor

side and the sensor is properly spaced against the flywheel (with 0.30" distance between the sensor and the flywheel). You should be able to move the spacer tool between the sensor and the flywheel without any resistance while applying pressure to the sensor board on the side of the motor with your finger.

Once you have determined the correct combination of styrene spacers use a couple small dabs of styrene adhesive or Super Glue to glue the styrene to each other. Remove the protective backing on the thin tape you applied to the sensor board and attach the styrene to the sensor board. Cut another 1" long piece of thin tape and apply it to the opposite side of the styrene strips you glued together and attached to the sensor board. The semi-completed sensor board should look like the diagram below.

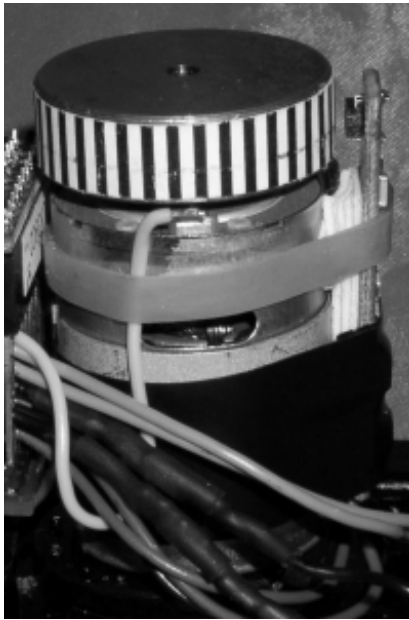


Remove the protective coating on the thin tape and carefully place the sensor board onto the motor side. ***(NOTE: Steam locomotives should mount the sensor board in the 2 o'clock or 10 o'clock position. This way the shell will not apply pressure to the sensor board when it is reattached.)*** Make sure the flywheel sensor is positioned so it is in the middle of the flywheel tape strip. With the spacer tool in position firmly press the flywheel sensor onto the side of the motor. Now, using a strip of electrical tape, wrap the tape around the motor, covering the bottom half of the flywheel sensor. As shown on the following page.

***NOTE: There is a small surface mount LED located on the sensor board. This LED will illuminate each time a black stripe passes in front of the sensor. Be sure you do not cover this LED, as you will need to use it for testing in the future. You also want to wrap the motor, covering the top of the sensor board, but make certain you can see the LED. (Make a small cut in the tape if necessary.) The finished motor, with the sensor board should look like the photo below.***

The reason the thin double-sided tape is used is to help facilitate holding the sensor board in place while you tape it to the motor. When you tape the sensor board use as much force as possible to securely affix the sensor board in place. This will prevent the sensor

board from moving during shipping, etc. The thin tape is used so it can be easily removed in the event the sensor board ever needs to be replaced.



The end result of this exercise is to have the flywheel sensor board **SECURELY** mounted to the motor with the proper 0.030” spacing between the sensor and the flywheel. It is absolutely imperative that the sensor board be mounted securely in place and the spacing is closely adhered to. We cannot stress how much the sensor board plays a huge role in the smooth operation of EOB.

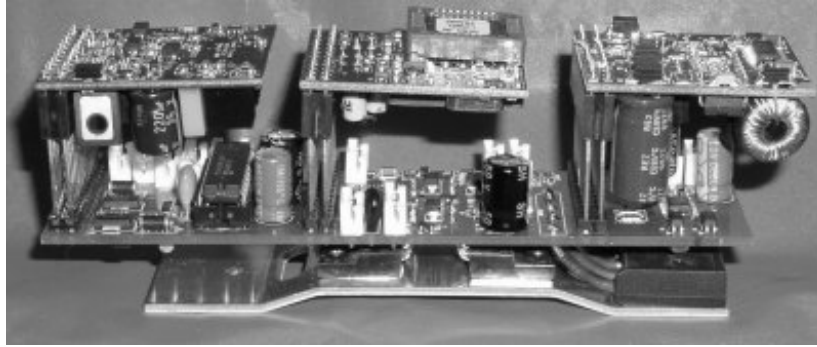
Once you are satisfied with the sensor board mounting return to the installation instructions to continue installing the motherboard. You will test the sensor board during the initial testing phase.

### Section 3 Initial Testing

**NOTE: Steam locomotive may or may not chuff during this phase of testing. Diesel locomotives may not rev up and down properly. Do not panic. We will address the chuffing and revs after the installation is completed.**

For the initial testing phase you will be testing the locomotive with the shell(s) off. This will allow you to verify the sensor board is reading the tape strip on the flywheel properly.

If you have removed the 3 plug-in boards that were on the EOB board out of the box please follow the diagram below to plug the boards back into their proper locations on the EOB board to complete the testing phase.



Locate the program/run switch you installed earlier in the installation. Slide the switch to “Program” (which is towards the front of the locomotive if you followed our recommendations).

Place the locomotive on a track that has a command base connected to it. Apply 18 Volts of AC power to the track. Using the Cab-1 remote press the following keys;

**ENG + 1 + SET**  
**(The horn/whistle will blow and the sounds will come on).**

Now press;

**ENG + 1 + AUX1 + 8**  
**(The horn/whistle will blow again.)**

Turn the track power off and slide the program/run switch back to the “Run” position (towards the rear of the locomotive if you followed our recommendations). Place the locomotive back on the track and reapply 18 Volts of AC power.

We now need to set up a couple operating parameters inside the EOB board itself. Using the Cab-1 remote press the following keys;

**ENG + 1 + DIR + AUX1 + AUX1 + AUX1 + 5 + 1**  
**(The horn will sound after pressing the 3<sup>rd</sup> AUX1, coupler after 5 and horn after 1.)**

That step just set up the pre-pulse, which affects the slow starting speed. By pressing 1 you have just set the locomotive up for the slowest starting speed. Now follow the directions below for the next programming parameter;

**ENG + 1 + DIR + AUX1 + AUX1 + AUX1 + 4 + 1**  
**(The horn will sound after pressing the 3<sup>rd</sup> AUX1, coupler after 4 and horn after 1.)**

This step set up the background pulse, which smoothes out the low-end performance. After the installation is completed there will be a block of instructions provided that will allow you to experiment with the various pre-pulses and background pulses so you are able to set the locomotive up to your own preferences.

Finally you want to select the speed step mode for testing (for this exercise it will be the 128 speed step mode). Using the Cab-1 remote press the following keys;

**ENG + 1 + DIR + AUX1 + AUX1 + AUX1 + 2**  
**(The horn will blow after the 3<sup>rd</sup> AUX1 and after 2.)**

Now, before turning the throttle, look at the flywheel sensor board. Using your finger slowly turn the flywheel in either direction and verify the small red LED is illuminating each time a black stripe passes in front of the sensor device. If you do not see the red LED illuminating then the sensor is not accurately counting the stripes, which means the cruise features will not work properly.

If you do not see the red LED illuminate go back to Section 2 and verify you mounted the flywheel sensor properly using the sensor spacing tool.

If you see the red LED illuminate each time a black stripe passes in front of the sensor continue turning the flywheel until you have made one complete revolution. This will allow you to verify the sensor is not skipping any stripes. After you have confirmed the stripes are being counted accurately continue with the testing.

Turn the track power off and wait 10 seconds. This is done so the start up direction of the locomotive is unaffected by the previous programming steps. After 10 seconds turn the track power back on. Using the Cab-1 remote press the BOOST button one time. The locomotive should begin moving at the first speed step in the 128-speed step mode.

***(NOTE: If the locomotive begins moving in reverse, don't panic. Just remember to reverse the motor leads when you return to the bench to complete the installation. This can be done easily by swapping the wires in the white plug. A diagram is located on the reference sheets attached the rear of the instructions to show how this is done.) Remember; if you did not turn the track power off do so now otherwise you may end up reversing the wires for no reason. The programming procedures make you press the DIR key several times, which may appear to make the locomotive start in reverse.***

Now press the BRAKE button. The locomotive will stop. Press the DIR key to change directions and press the BOOST key once again. The locomotive will begin moving in the opposite direction.

If your locomotive went from a dead stop to a medium/high speed or the locomotive has a lot of jerkiness to it the sensor is not reading the stripes correctly or the stripes do not line up accurately. Return to Section 2 for instructions on properly mounting the sensor board to the motor. Use the sensor spacing tool to verify you have the correct distance between the sensor and flywheel and the sensor is properly aligned with the tape strip.

If the locomotive crept along the track in both directions without any jerkiness you have successfully mounted the flywheel sensor. Congratulations! You can now return to the installation instructions to complete the installation of EOB.

All of the instructions for controlling EOB are included on the back reference pages as well as a laminated quick reference chart.

## Section 4

### Tip and Tricks for Installing EOB

There will be some instances where the EOB board may seem too long to fit into a locomotive. In instances like these you can slightly modify the EOB board to make it fit. For instance, an MTH SD-40-2 with a smoke unit will not accept a stock, out of the box, EOB board. To make the EOB board fit simply bend the Railsounds Power Board towards the Railsounds Audio Board. There is plenty of headroom inside the shell to accommodate the height created by bending the board backwards, thus angling the edge of the board towards the roof.

It also okay to mount the EOB board on its side, you will be required to fabricate a metal bracket so the heat sink is attached to the frame, but this method will not affect the performance of the EOB board.

If you have questions about fitting EOB in your locomotive, please feel free to contact us at 330-533-7181 Mon-Fri 9a-5p EST. We would prefer you run your idea past us before attempting the modification. This will help you as well as help us help other operators with their installations in the future.

## Section 5

# Engineer On Board Cruise Control Operating Instructions

Engineer On Board Cruise Control is a very complex circuit. However, it is easy to navigate through the features using a Cab-1 remote. One of the best features is the fact that you don't need to touch the locomotive while accessing the many programming features.

While these steps are easy to navigate through, there is a slight learning curve that you will need to go through. This learning curve involves several new commands that have never been used before in any other locomotive. We have included a small quick reference laminated placard for you to keep on the layout (and prevent you from having to carry around these instructions all the time). Please read through this block of instructions so you understand what each command is used for and its purpose.

The most important thing to remember when using these commands is to leave a 1 second delay between each press of the keys. EOB utilizes multiple commands to access various features. You will notice that some of these commands, if not given a delay between the presses of the keys, will activate unwanted commands such as shut down sounds, volume up and down commands and rev up and down commands.

EOB incorporates a new technology that we refer to as "Torquemaster". Torquemaster is essentially a bell curve. This bell curve is what helps EOB perform so smoothly. What Torquemaster basically equates to is a "leeway" which allows the cruise a + or - 5% difference in the speed step. For instance, you have a lash-up with an Odyssey equipped loco and the EOB is set for the 32-speed step mode. The Odyssey loco runs just a hair faster than EOB at the first step. EOB will not drag or pull the Odyssey loco, but instead will work in conjunction with it to be a more effective puller. This means that the coil couplers will be tight between the locos and there will be no fighting between the two locomotives. This also means that the EOB may slow just slightly heading up a grade, or speed up just slightly, down a grade (it won't be anything you will detect easily), but this is the Torquemaster working. Through extensive testing we have found that EOB works best with the Torquemaster than without it, which is why we incorporated the feature. Torquemaster cannot be turned off, as it is incorporated in the software. Torquemaster is not in use for the Cruise Off mode.

The commands you will use most often will be the selection of the cruise speed step modes. With EOB you can select between 32-speed steps, 128-speed steps and Cruise off. These selections require the locomotive to be stopped when issued, so we have incorporated the Direction key in the commands. Unfortunately speed steps cannot be changed on the fly. To select between these modes follow the key sequences below.

For the 32-speed step mode;

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 1**  
**(The horn will sound after the 3<sup>rd</sup> AUX1 and after 1.)**



The 32-speed step mode works just like any other locomotive with speed control. The red thumbwheel is used to increase the speed up and down. The BOOST key will increase speed, once released it will return to its original speed. The BRAKE key will bring the loco to a stop. When released the locomotive will return to its original speed. Once you set this mode it is remembered at start up. You do not need to reenter the command at power up unless you want to change the speed step modes.

For the 128-speed step mode;

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 2**  
**(The horn will sound after the 3<sup>rd</sup> AUX1 and after 2.)**

The 128-speed step mode works quite differently than any other locomotive control system. This is because the Lionel radio board (R2LC) is fixed at a constant 32 speed steps. The red thumbwheel can be used to get to the 32<sup>nd</sup>-speed step, but it will not go any higher than that. To circumvent this problem we were forced to use the BOOST and BRAKE key on the Cab-1 remote. Each press of the BOOST key increases the speed one step at a time. Each press of the BRAKE key decreases the speed one step at a time. Pressing and holding either the Brake or the Boost keys will not yield the same results as it does in the 32-speed step mode or the cruise off mode. The Direction key can be used as an absolute stop key as well.

What exactly does 128-speed steps mean? This means there are 128 steps between a dead stop and full speed. 4 times the amount available with any non-cruise equipped locomotive. 128-speed step mode provides much finer control of the speed. With this mode enabled you can actually make a locomotive start out so slow that you will actually hear the coupler slack being pulled out of a long string of cars (instead of being included in the sound system!). The results of this mode are absolutely magnificent for fine slow speed control. You do not need to reenter the command at power up unless you want to change the speed step modes.

You will lose the brake sounds in the 128-speed step mode. They are still there, you just won't hear them when you press the brake key to slow the train down. (The brake sounds work in the 32-speed step mode and Cruise Off mode.)

For the Cruise Off mode;

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 3**  
**(The horn will sound after the 3<sup>rd</sup> AUX1 and after 3.)**

The Cruise Off mode will provide 100% lash-up compatibility with non-cruise equipped locomotives. In this mode the response to commands is exactly the same as any other command equipped locomotive without cruise control. You do not need to reenter the command at power up unless you want to change the speed step modes.

In addition to being able to select the cruise steps you can also select the way your locomotive performs. There are 2 linear scales included in EOB. These scales control

how quickly the EOB board provides power to the motor. When set at the lowest position on the scale the low end speed is amazing, but the high top end is affected. If the scales are set to the highest position on the scale the low end suffers, but the top end is more precise. During the initial testing phase of the instructions you set both scales at their lowest positions. These are the positions we recommend, however, during our testing phases we did find some isolated cases where the lowest speed step was real jerky. To overcome this we simply adjusted these linear scales until the jerkiness disappeared. More often than not any jerkiness that appears in a locomotive is due to the sensor board not reading the flywheel stripes properly.

To access these linear scales the commands are as follows;

For the Pre-Pulse (affects the low end starting voltage)

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 5 + # (# can be any number 1 thru 8)  
(The horn will sound after the 3<sup>rd</sup> AUX1, a coupler sound after 5, a horn after #.)**

The scale is linear, meaning 1 is the lowest setting and 8 is the highest setting. The lower the last digit is the slower the first speed step will be.

For the Background Pulse (affects the top voltage)

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 4 + # (# can be any number 1 thru 8)  
(The horn will sound after the 3<sup>rd</sup> AUX1, a coupler sound after 4, a horn after #.)**

The scale is linear, meaning 1 is the lowest setting, 8 is the highest setting. The last digit is used to smooth out the slow end performance and eliminate any jerking.

**NOTE: For locomotives that exhibit a slight jerkiness at low speeds or for locomotives with up to 4 motors such as an F-3 AA set with 2 powered A units that exhibit a low speed jerk the solution is in the background pulses. The Pre-Pulse should always be set to “1”. The Background Pulse can be moved up to “5” without affecting the low end. The Background Pulse will smooth out any jerkiness seen at the first speed step.**

## Setting the Chuff Rate for Steam Locomotives

There is one final command that uses the Direction key in its sequence. This is the Master Chuff Reset code. This code is used to generate the chuff input that triggers the sound system. EOB allows you to select between 1, 2 and 4 chuffs per revolution while the locomotive is moving or stopped, this is done by using simple math. The Master Chuff Reset code is the number of stripes the sensor counts before it triggers the sound system to chuff. This reset code is the number of stripes counted in one complete revolution of the drivers. When you select two or four chuffs per revolution the processor on the EOB board divides the Master reset code by either two or four to produce the proper chuff triggers. For example, if the Master Chuff Reset code is 200, the sensor will

count 200 stripes and then produce a trigger for the sound system at one chuff per revolution. When in 2 chuffs per revolution the sensor will count 100 stripes before it produces a chuff trigger. For 4 chuffs per revolution it will count 50 stripes.

Finding the Master Chuff Reset code is a bit tricky and requires a lot of trial and error. But, once found the results will be spectacular. Because almost every locomotive uses a different diameter driver/gear ratio/flywheel this feature was integrated into EOB. Regardless of the load the chuff will be dead on every time, regardless of the number of chuffs per revolution.

The commands below illustrate how to access the Master Chuff Reset code command.

**ENG + DIR + AUX1 + AUX1 + AUX1 + 6 + # # # (# # # is a 3 digit code)  
(The horn will sound after the 3<sup>rd</sup> AUX1, a coupler sound after 6, a coupler sound after the 1<sup>st</sup> and 2<sup>nd</sup> # and a horn after the 3<sup>rd</sup> #.)**

By accessing this feature the locomotive is automatically put in the 32-speed step mode, with 1 chuff per revolution. For # # # section of the command begin by entering an arbitrary 3 digit number, such as 350 for instance. After you enter the code turn the throttle on the remote clockwise until the locomotive just starts to move and watch the rearmost driver and connecting rod closely. Note where the chuff occurs, wait for the driver to make a complete revolution and verify the chuff occurs at the same place each time. If the chuff does not occur at the same location, that's okay it can be changed (it more than likely won't on the first go 'round). However, watch where the chuff occurs, if it chuffs after the first mark the next 3 digit code you enter will need to be a number smaller than 350. If it chuffs before the first mark the next 3 digit code you enter will need to be a number bigger than 350. Work in 50 part increments. For a smaller number, use 300. For a larger number, use 400 and so on. Once you begin to zero in on the position you can begin to change the digits in increments of 10, then increments of 5 and finally 1. The 3-digit code can be almost any number, even or odd. It makes no difference.

Each time you enter a new 3-digit code you will need to repeat the prefix command of ENG + DIR + AUX1 + AUX1 + AUX1 + 6 then the new 3 digit code. We realize this is a painstaking process and can become tedious, but the outcome is worth it. Once you have found the 3-digit Master Chuff Reset Code enter it both below and on your Quick Reference placard in the space provided.

## Master Chuff Reset Code

Locomotive; \_\_\_\_\_

Manufacturer; \_\_\_\_\_

Master Chuff Reset Code; \_\_\_\_\_

### Setting the Chuff Rate for Diesel Locomotives

We realize of course that diesel locomotives do not chuff, however, we do recommend setting the Master Reset Chuff code to a predefined number. This will prevent the diesel sounds from revving up and down randomly. This done by following the commands below;

**ENG + ## + DIR + AUX1 + AUX1 + AUX1 + 6 + 0 + 5 + 0**

**(The horn will sound after the 3<sup>rd</sup> AUX1, a coupler after 6, a coupler after 0, a coupler after 5, and a horn after 0.)**

Once you have completed this step please refer to “selecting the chuff rate”. It is recommended that you set this position in the 4 chuffs per revolution setting, so the pulses to the sound system will be adequate enough for the brake sounds to play regardless of the speed in the 32-step mode or cruise off mode.

### Selecting the Chuff Rate

EOB allows you to change the chuff rate of the locomotive, from 1, 2 or 4 chuffs per revolution while the locomotive is either stopped or running. The commands for this are as follows;

**ENG + ## + AUX1 + AUX1 + 5**

(Each time 5 is pressed you will hear a series of whistles or horns. 1 blast for 1 chuff per rev. 2 blasts for 2 chuffs per rev. 4 blasts for 4 chuffs per rev. Pressing the sequence over and over again will simply result in the blasts repeating themselves; 1, 2, 4, 1, 2, 4, 1, 2, 4 and so on.

We recommend that diesels be set to 4 chuffs per revolution (a total of 4 horn blasts). This is accomplished by pressing the AUX1 + AUX1 + 5 command three times, or until you hear 4 horn blasts.

## Selecting the Smoke Unit Fan Output

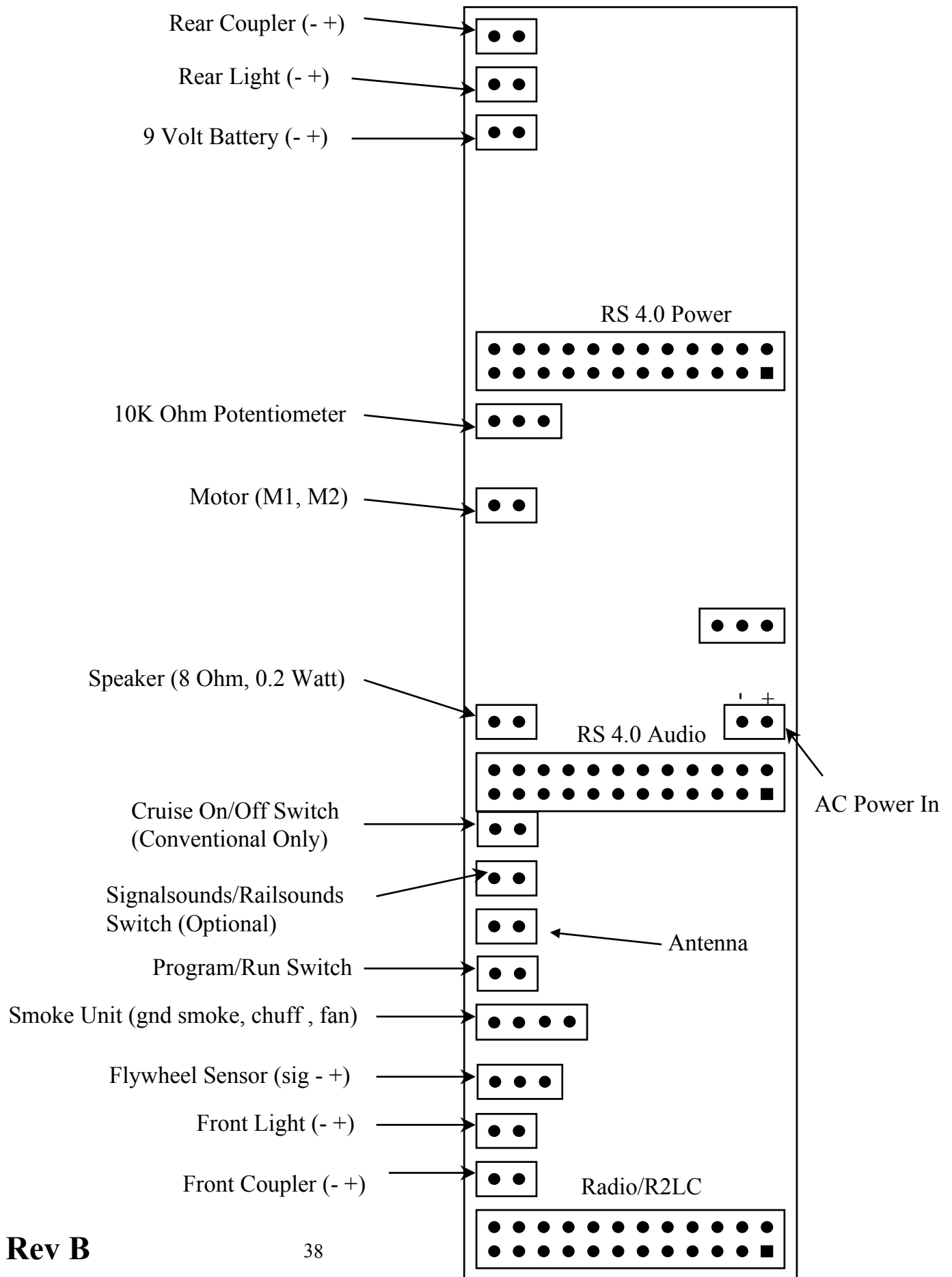
If you connected the smoke unit fan to the EOB board and you have a steam locomotive you can change the fan operation of the smoke unit while the locomotive is either on the fly or stopped. To access this command press the following keys;

**ENG + ## + AUX1 + AUX1 + 4**  
**(The horn will sound after 4.)**

By pressing the sequence you will select between Puff N Chuff, where the smoke fan pulses in sync with the chuffing of the smoke unit. By pressing the sequence again you will select the Diesel Accell feature, which will set the fan to full output regardless of the chuff rate. In either mode the smoke unit will loft smoke out of the stack while sitting at idle. This command can be pressed at any time the locomotive has power to it. AUX1 8 and 9 will still turn the smoke unit on and off.

Diesels can only select the Diesel Accell mode, there is no Puff N Chuff feature for diesel locomotives. (This was set when you set up the Master Chuff Reset code in the previous step.)

# Train America Studios Cruise Control Motherboard Pinouts



# Train America Studios 8 Pin Tether Orientation

Tender Side Tether (Male Side)

Red Wire Pickup Roller AC Hot	Black Motor Lead M1	Black Sensor Signal (red wire on sensor board)	Black Smoke Unit +
Black Loco Frame Ground	Black Motor Lead M2	Black Sensor +5VDC (blue wire on Sensor board)	Black Smoke Fan +5 VDC

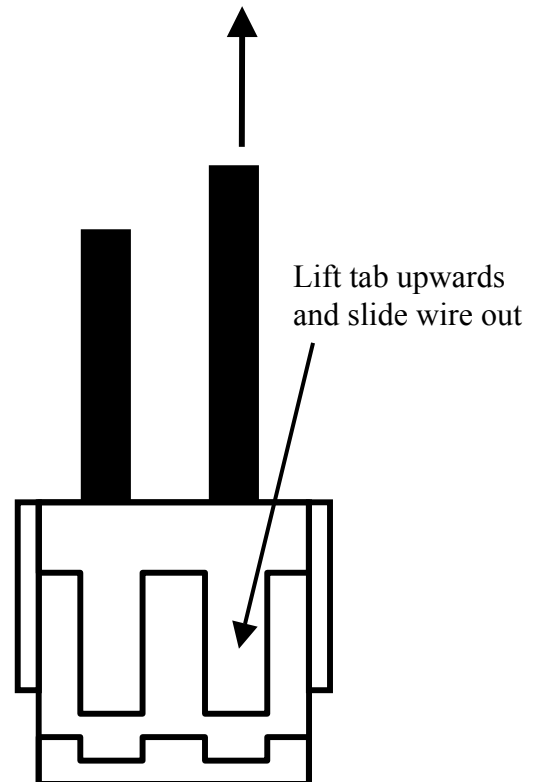
\*\* This view is looking at the connector, wires behind the diagram\*\*

Locomotive Side Tether (Female Side)

Black Smoke Unit +	Black Sensor Signal (red wire on sensor board)	Black Motor Lead M1	Red Wire Pickup Roller AC Hot
Black Smoke Fan +5 VDC	Black Sensor +5VDC (blue wire on Sensor board)	Black Motor Lead M2	Black Loco Frame Ground

\*\* This view is looking at the connector, wires behind the diagram\*\*

To reverse wires in a connector.



**Press tab downwards once wire is removed and reinsert another wire. You should be able to tug on the wire while holding the connector and the wire will not come free.**