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## GRADE CROSSING CONTROLLER with BELL SOUND

CAUTION-THIS DEVICE CAN BE DAMAGED BY STATIC DISCHARGE. PLEASE EXERCISE CARE DURING INSTALLATION TO AVOID THIS POSSIBILITY.

PLEASE READ INSTRUCTION SHEET COMPLETELY BEFORE ATTEMPTING TO INSTALL AND OPERATE THIS PRODUCT.

**OVERVIEW:** The GRADE CROSSING CONTROLLER with bell sound features full synchronization of the crossbuck lights and bell with four user selectable rates including either simultaneous or delayed bell. The controller is powered by 14-20 Volts AC and can be turned on either manually with a switch or automatically with its built in detection circuitry. An "on" output is available to drive a coil or relay for crossing gate operation and an additional output simulates a warming fire in a can or stove for the gate operator. These two outputs can also be switched to momentary drives to activate a twin coil solenoid. A three inch speaker is included. The volume is user adjustable.

**INITIAL CONNECTION INSTRUCTIONS:** The GRADE CROSSING CONTROLLER is completely assembled, except for the speaker, on a 5.75 X 2.75 inch circuit board which has standoffs at the four corners for easy mounting. Viewing the circuit board with the terminal connectors to the left, note the two pin connector labeled "SPKR" and the potentiometer labeled "VOL" along the lower edge. At the upper middle of the circuit board is a "SENSE COIL" with a hole in its center which is used in the automatic detection circuit. Wiring for the automatic detection circuit is accomplished by insulating a section of rail with gaps, fibre pins or plastic rail joiners. In three rail applications it is suggested that the center rail be used for simplicity. This insulated rail section is now electrically dead and must receive power from an additional wire attached to the power source or to the adjacent rail sections. This additional wire must be passed through the hole in the "SENSE COIL" before being attached to the insulated rail section. See drawing on page 3. The supplied speaker needs to be mounted in an enclosure for proper sound. The least of all would be a styrofoam cup. A 3" hole could also be made a long the edge of a mountain or skirt to hold the speaker. In some cases it is not necessary to enclose the back of the speaker since the surrounding building / mountain would act as a proper baffle. The speaker has two terminals that need to connect to the flying leads from the two pin connector. Since speakers are mounted at different locations, wire

needs to be soldered to the speaker terminals. This pair of wires then needs to be soldered or connected with wire nuts to the pair of wires from the two pin connector. Make sure that no shorts exist and that no contact can be made to any other object by properly insulating with electrical tape or heatshrink tubing. Any soldering to the board will void any warranty / repairs. All other connections are made at the terminal connectors at the left of the circuit board. Be sure to have all components connected properly before any power is applied to the board! If you missed plugging the speaker into the connector, turn the power off, wait 30 seconds, plug the speaker in and then re-apply power. Failure to do so could cause failure in the audio amplifier. DO NOT unplug and re-plug the speaker connection, or any other connection, while the sound unit is POWERED (ON) - this can damage sensitive components!

Input power can be from 14 to 20 volts AC however it is suggested that you not exceed 16 volts AC particularly if you intend to drive a 12 volt DC relay (such as DALLEE ITEM 555) from the "on" output. The AC input power is connected to terminals labeled "AC" or "6" and "7". The total load of the four outputs must not exceed 4 amperes so you may wish to install a 4 ampere fuse in the input connections as a safety measure. Terminals "1" and "2" are the outputs to the crossbuck lamps (IF USING LIONEL NO. 2760 HIGHWAY FLASHER YOU MUST DISCONNECT THE BUILT IN CIRCUIT AND CONNECT DIRECTLY TO THE LAMPS). Terminal "3" is the "on" output and can be used to drive gates or any type of device that requires an "on" signal. When using this output to drive LIONEL CROSSING GATES we suggest that the gates be used in pairs and wired in series, IE: wire from the output to one coil, then to the second coil and then back to common. Terminal "4" can be connected to a lamp which will flicker simulating a fire. Terminals "3" and "4" can also be used to drive a twin coil solenoid device when the momentary mode is selected. In this mode Terminal "3" will give a momentary output when the controller activates and Terminal "4" is a momentary output when the controller turns off. Terminal "5" or "C" is the common return for the four outputs. Because of the possibility of higher current loads on this terminal it is suggested that a heavier wire be connected to the terminal and all of the common wires from the output devices be soldered or wire nut to this heavier wire. Terminals "6" and "7" as previously mentioned are the AC input connections.

Terminal "8" or "SW" is used only for manual operation of the GRADE CROSSING CONTROLLER. If desired, an on-off switch should be connected between this terminal and the common terminal "5" or "C".

**INSTALLATION & OPERATING INSTRUCTIONS:** In the upper right corner of the circuit board, just below the mounting stand off, you will find a block of four mini-rocker switches which control variations in the operating characteristics of the GRADE CROSSING

CONTROLLER. The upper switch "4" selects the momentary mode in the "on" position and is used where twin coil solenoids must be activated. The next lower switch "3" selects the delayed bell feature. In the "off" position the bell rings simultaneously with lamp illumination. With this switch "on" the bell ring follows the lamp illumination. The remaining two switches "1" and "2" are used to select ring rates. The slowest rate is selected with both switches "off".

Pick your location on the layout and mount the circuit board and the speaker. As information, a styrofoam cup (coffee cup) makes an excellent mounting and sound chamber for the speaker. Connect your AC power (14-20 volts, 16 preferred) to terminals 6 & 7. If manual operation is to be used connect an on-off switch between terminals 5 & 8 or for automatic operation insulate a rail section and wire through the sense coil. Remember that the GRADE CROSSING CONTROLLER will be "on" when ever something (locomotive or lighted car) is drawing current in the insulated rail section. You can adjust how long the controller is "on" by changing the length of the insulated rail section.

With the GRADE CROSSING CONTROLLER "on" the bell will now ring. Use the volume control to set an adequate level for your layout and use the two lower rocker switches to select a ring rate that suits your preference. Remember that as you turn the switches "on" the rate increases. You have a choice of four rates as follows:

- "1" off, "2" off = slowest
- "1" off, "2" on = next
- "1" on, "2" off = next
- "1" on, "2" on = fastest.

Install crossbucks at the crossing and wire the lamps to terminals 1 & 2. Remember that one side of each lamp must be placed in common and connected to terminal 5. If you are using 1.5 volt bulbs you will need to connect a limiting resistor (390 ohm, 1/2 watt - Item #535) in series with the common. If your crossbucks use LED's the plus of the LED goes to common and again limiting resistors are needed. Now you can select either simultaneous or delayed bell ring.

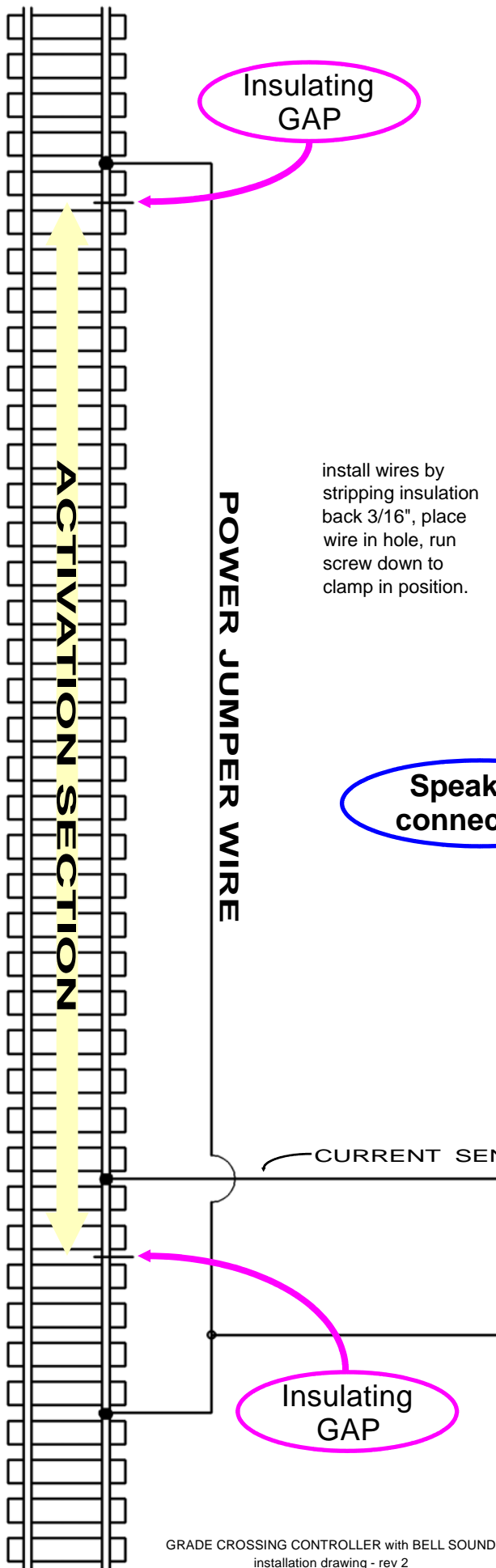
If you also wish to install gates at the crossing you will have to determine how the gates are actuated. Some gates employ a simple coil to pull the gate down with a spring or gravity return. In this case wire one side of the coil to terminal 3 and the other side to common terminal 5. You may be better to use this type of gate in pairs and wire the coils in series as previously mentioned. This may result in improved performance. Some gates are activated by motors which require a DC polarity change to raise the gates. In this situation a DPDT relay (DALLEE ELECTRONICS ITEM 555) can be activated by terminal 3 and the relay contacts wired for polarity reversing. With the relay activated by the GRADE CROSSING CONTROLLER the gate can come down and when the relay is relaxed the polarity to the motor is reversed

allowing the gate to go back up. If your gates are actuated by a twin coil solenoid you must wire the pull down coil to terminal 3 and the push up coil to terminal 4 AND YOU MUST SELECT THE MOMENTARY MODE BY PLACING ROCKER SWITCH #4 TO THE "ON" POSITION. The common of the coils is also wired to common terminal 5.

If you have selected the normal, rather than the momentary mode, and wish to include a fire for the gate operator connect a lamp between terminals 4 & 5. This bulb will flicker simulating a fire and could be installed in a trash barrel or in a stove. This effect works best with lamps that are under powered. To under power a lamp either place a resistor in series with the lamp or use a lamp of higher voltage rating than the applied voltage. Another way to reduce the lamp voltage is to place several in series (either using multiple trash cans or placing them under the layout out of sight). The unit we demonstrate with has two 12 volt grain of wheat lamps connected in series (yields lower intensity and lower heat).

The grain of wheat lamps were coated with red nail polish (rather transparent) then tissue paper was torn to small pieces and dropped into the containers (gives the ash effect). The trash cans were made from cut sections of 35mm film containers, rolled tighter and heated to seal the seam.

**Miscellaneous:** For those requiring precise operation of the GRADE CROSSING CONTROLLER merely add our OPTO-DT detector or use our Trak-DTT's in a lockout configuration. The Trak-DTT application can be found on our web site or in our Model RR Wiring Guide #17 (or higher). To use the OPTO-DT, merely align the infra-red optics and attach it's relay output to the manual switch inputs for activation. (a 12VPS is required for the OPTO-DT)



Insulating GAP

ACTIVATION SECTION

POWER JUMPER WIRE

install wires by stripping insulation back 3/16", place wire in hole, run screw down to clamp in position.

Speaker connector

CURRENT SENSE WIRE

Sense Coil

pass current sense wire through hole in sense coil.

**DO NOT strip the wire !**

CURRENT SENSE WIRE

Insulating GAP

Rocker Switches



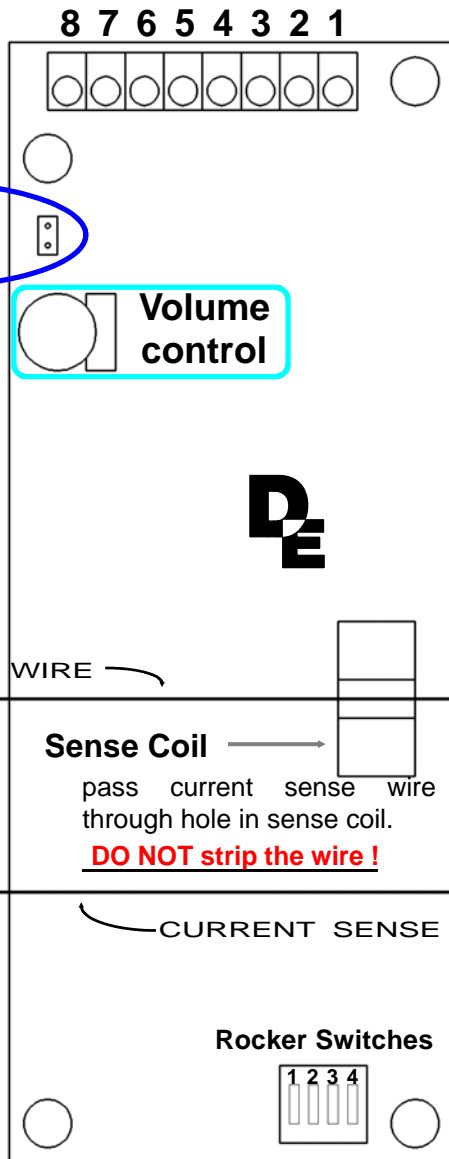
- 1 - RATE
- 2 - RATE
- 3 - Delayed Bell
- 4 - Crossing Gate and Warming fire or Solenoid control

AC input of 16 volts recommended. Please remember that you do need an input supply current slightly greater than your total load current (amps). If you are not sure and would like to fuse your input power (so as to not damage the unit) then we suggest using a 4 ampere fuse in series with one input power lead.

It is suggested to wire nut a group of wires to one wire, thus only placing one wire into the common connector.

**TERMINAL STRIP CONNECTIONS:**

- 1 CROSSBUCK LAMP #1
- 2 CROSSBUCK LAMP #2
- 3 CROSSING GATE / DOWN COIL
- 4 WARMING FIRE / UP COIL
- 5 COMMON CONNECTIONS
- 6 AC INPUT TERMINAL
- 7 AC INPUT TERMINAL
- 8 MANUAL ACTIVATION SWITCH.



use #6 wood screws to secure PC board at desired location

GRADE CROSSING CONTROLLER with BELL SOUND installation drawing - rev 2

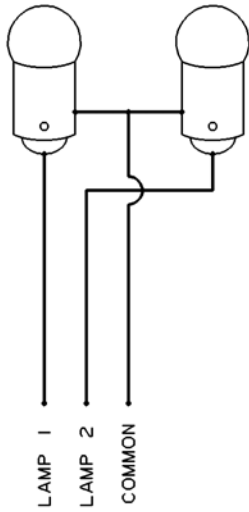
# GRADE CROSSING WIRING SAMPLES

for use with

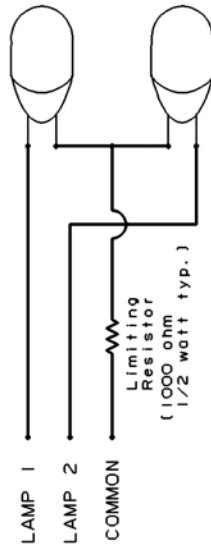
DALLEE ELECTRONICS

products

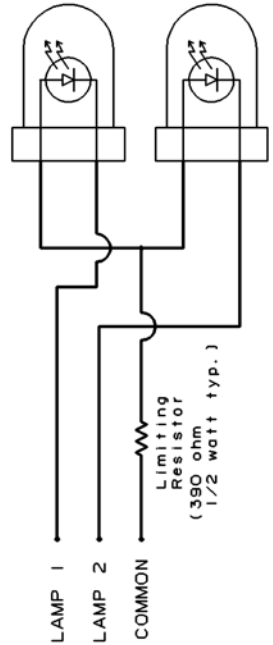
## CROSSBUCKS



Lamp connections



1.5 volt lamp connections

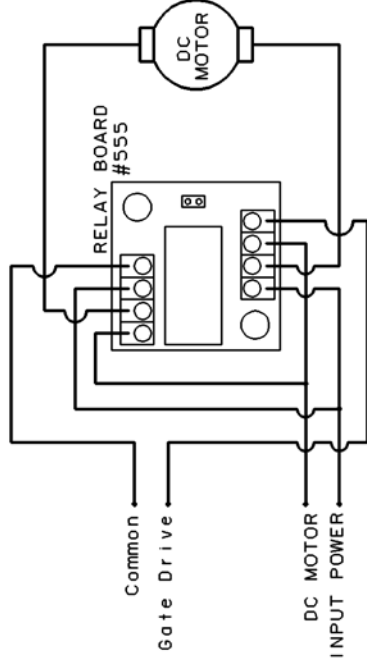


LED connections

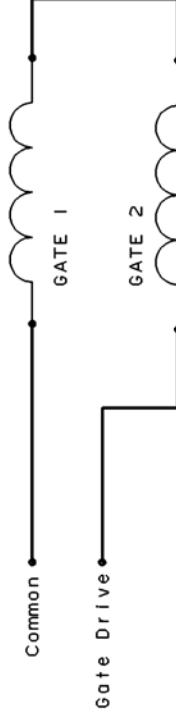
## GATES

DC switch motor.

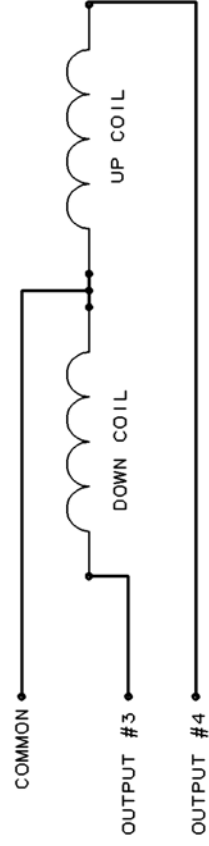
When using a relay to drive a DC switch motor a 1mfd (or slightly larger) capacitor is required across the "common" and "gate drive" to eliminate buzz in the audio. The capacitor's '+' lead connects to the "common", '-' to "gate drive". If utilizing the #555 expansion relay board, there are provisions for the capacitor to be mounted on the board. If pre-ordered with the Grade Crossing Controller, the capacitor is already present on the #555 board and polarity is not important when connecting to the main #587 board.



DC motor drive



Crossing gate coils connected in series



TWIN COIL DRIVE  
for use with Crossing Bell Sound Unit  
(switch #4 set ON)