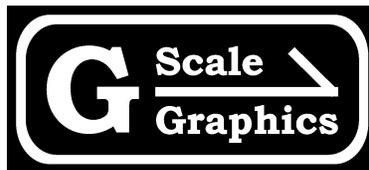
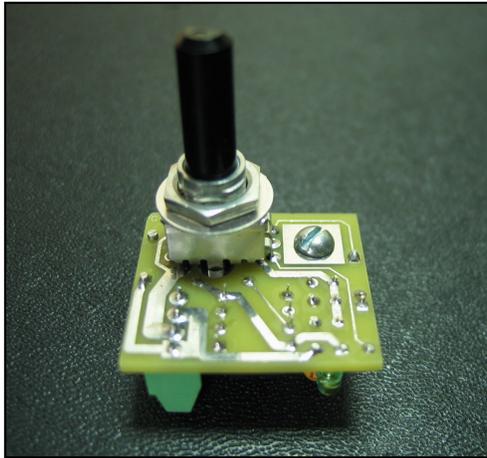


Simple Critter Control

Operation and Installation Manual



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Overview

The Simple Critter Control provides manually adjustable speed control for your battery powered critter or large scale locomotive. It is a very cost effective way to enjoy continuous running. Four connections; battery power in, motor power out, with a built-in speed knob. It doesn't get much simpler than that.

The Simple Critter Control is also an easy way to control a 2nd train on your layout. Speed is readily adjustable, so just set it close to that of your other train, then run it at a fixed speed while you control the primary train using your power-pack or radio control as needed to keep them separated.

The 5 amp motor driver is large enough to handle most locomotives pulling a full train, yet the board is small enough to fit in most "Critters". The single turn speed adjustment controls speed from 0 to 100%. This design extends battery life significantly over just using a rheostat or potentiometer to control motor current.

The Simple Critter Control consists of a small circuit board (1.0" X 1.1" X 0.5") with a built-in speed adjustment potentiometer located on the back side of the board. This allows you to conceal the board in the roof of your loco with the shaft of the speed pot protruding through the roof for easy access. The shaft can be shortened, if desired, and is easily disguised as a smoke stack or vent. You can also floor mount it with the adjustment under the critter.

Note: To complete your battery power conversion, in addition to the Critter Control, you will also need to provide a power on/off switch, battery pack, and a battery charger. You may also want to add a direction reversal switch and a charging jack.

Installation

Track Power to Battery Power Conversion

All track powered locomotives are very simple, electrically. Track power is picked up from the rails via pickups and usually connected directly to the motor. Sometimes there are switches in the circuit to reverse polarity or turn off track power. These connections need to be modified in order to properly connect the battery powered driver board.

Converting to battery power consists of these basic steps.

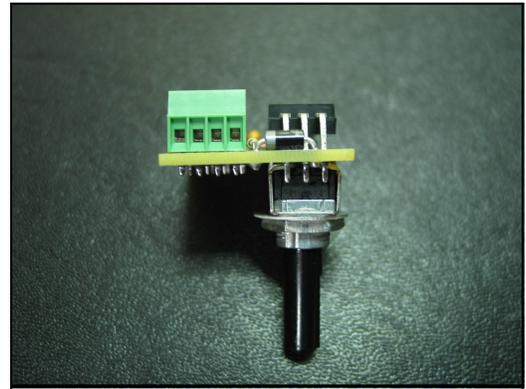
1. Determine battery voltage requirements.

Before you disturb any wiring, run your locomotive at the fastest speed you like to run on your layout and measure the track voltage. Add at least one volt to this measurement to account for worst case loss in the driver. Round this value up to the nearest 1.2v increment, and you have the number of cells you need.

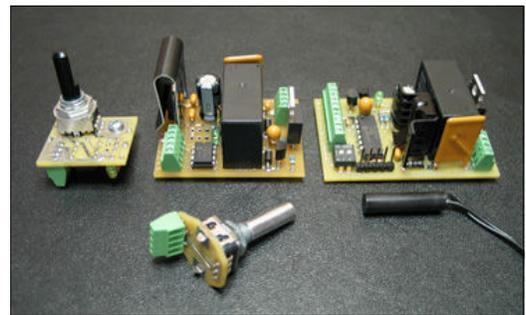
For example: Track voltage measures 12.6V at speed. $(12.6 + 1) / 1.2 = 11.3$. You will need at least 12 cells. $12 \times 1.2V = 14.4V$. (14.4V is a popular value for steam locomotives. Many critters can run on 12V. Diesels usually require 18V or more).

2. Disconnect the track power pickups.

By isolating your locomotive from track power, you can run more than one locomotive on the same track at the same time, either battery powered or track powered. If you don't do this, your battery will be directly connected to your track power supply, resulting in damage. Note that in doing this, you have also removed power from all lighting circuits, smoke units, and any other accessories that were running from track power. For battery power, smoke units are usually not used due to the high current requirements that will quickly drain the battery pack. Lights, depending on current requirements can be powered from the battery for constant light-



The speed adjustment of the Simple Critter Control protrudes from the roof or floor of your loco.



Critter Controls - Relative size left to right: Simple (1"), Basic (1 7/8"), Enhanced (2 1/4")

ing. Understanding existing wiring and/or circuit boards without documentation can be difficult. You may choose to just remove it all and wire directly to things you can see and understand.

3. Find a direct connection to the motor.

The output of the controller needs to be connected directly to the motor. All other control boards and switches should be removed from the circuit. Depending on the design of the locomotive, this may be an extremely simple process, or it may be difficult. Some motor blocks make it very simple. You will find two pairs of wires. One set goes to the track pickups, and the other goes to the motor. You can verify which pair goes to the track pickups using a continuity checker or ohmmeter. Track pickups will have continuity from one pin to one set of wheels. The motor will read a small resistance value across the two wires (e.g. 18 ohms). Simply disconnect the track pickup pair and connect the motor pair to the controller.

4. Install the discrete components and wire them together (battery pack, power on/off switch, charging jack, controller, and lights)

Installing the new components is a packaging exercise. Where will it all fit? Space for the battery pack and control board is usually the biggest consideration. And, where to locate the switches so they are accessible?

Wiring

Always use stranded wire and tin the ends with solder prior to making any connections. Wiring for the control inputs at terminals 1 thru 5 can be smaller gauge wire (26 Ga.). Wiring for the power input and motor output circuitry on terminals 6 thru 9 needs to be heavier gauge wire (20 or 22 Ga.) Any wiring connections or splices not directly connected to a component must be covered. Use heat shrink tubing or wire nuts.

Skills

All connections to the Critter Control can be made via screw terminals. However, basic wiring and soldering skills are required to make proper connections to the power on/off switch, reversing switch, and charging jack. Some drilling and minor fabrication or modifications to the unit under conversion may also be required.

Tools & Materials

A low wattage soldering iron, side cutters, needle-nose pliers, wire strippers, a 1/16" or 5/64" slotted screwdriver, resin core solder, 26 and/or 22 Ga. Wire, and heat shrink tubing are recommended to properly complete the wiring. A suitable drill, double-sided foam tape, and silicone adhesive may be useful for mounting components.

Installation of the Critter Control Board

The Simple Critter Control board is designed for mounting on the underside of the loco roof with the speed adjustment shaft protruding through the roof for easy access. The lock nut on the speed adjustment will secure the board to the mounting surface. It can be mounted most anywhere, but allow space for access to wiring, and no metal should be in contact with the board. The power component (large metal tab) will get hot, so keep it out of direct contact with plastic.

The speed pot is designed to accept a radio knob using a set screw. A false smoke stack or vent can be fabricated to act as the knob. The shaft can also be shortened. Wiring connections are made via screw terminals. Drill a 17/64" hole to clear the threads on the shaft, 1/4" for the shaft.

Handle the board by the edges, avoiding direct contact with the circuitry. Static electricity can damage the components. Try to ground yourself by touching something metal prior to handling the board. Refer to the wiring diagrams at the end of this manual.

Power Input (Battery)

The Critter Control will not function below 7v input at terminals 1(+), 2(-). Reverse polarity will cause damage. Voltage in excess of 20V will also cause damage. Battery packs of 7 to 13 cells are suitable (nominal 8.4 to 15.6V). A 13 cell pack can charge up to 19.5V. A 7 cell pack can discharge to 7.0V. If you want to use of a 7.2V (6 cell) battery pack, a 6 to 19 V power supply input range is available on request.

When making wiring connections to the battery pack, use extreme caution to avoid shorting the leads together. Do not connect the battery to the circuit until all other wiring has been completed. The battery pack should have a quick disconnect connector for safety and ease of replacement.

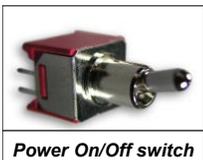
Warning ! Connecting the power input backwards will cause damage!

**Make sure terminal 1 is positive (+) and terminal 2 is negative (-).
This product is not intended for track power applications where polarity reverses.**

The power on/off switch can be located on the floor under the loco. If you have a critter, the charging jack can also be floor mounted, since you will probably take it off the track for charging. For a full size locomotive and/or tender, you may want to locate the charging jack on the end of the car to enable charging in place on the track. The switch in the charging jack isolates the battery from all other electronics when a jack is plugged in, regardless of the position of the power on/off switch.

Motor Output

Connect directly to the motor. All other unknown circuitry should be disconnected from the motor. You can use this output to power both the motor and incandescent lights. However, light intensity will vary with motor speed. For constant lighting, power Incandescent lamps directly from the battery. A maximum of 5 amps continuous current is available from the board. *Warning! At 5 amps the power transistor on the board (metal tab) will be extremely hot. Enough to burn you if touched, or melt any plastic it comes in contact with.*



Power On/Off switch

Switch Connections

Refer to the wiring diagram at the end of this manual for connections to all switches and charging jack.



Charging Jack

Testing

If you are having problems, and you have a volt-ohm meter, take the measurements indicated below.

Power-up

Check the voltage and polarity at terminals 1+, 2-. It should measure between +7.0 and +20.0 VDC. The green LED on the Critter Control board will be lit when power is applied with the proper polarity.

Measure the DC voltage at the motor output, M,M (3+, 4-). It should vary between 0 and battery input voltage, as the speed adjustment pot is rotated 300 degrees from full counterclockwise to full clockwise.

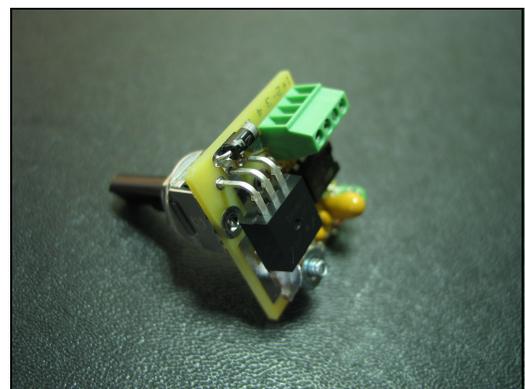
Manual Operation

Apply power to the board using the external battery on/off switch. The green LED on the board will illuminate when power is applied.

The motor will immediately start running at whatever speed the speed adjustment potentiometer is set for. Speed will vary from 0 to 100% of battery voltage as the pot is rotated CW.

Current draw with speed setting full CCW (counter clock wise) is less than 20 ma, or essentially "off". However, when not running your loco, you should turn off battery power with a separate switch to avoid draining the battery.

Running direction may be reversed through the use of an optional reversing switch (a cross wired DPDT switch). See wiring diagram on the next page.



Simple Critter Control - A small solution for simple battery power.

Simple Critter Control Specifications

Board Revision "A"

Mechanical

Physical Size: PCB – 1.0" X 1.1" X 0.5" (excluding speed pot)

Plastic shaft on the speed pot is 0.75" long, can be shortened as needed.

Weight: 0.4oz.

Bulkhead mounting: Circuit board will hang down a total of 0.7" from roof of loco.

User Connections: Screw clamp terminal strips accept individual wires, 30 to 20 AWG.

Requires a 1/16" or 5/64" slotted screwdriver

Electrical

Power Input from battery pack (Terminals +,- or 1+,2-) **Warning! Reverse polarity will cause damage!**

7.0V min to 20.0V max (7-13 cell battery packs)

6.0V min to 18.0V max (6-12 cell battery packs) - Available on request

Power Consumption (due to board, no motor load, speed setting full CCW): < 20 ma (18V supply)

Motor Output (Terminals M,M or 3,4)

Forward direction only. Optional reverse direction using external DPDT switch.

5 amps max, continuous

PWM (Pulse Width Modulated)

Max amplitude: Battery voltage minus driver loss

Typical voltage loss across driver: 0.1V @14.4V, 1A: 0.3V @24.0V, 2.5A.

Control

Single turn rotary speed setting potentiometer, 0 to 100% of input voltage, CCW to CW, 300 degs

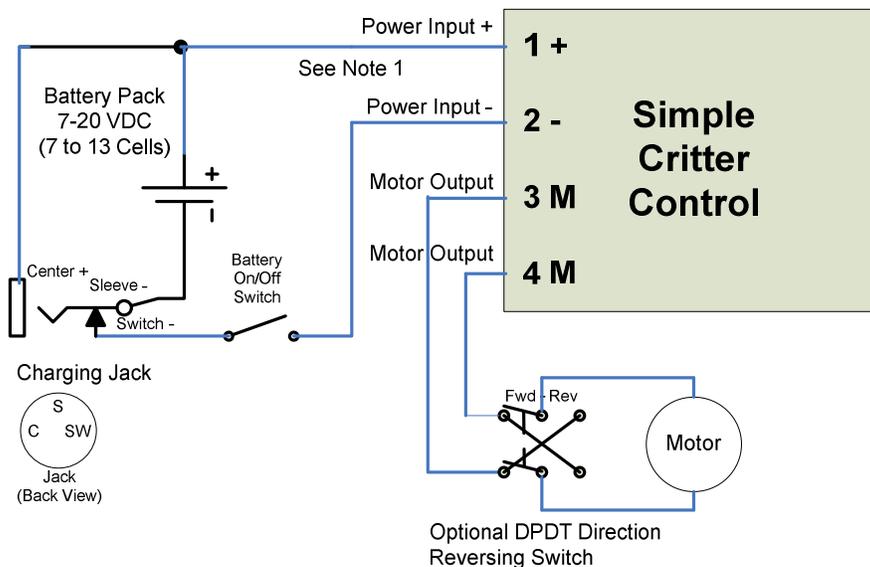
Battery Power Accessories (available from G-Scale Graphics)

Power On/Off Switch: Sub-Miniature w/short handle, SPDT (On-On), 3A, 28 VDC

Charging Jack: 2.5mm, 5A, w/switch

Battery Conversion Module (on/off switch, charging jack, LED, power distribution; all on one PCB)

Simple Critter Control Wiring Diagram



Note

1) Reverse polarity at terminals 1 and 2 WILL damage control.