# Model Railroad Locomotive Module (LM-3S-G)

## User Manual

**Ring Engineering Inc.**
**(219) 322-0279**
**www.RingEngineering.com**

**Revision 2.02**

## Introduction

Please read all warnings and instructions before installation and use. For the latest information including the latest revision of this manual please visit our Internet site at ***www.RingEngineering.com***. It is important that you check for the latest revision of this Instruction Manual on the Internet. Go to RailPro, Products, then LM-3S-G.

The LM-3S-G can be installed in a G or O scale model train locomotive that you want to control the motion, lights, and sounds with a RailPro controller.

## Warnings

⚠ **WARNING:** The power supply or battery used to power your LM-3S-G must have short circuit protection and the short circuit protection should not exceed 12 amps.

⚠ **WARNING:** Maximum voltage is 24 Volts. Only power your LM-3S-G module with a Ring Engineering Inc. RailPro Power Supply designed for the LM-3S-G or a DCC power supply that only has the signal that is described in NMRA DCC standards S-9.1 and S-9.2. You may use a proper battery to power your LM-3S-G.

⚠ **WARNING:** If this module is wired incorrectly, or the maximum allowed voltage is exceeded, it is possible that enough heat can be generated to ignite flammable material, causing a fire. The use of improper resistors for LED or low voltage lights is one possible source of this danger.

⚠ **WARNING:** You can be burnt by the locomotive module heatsink if you touch it while it is powered on. You should not touch the module until the power has been removed for at least 30 minutes to allow it to cool to a temperature that would be safe to handle.

⚠ **WARNING:** Do not open or remove the enclosure.

⚠ **WARNING:** Temperature: Operating 32F to 90F, Storage 0F - 110F

⚠ **WARNING:** Operate and store in dry environment only.
Relative Humidity: Operating 20% to 90% non-condensing, Storage 10% to 95% non-condensing

⚠ **WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

⚠ **WARNING:** This product contains small parts and is not recommended for persons under fourteen (14) years of age.

## *Warnings about Battery Power*

- High power batteries can explode and catch fire. Lithium batteries (i.e. LiPo) can catch fire if they are shorted or punctured.
- If you discharged lithium batteries even one time below its critical voltage it can be permanently damaged and catch on fire when used.
- If your discharge or charge current is higher than the battery is rated for it can explode or catch fire.
- The smoke from a lithium battery fire can be dangerous to your health.
- This is not intended to be a complete list of dangers related to using batteries, so if you are going to use batteries, you need to be aware of all the risks involved.
- Maximum voltage for a lithium battery pack is 5s (18.5 volts - five 3.7V cells in series).

## *Specifications*

Maximum Power Input Voltage: 24 Volts
Maximum Motor Stall Current: 8 Amps
Maximum Output Current on a Single Output: 1.2 Amps.
Maximum Output Current on all Outputs Combined: 1.2 Amps.
Audio Output Power: 13 Watts into a 4 ohm load. 7.4 Watts into an 8 ohm load.

## *Installation*

When done correctly we are confident that RailPro can be installed in most G and O scale locomotives and it will perform as expected. However, installing a RailPro module in your locomotive is done at your own risk. Ring Engineering will not be responsible for any incidental or consequential damages to your equipment or property.

### Step 1 – Remove unneeded circuit boards.

You can remove any circuit board(s) from your locomotive leaving only the motor(s), lights, and speaker(s). The LM-3S-G has all the electronics necessary to run your locomotive motor(s), lights, speaker(s) and no other circuit boards are necessary. Locomotives may have light boards that have only the lights and dropping resistors on them. In most cases it is wise to keep such light boards with dropping resistors in place.

Some manufacturers have a special circuit board for the smoke unit and that circuit board needs to be kept in the locomotive and properly connected. Connecting a LM-3S-G output directly to a smoke unit that needs a circuit board to protect the smoke unit from burning out, can damage the smoke unit and may become a fire hazard.

### Step 2 – Mount the LM-3S-G in your locomotive.

**IMPORTANT:** Module must be mounted level with the RailPro logo pointing straight up in order for it to have proper heat dissipation. You need to be sure there is 1/8" of space on the four sides of module and a 1/2 inch of space above the module for proper cooling. The module can be attached with double face tape to the bottom of the LM-3S-G module.
**TIP:** If the auto set for the Motor Full Load current is set up to less than 1500mA you can mount the module in any orientation.

**TIP:** Mounting the module higher in the locomotive and away from metal parts may extend its radio range.

**Step 3 – Connect the motor(s) per the included wiring diagram.**
See page 7 for wiring diagram.
**IMPORTANT:** Only attach wires to the screw terminals that are between 18 and 26 AWG.
**IMPORTANT:** You should solder the ends of any stranded wires to prevent a strand from getting into an adjacent screw terminal and causing a short.

**Step 4 – Connect the lights per the included wiring diagram.**
**IMPORTANT:** If your light bulbs are LEDs or low voltage bulbs you will need to be sure to add the dropping resistors as shown in the wiring diagram for low voltage lights.

If your lights need resistors and you do not include them, you can damage your lights.
**IMPORTANT:** It is best to connect any lights to the five volt source. Many G scale locomotives have light boards that are designed for five volts. Ask your locomotive manufacturer what voltage is required for their lights.
**TIP:** You do not need the resistors if your lights are five volt lights.
**TIP:** You can remove any unused wires from the nine pin connector by lifting the keeper on the connector and sliding the wire out of the connector. It is wise to keep the wires and if you need them later you can slide the wires back into the connector.

## Step 5 – Connect the speaker(s) per the included wiring diagram.

An 8 ohm speaker that is rated for less than 7 watts or a 4 ohm speaker that is rated for less than 13 watts may be damaged by the LM-3S-G and could become a fire hazard.

## Step 6 – Connect the power source (Track Power or Battery Power) per the included wiring diagram.

Never connect track pickup and battery power at the same time.
You may use a double pole double throw switch that disconnects the battery power before connecting the track power and vice versa such that when the switch is in one position the LM-3S-G can be battery powered and when the switch is in the other position the LM-3S-G can be track powered.

The voltage of the power source must be less than your locomotive motor rating.

If battery power is used, no more than 5 series connected (5S - 18.5volts) LiPo batteries should be used. No mare than 16 series connected NiMH batteries should be used (19.2 Volts).

## Step 7 – Double check your wiring and be sure every thing is connected properly.

Be sure all the wires are connected to the proper terminals and there are no short circuits.

If this module is wired incorrectly it can cause a fire and can be damaged.

Improperly wired module is not covered under the warranty.

**IMPORTANT:** Check carefully between the screw terminals to be sure all strands of stranded wires are in the correct terminal and no stray strands are accidentally in the adjacent screw terminal. That will cause a short circuit and can damage the module.

### Step 8 – Power up the module.

### Step 9 – Press 'Find Product' on your RailPro controller.


### Step 10 – Go to the locomotive adjustments and in the Name field enter the locomotive road number.

From the "Control Locomotive" page you can press the "Adjust Setups" button (round button on the left side of the screen) to view the "Locomotive Setup" page. As with most RailPro products you can give this product a name and a password from this screen.


**TIP:** Notice the name we gave the locomotive on the page above is 9523 UP. Although you can name your locomotive anything, it is wise to give them good names. You should put the road number first and any letters after the numbers so they sort correctly.
**TIP:** You can leave the password field blank if you do not need password protection. A password can prevent other RailPro controllers from controlling your products.

## Step 11 – Go to the adjustments and use Next Page button until you see 'Motor Full Load Current'.

This is the only setting you should set before using your RailPro equipped locomotive. By setting the motor full load current, you setup the locomotive module to: 1) Allow multiple locomotives to run well when linked together and 2) Allow the module to detect and report motor faults if necessary.


1. On your RailPro controller's Main Page press the “Locomotives” button. Touch the picture of the locomotive to take control of the locomotive.
2. Press the "Adjustments" button (round button on the left side of the screen). Then press “Next Page” button until you see the “Motor Full Load Current” button. Then press the “Motor Full Load Current” Button then press the “Yes” button when it asks to “Use auto set?”
3. Press the “Start Test” button and wait until the test finishes.
4. Press “Exit Page” button and press the “Save” button.

Caution During the test your locomotive will run at full speed and a G locomotive can pull with a lot of force so be prepared to hold on tight.

Caution During the test your locomotive may run at full speed backward. So be prepared for it to go in either direction. If your locomotive runs backward, go into the adjustments and change the motor direction and run the test again.

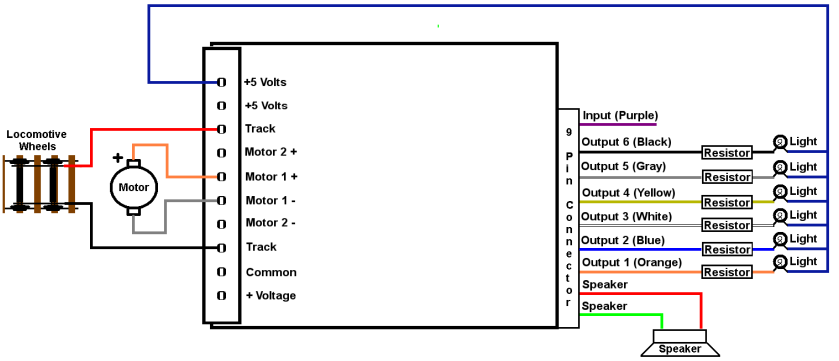
Caution If the 'Motor Full Load Current' sets to above 1500mA the module must be oriented level with the RailPro logo on the module label pointing straight up, and the specified space around the module must be maintained to promote proper heat dissipation. See Step 2 for mounting details.

**IMPORTANT:** If you are using battery power, you need to be sure the battery is always at the same voltage (same amount of charge) before setting the Motor Full Load Current. You can check your battery voltage on the handheld controller locomotive information page. Recommended battery voltage before setting Motor Full Load Current is 12.7 volts for 4 series LiPo and 16.0 volts for 5 series LiPo.

## Step 12 – You can now use your RailPro locomotive.

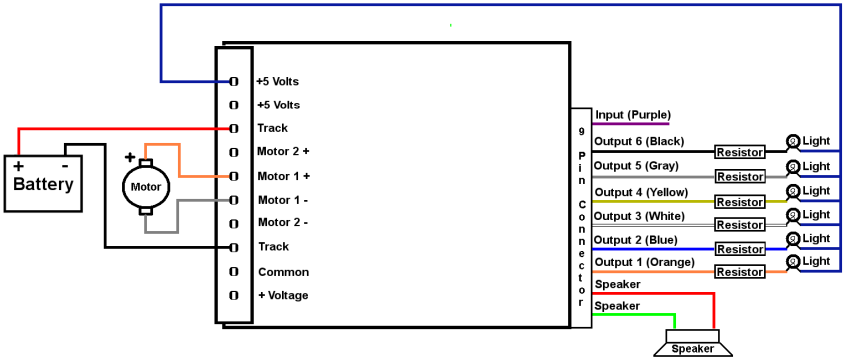
**TIP:** You can customize the locomotive module settings if you want to. You can load a picture of your locomotive, change sounds, light effects, change the user button setup, and much more. Please see the RailPro Assistant user manual (online only www.ringengineering.com/RailProAssistantSoftware.htm) and the RailPro handheld controller user manual for setup details. www.ringengineering.com/HC-2.htm

### Typical Wiring Diagram for a Track Powered Locomotive




**WARNING:** Using LED's without resistors can damage the LED's!
Use 200 Ohm 1/4W for 10mA or 100 Ohm 1/4W for 20mA.
The above resistor values are only correct for a White LED (3 Volt) that is powered by the +5 volt supply.
**WARNING:** If you use the wrong resistor, it is possible to generate enough heat to ignite flammable material, and possibly cause a fire.

### Typical Wiring Diagram for a Battery Powered Locomotive

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The above resistor values are only correct for a White LED (3 Volt) that is powered by the +5 volt supply.
**WARNING:** If you use the wrong resistor, it is possible to generate enough heat to ignite flammable material, and possibly cause a fire.

## *Warranty*

Limited One Year Warranty

Ring Engineering, Inc. (Ring Engineering) warrants that for a period of one year from the date of purchase, this product will be free from defects in material and workmanship. Ring Engineering, at its option, will repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with new or remanufactured product or component. If the product is no longer available, replacement may be made with a similar product of equal or greater value. This is your exclusive warranty.

This warranty is valid for the original retail purchaser from the date of initial retail purchase and is not transferable. Ring Engineering dealers, distributors, or retail stores selling Ring Engineering products do not have the right to alter, modify, or any way change the terms and conditions of this warranty.

The warranty does not cover normal wear of parts or damage resulting from negligent misuse or modification of the product. Further, the warranty does not cover Acts of God, such as fire, flood, hurricanes, and tornadoes.

Ring Engineering shall not be liable for any incidental or consequential damages caused by the breach of any express or implied warranty or condition. Except to the extent prohibited by applicable law, any implied warranty of merchantability or fitness for a particular purpose is limited in duration to the duration of the above warranty. Ring Engineering disclaims all other warranties or conditions, express or implied statutory or otherwise. Some states or jurisdictions do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

> To obtain warranty service contact Ring Engineering at:
> Email: info@ringengineering.com
> or Phone (219) 322-0279
> to get a return authorization and return instructions.

If your Ring Engineering product is not covered by warranty, or has been damaged, an estimate of repair costs or replacement costs will be provided to you for approval prior to servicing or replacement.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.