

# Universal E-UNIT

for AC - SERIES and DC "CAN" MOTORS.

ITEM #400

Handles up to 4 amperes of total motor load.

\$44.95

**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 the later locomotives with permanent magnet DC motors. It has a capacity of up to four amperes of current flow, sufficient for some two motored locomotives, others may find the need to use item #1400, a 10 ampere E-Unit. 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



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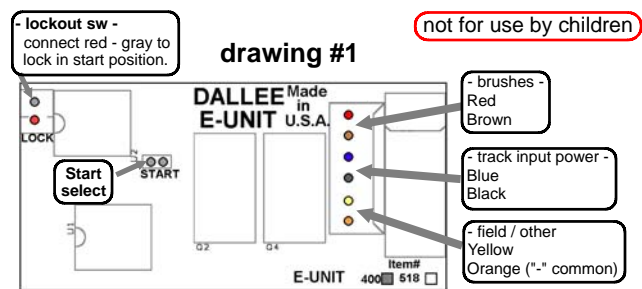
engine on it's side and clip-leading power to the track pickups after the entire unit has been wired!

Connection 2, 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.

Connection 3, yellow & orange wires. DC motor operators should simply connect the two wires together then skip to the next step. For series motors, 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.

Connection 4, optional lockout connection. Located at the left side of the circuit board, labeled "LOCK", which permits a switch (Item 524) to be connected to lock the E-unit so it does not sequence. To include a lockout switch insert the 2 position wire harness with the red and gray wires. Connect these to the the switch. The E-unit can be locked in either the FORWARD or NEUTRAL positions depending on the status of the lockout switch (open = sequence). Never let these wires come into contact with anything else!

Connection 5 is a 2 pin header with a shorting connector installed. It is labeled "START" With the jumper installed (as shipped) the E-unit will



locomotive. The E-unit was also designed for easy installation of accessory items such as lighting.

**INSTALLATION:** Install the E-unit where space permits, using the attached mounting tape, being careful that no bare wires or other metallic objects come in contact with the components or the circuit board. Be very careful that nothing comes into contact with the bottom portion of the board to a metal chassis or other metal parts or wires. This will damage the E-unit and will not be covered under any type of warranty. If you need to get better clearance, use more double sided tape (item 388). Ideally, to improve heat dissipation, the E-unit should be mounted with as much free air space as possible.

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

Connection 1, 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

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 blue and black wires of the E-unit. LED marker lamps can also be wired across the track pick up (blue & black wires) 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. The bulbs must be insulated from the frame ground. Connect a light bulb between the brown wire and the orange wire and it will be illuminated only in the FORWARD direction. A bulb connected between the red wire and the orange wire will illuminate only in REVERSE. Refer to drawing #4.

If you would like to include 1.5 volt bulbs for constant intensity lighting simply wire the bulb across any 2 or 3 diodes depending on the brightness level you desire. See drawing #5 options.

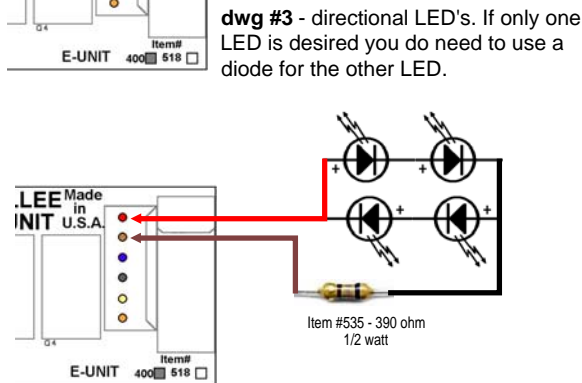
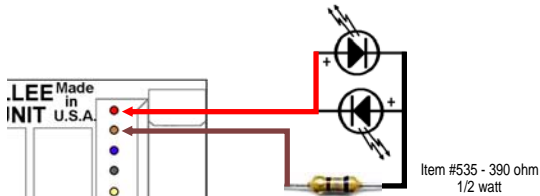
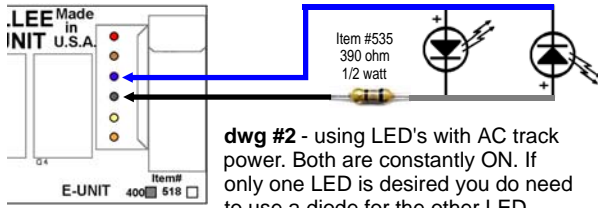
You can combine directional lighting (drawing #4) and motor speed reduction (drawing #5) on the same locomotive. This combination is shown in drawing #6.

If you wish to use 1.5 volt bulbs for constant intensity directional headlights this can be accomplished by installing a string of diodes in series with the motor brush connections. Make these connections through the red wire as shown in drawing #7 and that high current diodes (Item #375) be used as they must be able to carry the full motor

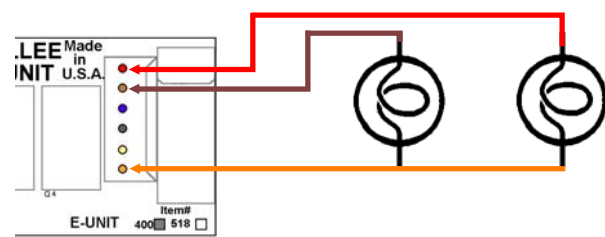
current. Voltage to the motor will be reduced by .5 to .7 volts for each diode in the string resulting in less overall locomotive speed. Drawing #8 includes an additional 1.5 volt bulb that is non-directional for interior lighting.

Units returned for repair or replacement, at our discretion, require \$25 minimum, plus return shipping of \$12 to be included with the unit.

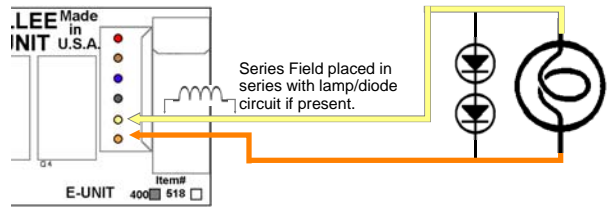
E-Unit 400, v3.6



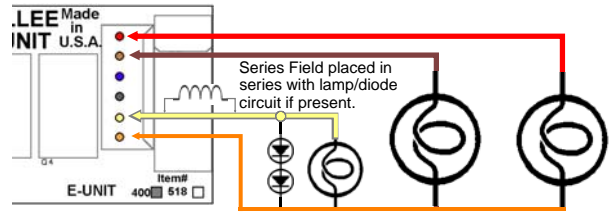
**dwg #4** - standard lamps for directional lighting without series diodes. The lamps MUST be insulated from the chassis.



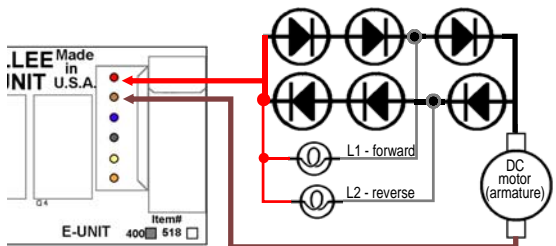
**dwg #5** - 1.5 volt lamps for constant lighting. The lamps MUST be insulated from the chassis. If using a series motor, the field winding must be placed in series with this.



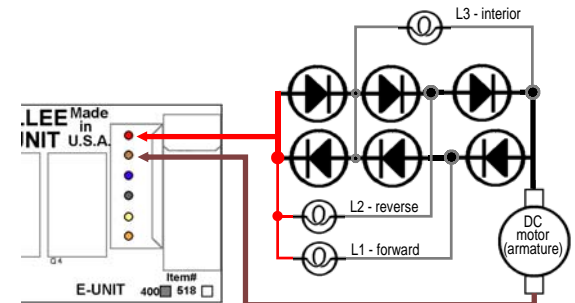
**dwg #6** - 1.5 volt lamp for constant lighting with standard voltage lamps for headlights. The lamps MUST be insulated from the chassis. If using a series motor, the field winding must be placed in series with the yellow wire.



**dwg #7** - 1.5 volt lamp directional headlights. The lamps MUST be insulated from the chassis. This configuration reduces the operating voltage to the motor.

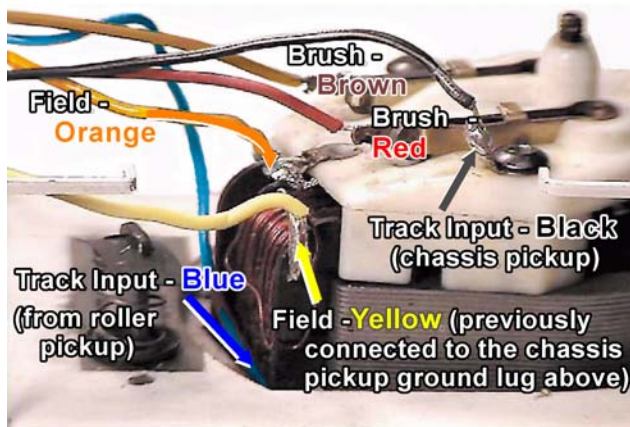


**dwg #8** - 1.5 volt lamp directional headlights plus 1.5 volt constant lighting. The lamps MUST be insulated from the chassis. This configuration reduces the operating voltage to the motor.



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**Help for Lionel series motors.** This picture shows where the grounded field wire needs to be separated from the chassis for the e-unit's proper connection.



**Help for Am Flyer series motors.** This picture shows where the wires are normally terminated. Colors indicated are those that match the eunit's board connector and not the locomotives existing wires.

