

# Universal E-UNIT

for AC - SERIES and DC "CAN" MOTORS.

ITEM #400

Handles up to 4 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 if power is off for approximately 6 seconds or more. The 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 is required for the electronic circuitry to properly charge.

This electronic E-unit is designed for universal use. It will provide sequential direction control for wound field series type motors and for later locomotives with permanent magnet DC/"can" motors. It has a capacity of up to four amperes of current flow, sufficient for some two motored locomotives, for heavier loads use either E-Unit #406 or #1400. 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) 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. The E-unit was also designed for easy installation of accessory items such as lighting.



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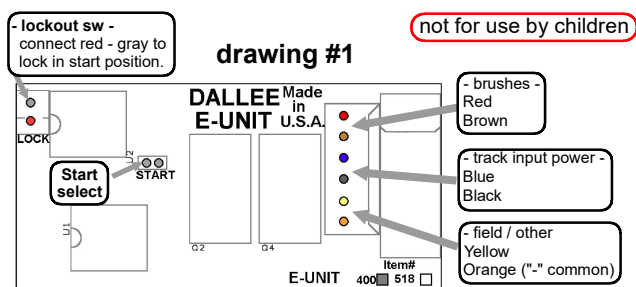
**Step #3,** blue & black wires, connect to the input power coming from the track. To keep wiring uniform, the blue wire is to be connected to the center rail pick up rollers, right hand rail on two rail installations. The black wire is to be connected to the locomotive frame ground and thus to the outside rails, left hand rail for two rail installations.

**Step #4,** yellow & orange wires. **DC motor operators:** simply connect the two wires together then go to step #5.

**Series motor** operators: these connect to the wound field of a series motor. Yellow wire to the first field wire, orange 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 the orange wire. This will isolate the field winding from track power and connect it only to the orange wire 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 (black 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 the orange wire to the previously attached chassis field wire and the yellow wire 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.

**Step #5,** 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.

**Step #6** 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.



**Step#1:** Install the E-unit where as much free air space exists, using the attached mounting tape. For best adhesion, degrease the area first, then being very careful that no bare wires or other metallic objects come in contact with the components or the circuit board, mount the E-unit. If any contact is made to any metal object or stray wire while powered up, damage will occur to the E-unit. If you need to get better clearance, use more double sided tape (item 388).

Refer to drawing #1 for the location of the connections that must be made to complete the installation. Adjacent to the black box on the end is a six (6) pin header which encompasses connections 1, 2, and 3. These connections are made with a 6 place wire harness.

**Step #2,** red & brown wires, connect 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 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 clip-leading power to the track pickups after the entire unit has been wired!

Smoke units that were initially connected to a series motors brushes should be connected to the track power input instead. This makes them work better! Connector's (item #520, item #757) are available for easy disconnect if desired.

When installing in tight locations where the wires are better at a right angle from the main board, which lowers the total overall height, use item #614. See our web site for other installation notes & pictures.

**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. Lighting applications are shown on the reverse side of these instructions and on our web site. Drawings 1 through 3A show the wiring. Drawing #4 shows directional lighting with light bulbs. The lamp socket must be insulated from the frame ground.

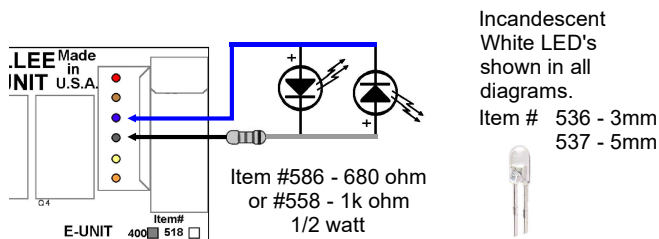
## Troubleshooting:

DC motor does not run - need to connect the yellow and orange wires together as instructed in step #4.

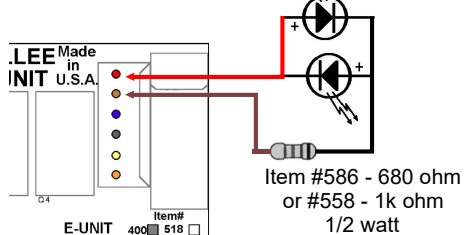
Doesn't sequence - your power source is not going to zero volts or the time at zero volts isn't long enough.

Only goes in one direction - either improperly wired and/or a powered wire touched the E-Unit. Improper wiring/handling is NOT covered by any warranty! Units returned for repair or replacement (at our discretion), require \$45 minimum, plus \$15 return shipping to be included with the unit. Wire harness can be left installed in your engine. Prices subject to change w/o notice.

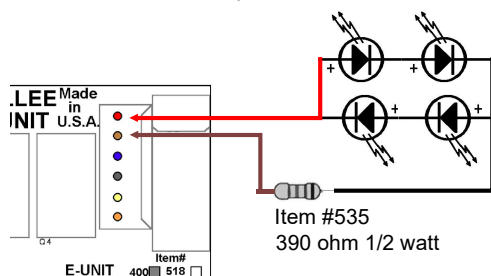
DO NOT disconnect the 6 pin wire harness by pulling on the wires, pull only by the connector body! Wire harnesses damaged from improper use are not covered under any warranty.



**dwg #2** - using LED's with AC track power. Both are constantly ON. If only one LED is desired you need to use a diode, #374, in place of the other LED.



**dwg #3** - directional LED's. If only one LED is desired you need to use a diode, #374, in place of the other LED.

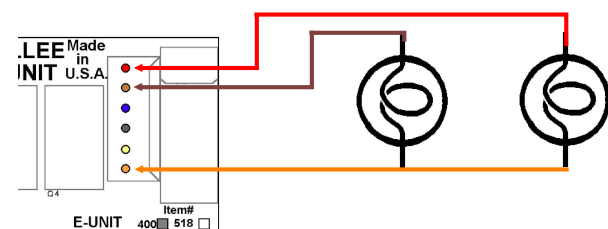


**dwg #3A** - 2 directional LED's. If only one direction pair of LED's is desired you need to use a diode in place of the other LED's.

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

Item 1236 - T1 (3mm)

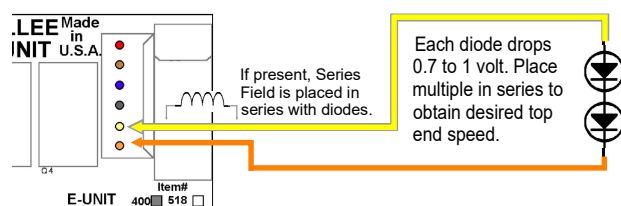
Item 1237 - T1¾ (5mm)



**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.

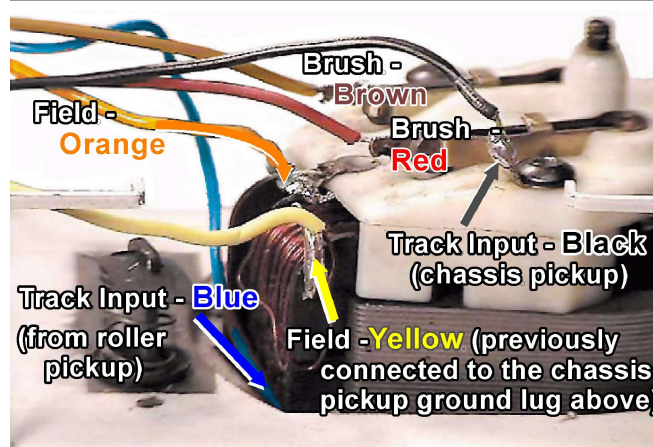
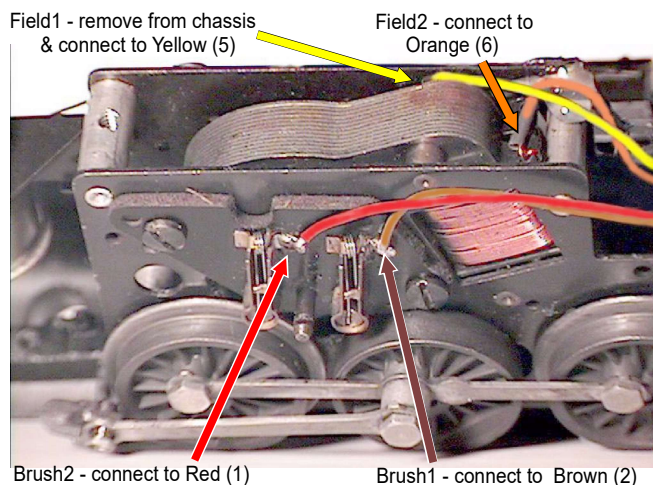
Other motor "help" is available on our web site. Look under "Product Instructions & Technical Index" and scroll down to the "E" unit section.



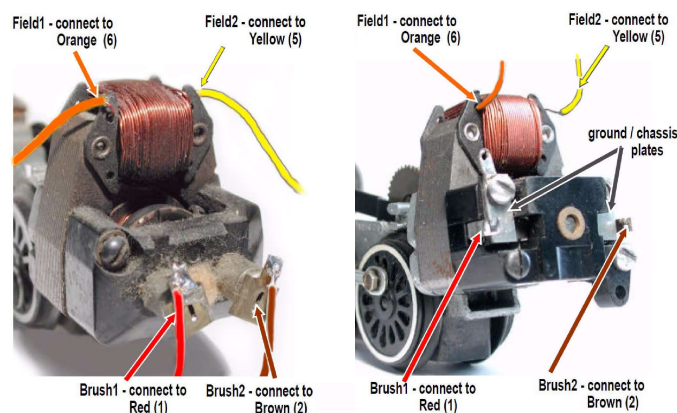
**dwg #5** - Reduce the engines top speed. Diodes should be rated to handle the motor current. The more placed in series, the slower the top end speed!

Use item #374 (1amp), #370 (3 amp), or #375 (6 amp).

**Help for Lionel series motors.** These pictures show #400 eunit wire connector colors and not any existing locomotive wires. Be sure to remove any grounded field wires from the chassis for the e-unit's proper connection. Not doing so may damage the E-Unit!



**Help for AF series motors.** Colors indicated are the #400 eunit connector and not the locomotives existing wires.



in later production type diesel or steam locomotives with a "hot chassis", make sure the ground/chassis plates (or anything else) do not contact the brush wires! This will damage the E-Unit.

