

# Universal E-UNIT

for AC - SERIES and DC "CAN" MOTORS.

ITEM #1400

For up to 12 amperes of total motor load.

**OVERVIEW:** "E" units provide sequential direction control of model locomotives that are designed to operate with AC track power. Some "E" units had only forward and reverse positions, however the vast majority function with a FORWARD-NEUTRAL-REVERSE-NEUTRAL-FORWARD sequence as track power is interrupted. Unintentional power interruptions caused by track dirt or gaps in the rails such as at switch turnouts tend to be ignored by this ELECTRONIC "E" UNIT so the possibility of accidental sequencing is minimized. Unlike mechanical "E" units which retain their last position, this ELECTRONIC "E" UNIT will revert to an initial "power on" state after power has been interrupted for an extended period of time. This initial state can be either FORWARD or NEUTRAL. Upon first applying power, sequence initiation can start after a few seconds. Otherwise the E-Unit will appear to be locked in the forward direction.

This ELECTRONIC "E" UNIT (1.5"w x 2.5"l x 0.9"h) is designed for universal use. It will provide sequential direction control for wound field series type motors and for the later locomotives with permanent magnet DC motors. It has a capacity of twelve (12) amperes of current flow, sufficient for most two motored locomotives or single, high current, motored locomotives. While most operators will use AC track power, this "E" unit will also sequence with DC track power. The initial "power on" state is user selectable so you can decide if you want the locomotive to start in either FORWARD or NEUTRAL. Provision is made so that a switch (not supplied, item #524) can be installed to lock the "E" unit in its initial state. Lock in FORWARD for automation applications or lock in NEUTRAL to allow sound systems to function with a static locomotive. If power is off for approximately 6 seconds, the "E" unit will reset to its initial "power on" position.



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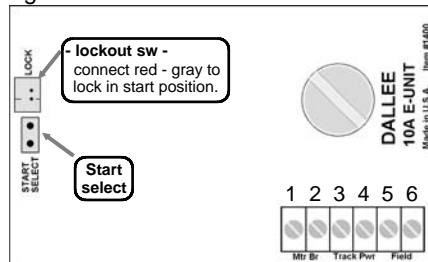
motors in parallel or try a series connection. A series connection will slow the locomotive down but may yield more realistic speeds. It will also reduce the current required by half! Series motor operators with dual motors should keep their brush connections in parallel. Make sure the rotational direction of the motors is correct. If one is not correct reverse the brush wires to only one motor. This can be tested by laying the engine on it's side and cipleading power to the track pickups after the entire unit has been wired!

Connection 2 is position 3 & 4 are the input power coming from the track. To keep wiring uniform, position 3 wire is to be connected to the center rail pick up rollers, right hand rail on two rail installations. Position 4 is to be connected to the locomotive frame ground and thus to the outside rails, left hand rail for two rail installations.

Connection 3 is position 5 & 6. DC motor operators should simply connect the two terminals together then skip to the next step. For series motors, these connect to the wound field of a series motor. Position 5 connects to the first field wire, 6 to the other one. LIONEL generally grounds one side of the field winding either to the locomotive frame or to a solder lug on the motor. You must locate this connection and DISCONNECT it from ground and connect it to position 6. This will isolate the field winding from track power and connect it only to position 6 of the "E" unit. Once you have disconnected the field from ground you can use this ground location to connect the track input power wire. Some motors utilized "split fields". They usually have two colors of magnetic wire wound on the field. These also require you to remove the wire attached to the chassis. Then connect position 6 to the previously attached chassis field wire and position 5 to only one remaining field wire but not both. The other split field wire does not get connected! For dual motored units connect the fields and brushes in parallel to the e-unit. Make sure the rotational direction of the motors is correct. If one is not correct reverse the brush wires to only one motor.

Connection 4, optional lockout connection. Located at the upper left side of the circuit board, labeled "LOCK". This permits a lockout switch assembly, item 517, to be connected to lock the "E" unit so it does not sequence. The "E" unit can be locked in either the FORWARD or NEUTRAL positions depending on the status of the lockout switch (open = sequence) and startup selection (see Connection 5). A wire harness, item 224, can also be purchased to use your own switch.

fig #1



## Wiring Key

1, 2: "Mtr Br" - motor brushes

3, 4: "TrackPwr" - track input power

5, 6: "Field" - field wire connections, if present. Otherwise jumper together.

**INSTALLATION INSTRUCTIONS:** Install the "E" unit where space permits. Ideally, to improve heat dissipation, the "E" unit should be mounted with as much free air space as possible. A clear area for the large 1 1/8" power block needs to be made. This can be either the main chassis, or another piece of flat metal for proper mounting. When selecting the placement of a mounting hole, be careful that no bare wires or other metallic objects can come into contact with the components or the circuit board. Drill a clearance hole for the #10 bolt to protrude through (7/32" hole). Make sure that no metal flashing is present. If paint is present, it is best to clean it off with a small wire wheel or other non-gouging removal tool. This mount has to be cleared of all bumps and ideally coated with silicon dielectric grease but although not ideal, it can be mounted in lieu of. At minimum, clear silicon type lubricant will also suffice. Before applying, remove the lower #10 nut with it's lock washer. Clean the area and apply dielectric grease or in lieu of that, silicon lubricant. Place the bolt through the hole mounting the main unit with the #10 split washer first followed by the #10 bolt. Tighten securely.

Refer to figure #1 for the location of the connections that must be made to complete the installation. There are 6 positions in the clamp type barrier strip. Place your wire stranded (not solid) wire, with it's insulation stripped 3/16" back, into the appropriate locations. Then turn the screw clockwise to clamp the wire into position.

Connection 1 is position 1 & 2 wires which are to be connected to the motor brushes. These wires should be connected so that when the "E" unit initially "powers on" in FORWARD the locomotive actually starts in FORWARD. For permag, DC, dual motored units, either connect the

Connection 5 is the startup selector, it has a 2 pin header with a shorting connector installed. It is labeled "START" With the jumper installed (as shipped) the E-unit will initially "power on" in the FORWARD position. If the connector is removed, the E-unit will initialize in the NEUTRAL position.

Smoke units should not be connected to the motor brush or field wires. For better operation of the smoke unit, connect these units directly to the track power.

**OPERATIONAL NOTE:** If your engine becomes derailed, or is pulling too many cars and stalls out, excessive currents can be drawn by the motor. If you leave the power on the track, while stalled and drawing these excessive currents, damage can result to the "E" unit. It is always best to remove track power and correct the problem instead of leaving track power on while attempting to get things moving.

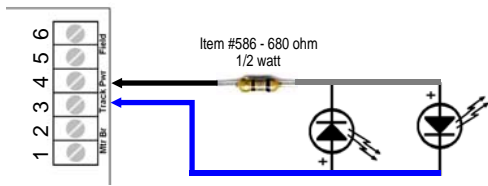
**LIGHTING & OTHER INSTALLATIONS:** Many lighting variations are possible and easy to incorporate because of the design of this "E" unit. If you are using 14 or 18 volt bulbs and want them on whenever there is track power wire the lights to the same connections as the track power input. LED marker lamps can also be wired across the track power pick up as shown in drawing #2. To make LED marker lamps directional refer to drawing #3. These drawings assume proper motor and track input connections exist.

Directional lighting is a simple matter. Some engines have the bulbs connected to the chassis. These bulbs must be insulated from the chassis for directional operation. Connect a light bulb between positions 1 and 6, it will be illuminated only in the FORWARD direction. A bulb connected between positions 2 and 6 will illuminate only in REVERSE. Refer to drawing #4.

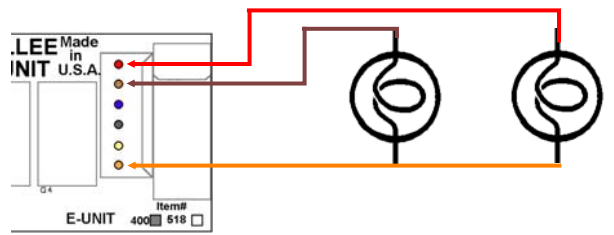
Directional lighting is best done with our "Incandescent White LED", item 536. It also requires a limiting resistor, item 558. Instructions can be found on our web site.

Units returned for repair or replacement (at our discretion), require \$56 minimum, plus \$14 return shipping (see current price schedule, page 6) to be included with the unit. Prices subject to change w/o notice.

not for use by children

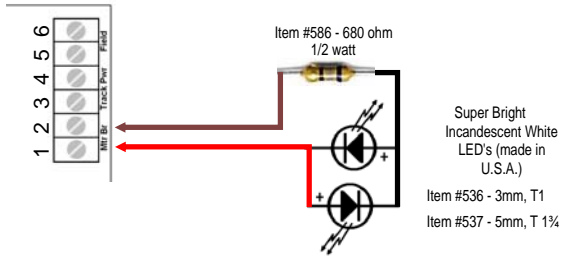


**dwg #2** - using LED's with AC track power. Both are constantly ON. If only one LED is desired you do need to use a diode for the other LED.



**dwg #4** - standard lamps for directional lighting without series diodes. The lamps MUST be insulated from the chassis.

Note: It is normal for a small glow in the opposite direction lamp/LED. This is caused by the back EMF of the motor. Some will have more than others. This is usually negligible and is harmless. Other motor "help" is available on our web site. Look under "Product Instructions & Technical Index" and scroll down to the "E" unit section.



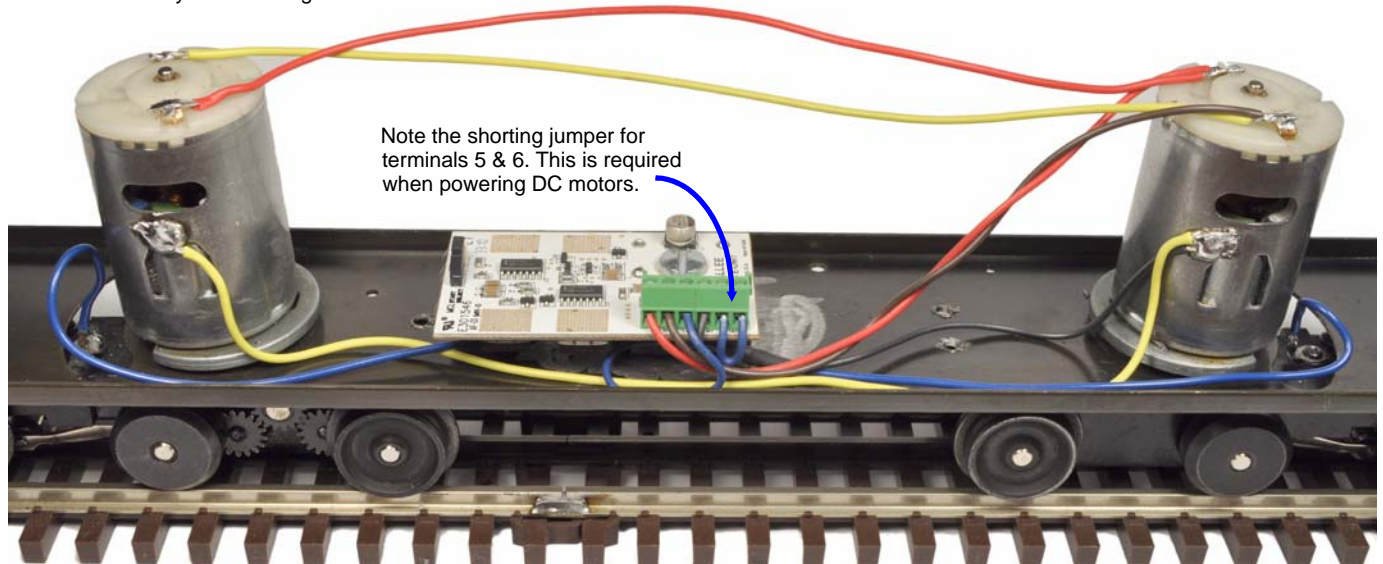
**dwg #3** - directional LED's. If only one LED is desired you do need to use a diode for the other LED.

Incandescent White LED Headlight kits are also available (contain all parts and drawings necessary for flicker free operation).

Item 1236 - T1 (3mm)

Item 1237 - T1¼ (5mm)

Installed in an early Williams engine with two DC "can" motors.



Installed in a Lionel engine with two series motors with the optional lock out wiring harness, #222, wired to the existing chassis switch.

This engine also has a HiLine™ sound unit installed in the fuel tank with a #232 speaker.

