Mini Commander

Instruction Manual

The Electric Railroad Co.
939 Wood Duck Avenue
Santa Clara, Ca. 95051

Table of Contents

1 Features

Configurable Outputs

The Mini Commander is the only command control receiver that has configurable voltage and pulse durations for controlling your accessories. All selection of the voltage and pulse settings is configured from the CAB-1 controller.

Soft Set Technology™

The Mini Commander has exclusive “Soft Set Technology”; which allows you to change the unit ID (1 - 99) and the voltage/pulse settings without complicated program / run switches or power on / off sequences.

Multiple Command Set

Responds to ACC and ENG commands. The unit is capable of responding to ENG commands for later expansion into accessories with bi-directional motors.

A Built in Antenna

The built in antenna will suffice for many applications. A connector is provided for an extension antenna when the signal exposure to the built in antenna is not sufficient.

Multiple Output Functions

The 4 outputs are capable of pulse, toggle, and strobe functionality. The high current outputs are the most flexible allowing the voltage to be set (2-18v), the output mode (pulse or steady), and while in pulse mode the length of the pulse can be set (0.25 to 2.0 sec). The low current outputs work as on / off outputs at a constant 9v. One low current output is capable of strobe functionality.

2 Tools required for installation

The tools listed below should help to get you organized for the installation. The mini commander is mounted with double stick tape, and therefore the installation can be reversed at a later time if desired.

- Small screwdrivers, Phillips and Slotted
- Small wire cutters
- Small long-nose pliers
- Wire strippers
- Low power soldering iron
- Rosin core solder
- Electrical tape

3 What's supplied

The Mini Commander kit consists of:

- Mini Commander circuit board
- Four (4) wire connectors with leads
- Extension antenna wire
- Configure / Run jumper
- Configure / Run switch
- Two (2) 1N400x diodes
- Two (2) 1uf / 50v caps
- Two (2) small wire ties
- Heat shrink tubing
- Double stick tape
- Manual

4 Overview

The Mini Commander™ was designed for easy installation into any AC 3-Rail operating car or trackside accessory. It measures only 1" wide x 2" long x .5" high in size and will fit in almost any environment you want to add command control operation.

The Mini Commander features four (4) outputs that can be operated from your CAB-1 control. Two outputs are high current outputs. These high current outputs, designated HC1 and HC2, are capable of delivering one-ampere (0.8A) of continuous current. The other two outputs, designated LC1 and LC2, are low current and are capable of delivering one-half ampere (0.4A) of continuous current.

Each of the high current outputs is fully configurable relative to the voltage and pulse length. The output can be also be configured as a level (not pulsing).

The Mini Commander features "Soft Set Technology" to enter the configuration mode. While the use of a configure/run switch is supported and installation is recommended, it is not necessary to use as long as you know the ID of the Mini Commander. The configuration sequence is the same no matter how you enter configuration mode. When used, no programming track or complex power-sequencing requirement is needed to setup your Mini Commander.

5 Mini Commander Operation

The Mini Commander outputs are controlled from the Cab-1 key sequences.

When configured as an accessory (ACC):

- AUX1 controls high current output one (HC1)
- AUX2 controls high current output two (HC2)
- Numbers 1 & 4 control low current one (LC1)
- Numbers 3 & 6 control low current two (LC2)

Pressing the number 1 – which is the same as the "up arrow" on the CAB-1 overlays, activates LC1. Number 4 turns off LC1, shown as the "down arrow" on the Cab-1 overlays.

Output LC2 is unique in that it has a strobe feature. Normally numbers 3 and 6 control the output (with 3 being on, and 6 being off). To active the strobe feature you use number 9 to turn on the output. Number 6 is always used to turn off the output. Number 9, as you may recall, is the strobe on for the engines equipped with strobe lights.

When configured as a switch (SW):

- AUX1 controls high current output one (HC1)
- AUX2 controls high current output two (HC2)
- When set to "through" (AUX1 pressed), LC1 is on
- When set to "out" (AUX2 pressed), LC2 is on

In this mode of operation, LC1 and LC2 are state-full, and are returned to their previous setting after power cycling.

Operation continued

When configured as an engine (ENG):

- AUX1 controls high current output one (HC1)
- AUX2 controls high current output two (HC2)
- Numbers 1 & 4 control low current one (LC1)
- Numbers 3 & 6 control low current two (LC2)

Connector P1 will output motor control signals. The motor signals are designed for use on the Gantry Crane. A driver board is required for this application. See the website for details on how to construct the driver.

Perhaps the best reason to use ENG as the class of the accessory is the enabling of the optional RailSounds™ output. To enable the RailSounds output, you must enter AUX1 + 0 after setting the ENG ID.

Sequence:
ENG + ## + SET
AUX1 + 0 - enables sound and couplers

When this is entered, the P1 connector pin 1 will now output RailSounds information. The F and R coupler buttons on the Cab-1 will now control the HC1 and HC2 outputs respectively. Configuration of the HC1 and HC2 outputs are still under the AUX1 and AUX2 key sequences when in configuration mode.

This configuration allows adding a sound system and electro-couplers to rolling stock or a dummy engine. To return to Gantry Crane operation, simply reconfigure the ENG + ## + SET without the AUX + 0 sequence.

* RailSounds and electro-couplers are the trademark of Lionel LLC.

6 Soft Set Technology

The use of Soft Set technology will allow you to configure the ID and voltage and pulse settings without operating the configure/run switch. While operating the configure/run switch is supported and even necessary at times (forgotten ID); the configuration sequence is entered the same when you use Soft Set or the configure/run switch.

To enter Soft Set, you must know the current ID of your Mini Commander. When shipped, the setting is accessory (ACC) one (1). Enter Soft Set by pressing ACC + 1, then the "SET" key 5 times minimum, with a one second pause between presses. When a lamp is connected to the Mini Commander on LC1, it will start to flash. If the device attached to the Mini Commander is running, it will stop. This is your feedback that you have entered Soft Set. Typically 5 presses of "SET" will be sufficient, but if you have no feedback, simply pressing "SET" a few extra times will insure you have indeed entered Soft Set.

To leave Soft Set, you must not press any Cab-1 key for six (6) seconds. This also means you need to complete a key press every six (6) seconds to keep the Mini Commander in configure mode.

Plan your keypad sequence in advance, and you will have ample time to configure the Mini Commander. Once you master the Soft Set capability, we believe you will tend to use it to do configuration.

If this seems cumbersome, simply fall back to placing the jumper on or switching the configure/run switch to "configure" to complete any configuration needed.

7 Mini Commander Configuration

When configuring the Mini Commander, the sequence of keys pressed determines the voltages and pulses (or levels) applied to the outputs HC1 and HC2.

Configuration consists of setting the "class" (ACC or ENG), the ID (1 - 99), and the voltage and pulse durations. When configured as ENG, the P1 connector outputs the PWM signals (for motor operation) and Rail-Sounds signals. This is for future expansion, and will be used to operate Gantry Cranes or controlling Rail-Sounds cards.

When you are in the configuration mode, the key presses sequence the Mini Commander's internal state machine to store your selections. Prior to pressing the "SET" key, the class and ID must be pressed. If you start the configuration by using ACC class, the Mini Commander will respond to ACC commands.

Once you have pressed the "SET" key, the class and ID are stored into non-volatile storage for operating mode. Next the outputs selections are optionally configured.

To configure the outputs HC1 and HC2, controlled by AUX1 and AUX2 respectively, first press AUX1 or AUX2. This instructs the Mini Commander to receive and store the next sequence for HC1 or HC2.

The voltage is the first parameter to set, so press 1 to 9 next. The number pressed is multiplied by 2 and stored to configure a setting of 2v to 18v (approximately) on the output when activated.

Configuration continued

This is followed by BOOST or BRAKE. Boost sets the toggle mode of operation. When operating in toggle mode, the output toggles to the opposite state that it was in, thus on toggles to off; and off toggles to on.

If BRAKE was pressed, you must enter a number from 1 to 8 next. This number is multiplied by 0.25 second to set the output pulse length. This yields a pulse minimum length of 0.25 second to a maximum length of 2.0 seconds.

While this may seem complex at first glance, if you make a mistake it is easy to recover. Simply press "SET" at any time during the sequence and the internal state machine is reset and ready receive the voltage and pulse selections again from the beginning of the AUX key sequence.

NOTE: While in **operation**, the keypad is sampled by the Mini commander every 0.5 second maximum. This de-bounces your key presses. If you hold down the activation key (AUX1 or AUX2); the output will re-trigger every one-half second. If the configured pulse length exceeds the re-trigger time; the output will stay on as long as you hold the activation button.

Example configuration sequences:

Example 1:
ACC + 22 + SET
AUX1 + 5 + BRAKE + 4
AUX2 + 6 + BOOST

On ACC 22, AUX1 will deliver a one second pulse on HC1 at 10v when pressed. AUX2 will deliver a 12v level on HC2 that will toggle state on each press of the AUX2 key.

Example 2:
ENG + 5 + SET
AUX1 + 7 + BRAKE + 3
AUX2 + 9 + BRAKE + 8

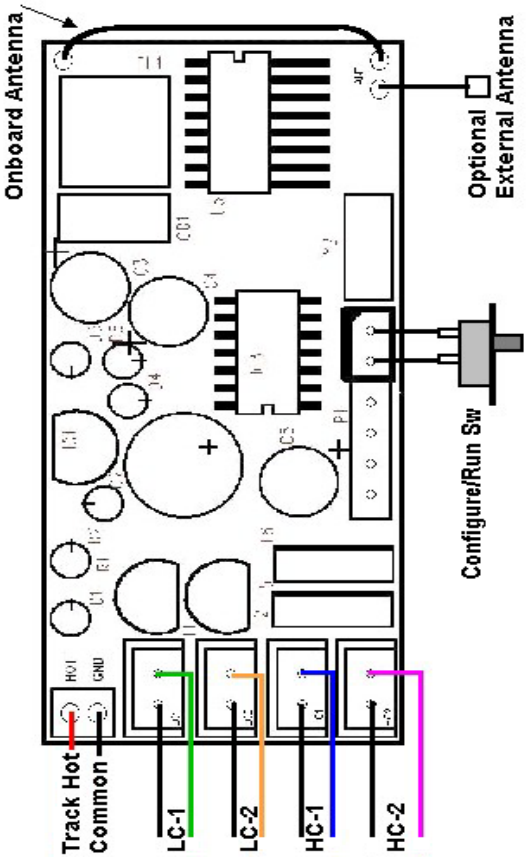
ENG 5 will be controlled. The AUX1 output will deliver a pulse of 14v for 0.75 second. While AUX2 key presses will deliver a pulse of 18v for 2.0 seconds.

Example 3:
ENG + 42 + SET
AUX1 + 0

ENG 42 will be controlled, with the RailSounds signal data delivered to Pin 1 of P1, and AUX1 / AUX2 will deliver a pulses to control coil couplers activated by “F” and “R” respectively.

8 Connections

While reading through the following installation section, refer to the below diagram for connections.



Connections continued

Primary connections to the Mini Commander are power, the four (4) outputs to the controlled device, and optional antenna.

Connector	Usage	Ratings
Hot/Com	AC power connection	12 to 20 VAC
LC1	Low Current 1 output, controlled by 1-4 keys	400ma continuous 800ma peak
LC2	Low Current 2 output, controlled by 3-6-9 keys	400ma continuous 800ma peak
HC1	High Current 1 output, controlled from AUX1	800ma continuous 1.6 amp peak
HC2	High Current 2 output, controlled from AUX2	800ma continuous 1.6 amp peak
ANT	Optional Antenna	6 to 10 inch wire
P1 1&2	Configure / Run switch	Close to Configure

P1 Connector pin out details	
Pin 1	Motor Select (Gantry Crane*) or RailSounds signal
Pin 2	Ground (Do not connect motor common to this pin)
Pin 3	Regulated 5v for opto-isolators (50ma max)
Pin 4	Motor PWM for reverse drive
Pin 5	Motor PWM for forward drive
Pin 6	Programming pin (VPP)

A minimum amount of skill is required in some installations. If you feel that you need help, refer the installation to your dealer or directly to us. If needed, we can be reached at support@electricrr.com for technical advice.

* See website for schematic details

9 Starting your installation

Please take time to plan out your installation. This is especially true with rolling stock. Since there are so many different products and manufacturers of accessories and rolling stock, it is impossible to describe an exact installation procedure in each case. For the most part however, there will be common areas to all installations. Before you begin, examine the wiring already present in the accessory or rolling stock – taking notes or digital pictures for reference is a good idea.

The installation will involve connecting the Mini commander to the various motors and / or lighting to be controlled. Motors include vibration, can, and solenoid types. For example, coil couplers are a form of motor, with linear actuation. You will want to connect the motor(s) to the high current outputs (HC1 or HC2).

Lighting is best connected to the LC1 output. Any strobe lighting is best connected to the LC2 output. Typically strobe lamps are 12 volts, and may be directly connected to the Mini Commander.

In some instances the lamps will be lower voltage, or perhaps LED's. If so, they usually have voltage-limiting circuitry present. It is possible to activate these voltage-limiting circuits from the Mini Commander, however in many cases you may remove them and add a series resistor and a diode to save space. The diode polarity is dependent on the output selected (LC1 or LC2), please see the website for details.

Installation continued

Trackside Accessories:

Installation into trackside accessories is usually a fast procedure. If the base is non-metal, the built in antenna usually works fine when you locate the Mini Commander close to the track underneath the accessory.

Place the accessory on a clean, level work surface. Position the Mini Commander with the antenna loop parallel and as close as you can to the track. If the antenna is father away than a few inches, connect the antenna extension to the Mini Commander at terminal ANT and route the antenna wire parallel to the track underneath along the front of the accessory. Once you meet these criteria, attach the Mini Commander to the bottom by using the supplied double-sided tape.

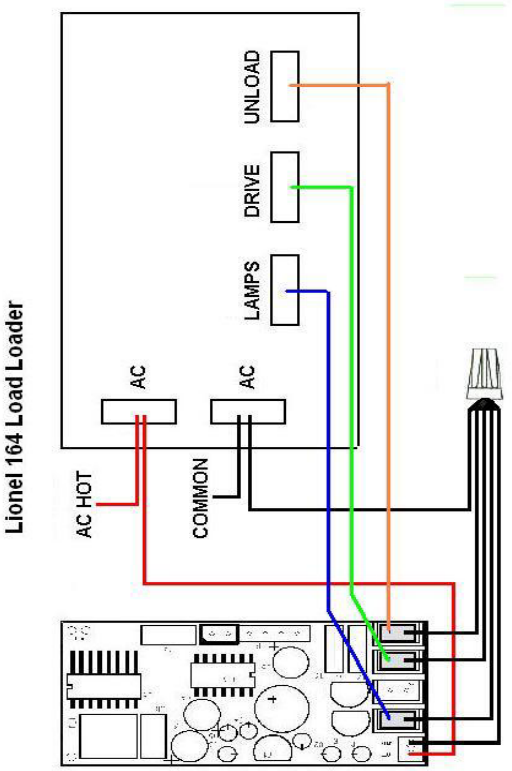
In accessories where access is open to the Mini Commander, the configure/run switch can be as simple as the supplied jumper. Installing the jumper on P1 as indicated on the Mini Commander silk screen will place the Mini Commander in configure mode. Simply place the jumper on a single pin to store when not in configure mode. Id needed, you may use the supplied switch, mounting it in a location for easy access.

The output connections are color-coded; the black wires are the commons. The white wires are the driver outputs. Care should be given to make certain the driver outputs are not shorted to commons or the Mini Commander will be permanently damaged.

Installation continued

The following example shows the typical connections for a model 164 log loader trackside accessory. Using this as a guide, it should be possible to adapt your particular accessory to operate from the Mini Commander.

Check our website often for more details on accessories we have upgraded.



Installation continued

Operating Rolling Stock:

Installation into rolling stock is the most complex use of the Mini Commander. In some cases, it is fairly straight forward, in others - it is a major "operation".

When the operating car is controlled from an "operating track"; the power pickup needs modified. The car works by the voltage delivered from two pickup shoes that contact special rails on the "operating track". To allow these cars to operate under Command Control, a power collector needs to be installed into the trucks. These are available from many part places on the Internet, and are fairly simple to install. One such vendor for the power collectors is Mike's Trains, www.mikestrains.com. The collectors come with and without couplers; so be sure to get the correct style when ordering.

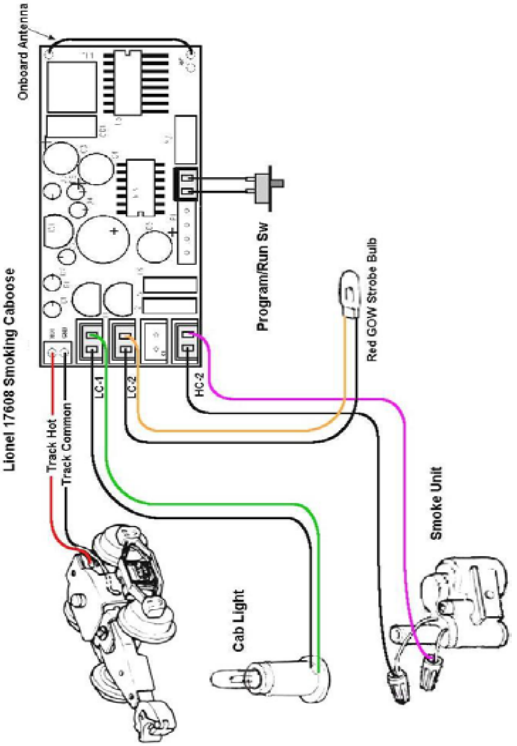
To begin, remove the body as applicable and set aside where it cannot be damaged. Remove all exposed lamp bulbs so they do not get broken during the installation. Place the chassis on a clean, level work surface. If any wires are attached to the shell, typically there are wire-nuts that release the connections.

The first task it to locate the Mini Commander on the chassis that allows the body to fit on re-assembly. Also pay particular attention to the Mini commander antenna location, which needs to be away from the motors as far as possible and not be shielded in metal. If the antenna is shielded in metal, an extension antenna connected to the ANT terminal is required. On some operating cars, the antenna will need to be installed with creativity. For example, on the log dump car, one can fashion a "flag" out of stiff insulated wire that is really the antenna.

Installation continued

The following example shows the connections for a model 17608 C&O Caboose operating car. Using this as a guide, it should be possible to adapt your particular operating car to operate from the Mini Commander.

Start with operating cars that are easier to modify, and as you are more familiar with the Mini Commander, the more complex cars will upgrade to command control easier! Check our website often for more details on cars we have upgraded.



10 General installation notes

Since the Trainmaster system operates on a constant track voltage of 18 volts, the low current outputs will deliver half wave-rectified voltage of 9 volts. Most lamps are 12v or 14v and will be directly connected to the Mini commander. If the bulbs are 1.5v, install a series-dropping resistor rated at 330ohm - ½ watt. For other voltage bulbs, use the formula below to calculate the value of the resistor:

$$R = (18-V) / I$$

Where:

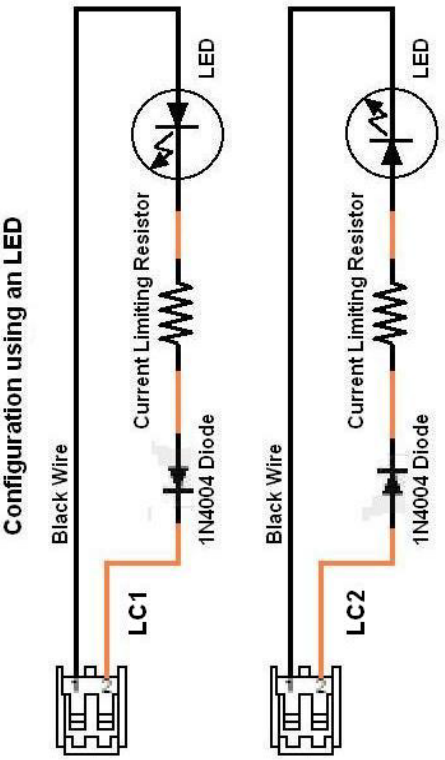
R = the value of the resistor in ohms
V = the lamp rated voltage
I = lamp current

As a rule, lower voltage bulbs have large operating currents. For example 1.5V bulbs require about 50mA for rated brightness. For a 6V bulb, the operating current is less, about 12mA. Keep this in mind when calculating the appropriate resistor values to sanity check your calculation.

When operating smoke units, it is recommended to use one of the high current outputs. If the resistance of the smoke unit is less than 30 ohms, you should replace it, preferably to a modern type designed to use liquid smoke fluid.

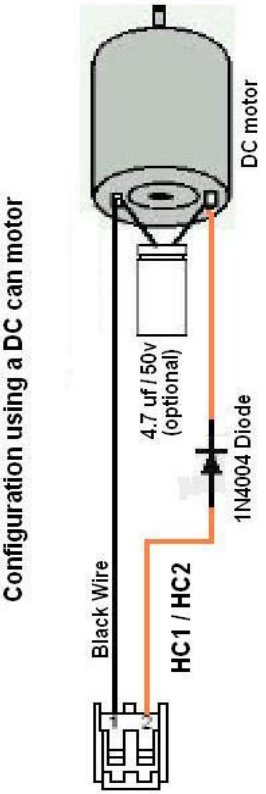
General installation continued

For LED's to be driven from the LC1 or LC2 output, you will need to add resistor in series with the LED to limit its current and a series diode (included) to protect it from damaging peak reverse voltage. The value of the resistor depends on the efficiency of the LED's and the level of brightness desired. A value of about 510 ohms is typical for red LED's. For white LED's a lower resistor value is needed, usually in the range of about 270 ohms.



General installation continued

To connect a DC (can) Motor, you will need to use a diode (included) in series with the Mini commander output. The motor will rotate only one direction in this configuration, and the positive terminal should be identified before assembly. The filter cap on the motor is optional, but recommended for smoother operation of the motor.



11 Configuration

Once installed, the Mini Commander will need to be configured for operation before use. When shipped, the Mini Commander will respond to accessory (ACC) one (1). When power is applied, both HC1 and HC2 will be set to 12 volts delivering a 0.25 second pulse. The LC1 output is on, and the LC2 output is off.

The reason LC1 is defaulted to on at power up is due to the recommendation to connect lamps to this connection. It is felt that accessories or rolling stock illumination would normally be on at power up.

To configure your Mini Commander, you will need to give thought to what voltage and pulse time is required for the high current outputs. Appendix "A" details our recommended settings by accessory. Use this as a guide and adjust the operation to your environment.

For example to operate the model 164 Log Loader, enter configuration mode then press:

ACC + ## + SET (## is your desired accessory ID)
AUX1 + 4 + BOOST
AUX2 + 8 + BRAKE + 4

This configures HC1 (activated by AUX1) to 8v with a toggle mode of operation. Each time AUX1 is pressed, the drive motor will change state. HC2 (activated by AUX2) is configured for a 16v pulse that lasts for one (1) second. When AUX2 is pressed the logs will dump, and the dump motor will reset after one (1) second passes.

Configuration continued

Typical applications for rolling stock are cabooses with smoke, lighting, and strobes. The Mini commander supports a strobe lamp on output LC2. It is suggested to use HC2 for the smoke unit. In this fashion, the AUX1 key is only used to shift the keypad for controlling the lighting. To configure the Mini Commander for a typical caboose, enter configuration mode and press:

ACC + ## + SET (## is your desired accessory ID)
AUX2 + 6 + BOOST

This configures the HC2 output to deliver 12v to the smoke unit. If this does not produce enough smoke, you can increase the voltage by re-configuring the output to a higher voltage. To change the voltage, do the following:

- Select the caboose
- Confirm operation
- Press SET 5 times (illumination flashes)
- Press AUX2 + 7 + BOOST
- Wait for illumination lap to stop flashing (6 secs)

Notice it is not required to enter the ACC + ## + SET again. Once you have the device selected, and configuration changes are automatically applied to the Mini Commander on the correct ID.

12 Configuration Summary

To Enter Soft Set Technology™ Configuration mode
Class (ACC or ENG) + **Number** (ID) + **SET** key Five Times

To set Class and ID Number
ACC or **SW** or **ENG** + **Number** (up to 2 digits)

To set Output Voltage and Pulse lengths	
	+ **Number** sets HC-1's **Voltage**
	+ **Number** sets HC-2's **Voltage**
	Sets selected mode to **Toggle**
	Sets selected mode to **Pulse** + **Number** sets **Pulse Length**

13 Recommended Settings

The following accessories and operating cars listed have been tested. Please check our website for pictures and updates.

Accessory Configuration Settings (18v supply)	
Lionel 164 Log Loader	AUX1 + 3 + BOOST AUX2 + 8 + BRAKE + 3
Lionel 464 Saw Mill	AUX1 + 4 + BOOST
Lionel 445 Switch Tower	AUX1 + 5 + BRAKE + 6
Lionel 24134 Gantry Crane	AUX1 + 7 + BOOST

Operating Car Configuration Settings (18v track)	
Lionel 3461 Log Dump Car	AUX1 + 4 + BRAKE + 2
Lionel 3469 Dump Car	AUX1 + 5 + BRAKE + 2
Lionel 3444 Cop and Hobo Car	AUX1 + 7 + BOOST

Warnings:

- Under no circumstances configure a vibration motor above 7 + BOOST (14v). Check for overheating on the Mini commander card after installation on a vibration motor.

- Always test for overheating of the Mini Commander after installation; excessive back EMF or excessive current will cause the Mini Commander to heat up. Be careful, things heat up pretty fast and get very hot when there is a problem. Run for about 5 seconds, check. Run for a couple minutes, and check again.

- **DO NOT** connect to AC motors with field coils, only use DC can-style motors on the HC1 or 2 output.

14 Troubleshooting

- A rapid alternating flashing of the LC1 and LC2 outputs indicates TMCC signal loss. When the TMCC signal is restored, the Mini Commander will reset and resume operation.

- When in Configuration Mode, the LC1 output will flash slowly (about once per second). This occurs during Soft Set or when setting the "Cfg/Run" switch to Configuration. When no lamp is connected to LC1, simply press the SET key a few additional times to be sure Soft Set was activated.

- LED polarity is important when connecting to the LC1 and LC2 outputs. If the LED fails to light, try reversing the LED and series diode.

- The Mini Commander has built in snubbers on each output. Each snubber is a 0.1uf / 100v capacitor. In some high inductance applications, this will not be sufficient. If a high inductance load is attached, a 1.0uf / 50 v NPO capacitor may be added across the load. The need for the additional 1.0uf capacitor is indicated when the attached coil motor cannot be turned off as expected. For example: the Dump Car needs the capacitor, and is indicated by the dump operation continuing after the CAB-1 key is released.

15 Limited Warranty

The Electric Railroad Company warrants to the original consumer purchaser that this product will be free of defects in materials and workmanship for a period of 90 days from the date of original purchase. This warranty does not cover service, repair, or replacement to correct any damage caused by improper installation, improper connection, external electrical fault, accident, disaster, misuse, abuse, or modifications to the product. All other express or implied warranties, including the implied warranty of merchantability and fitness for a particular purpose, are hereby disclaimed. If this product is not in good working order as warranted, the sole and exclusive remedy shall be repair or replacement. In no event shall The Electric Railroad Company, or any dealer, distributor, or authorized installation and/or repair service provider be liable for any damages in excess of the purchase price of the product. This limitation applies to damages of any kind, including but not limited to, direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages whether for breach of contract, tort or otherwise, or whether arising out of the use of or inability to use the product, even if The Electric Railroad Company, or any dealer, distributor, or service provider has been advised of the possibility of such damages or any claim by any other party. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. During this warranty period, the product will either be repaired or replaced (at our option) without charge to the purchaser, when returned either to the dealer with proof of the date of purchase or directly to The Electric Railroad company when returned prepaid and insured with proof of date of purchase. Some states do not allow limitations on how long an implied warranty lasts, so such limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

16 Repairs

Each and every product is thoroughly tested before it is shipped. The likelihood that it is not working when it reaches you is very small. However, if after troubleshooting it yourself you cannot get it to work properly, you should contact us to help determine the problem.

Should your product ever need repair, you should return it postpaid directly to The Electric Railroad Company. If the product is within the warranty period, it will be repaired or replaced and returned to you free of charge. Units out of warranty will be repaired or replaced for a service charge of $25.

Please email to support@electricrr.com for return authorization before returning any product.

17 Disclaimer

Improper installation or configuration of the Mini Commander can cause overheating and fires! Since it is not possible to understand every installation, it is the consumer's responsibility to verify proper operation of the Mini Commander to prevent malfunction. If you are unsure of your planned installation's compatibility, please contact us first before taking any risks!