Universal E-UNIT

for AC - SERIES and DC "CAN" MOTORS. ITEM #406
Handles up to 6 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 six amperes of current flow, sufficient for some two motored locomotives, E-Unit #1400, a 12 ampere E-Unit, will power the heavier loads. 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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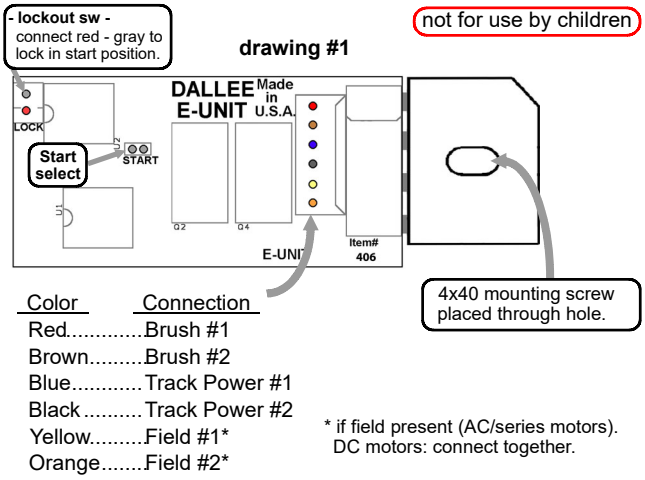


Color	Connection
Red	Brush #1
Brown	Brush #2
Blue	Track Power #1
Black	Track Power #2
Yellow	Field #1*
Orange	Field #2*

* if field present (AC/series motors). DC motors: connect together.

Step #1: Install the E-unit where as much free air space exists and has room to attach the bridge rectifier (black item on end with hole in it for fastening) to the chassis using a #4-40 screw, compression washer, and nut. The opposite end has a piece of 1/8" tape which should be secured to a grease free area. First check the area to be mounted and then remove the covering on the tape to secure it. Be very careful that no bare wires or other metallic objects come in contact with the components or the circuit board when mounting 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.

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 are six (6) wires which encompasses connections 1, 2, and 3 below. Read through the instructions first and then proceed to connect the wires accordingly for your installation/locomotive.

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!

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 proceed 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.

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.

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. Various lighting applications can be found on page 2 of the #400 E-unit's instructions.

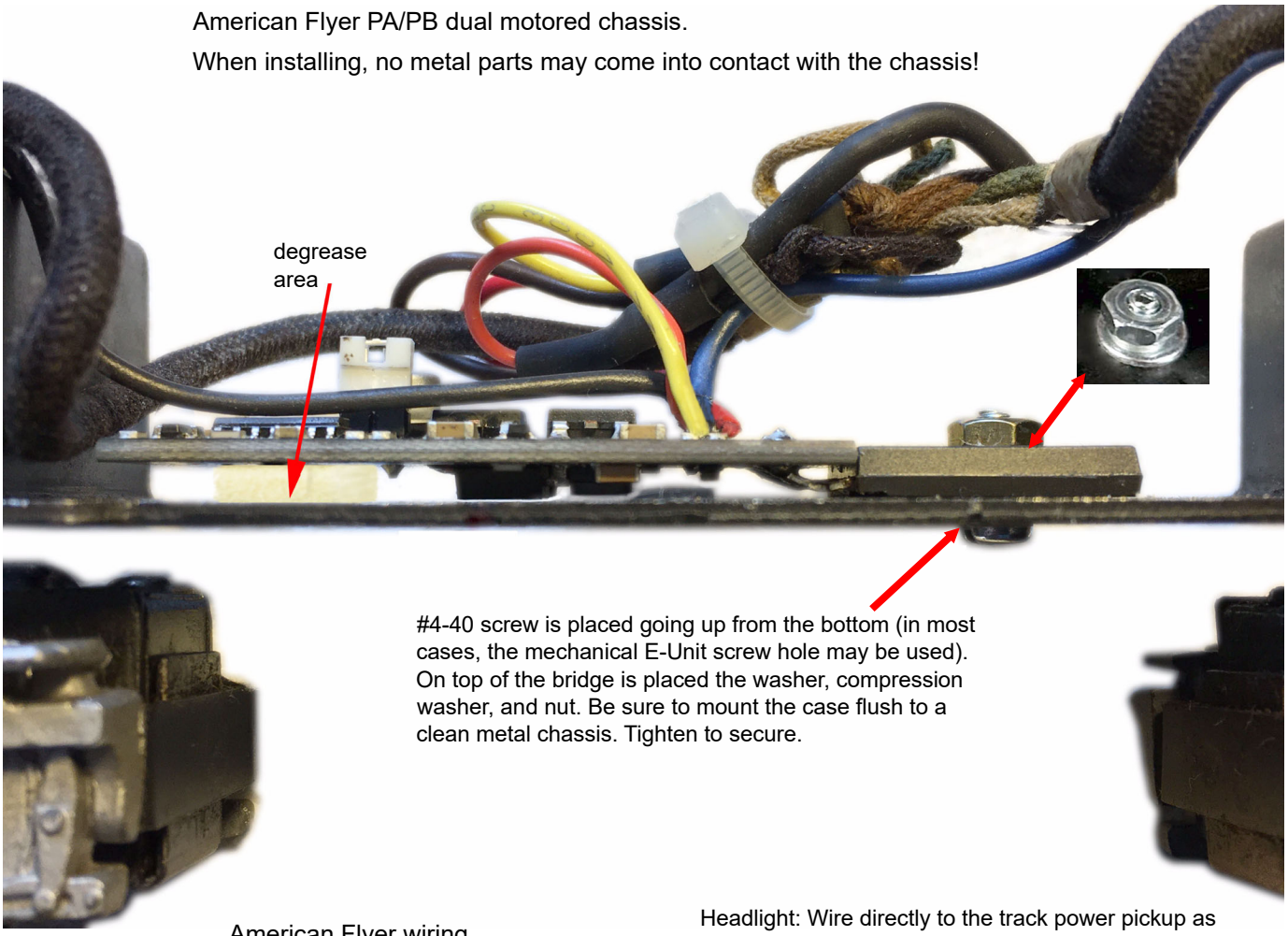
Units returned for repair or replacement (at our discretion), require $55 minimum, plus $12 return shipping to be included with the unit. Prices subject to change w/o notice.

Wires supplied on this E-unit are heavier in gauge to handle the higher currents that this E-unit is rated for and are not intended to be used betwen a locomotive and it's tender since they are not very flexible.

This E-Unit can be used in multiple types of installations from "Standard Gauge" to "O" and "S" gauge. Since it's main application is dual motored "S" gauge equipment, we have tailored the instructions to facilitate that installation.

American Flyer PA/PB dual motored chassis.

When installing, no metal parts may come into contact with the chassis!



#4-40 screw is placed going up from the bottom (in most cases, the mechanical E-Unit screw hole may be used). On top of the bridge is placed the washer, compression washer, and nut. Be sure to mount the case flush to a clean metal chassis. Tighten to secure.

American Flyer wiring

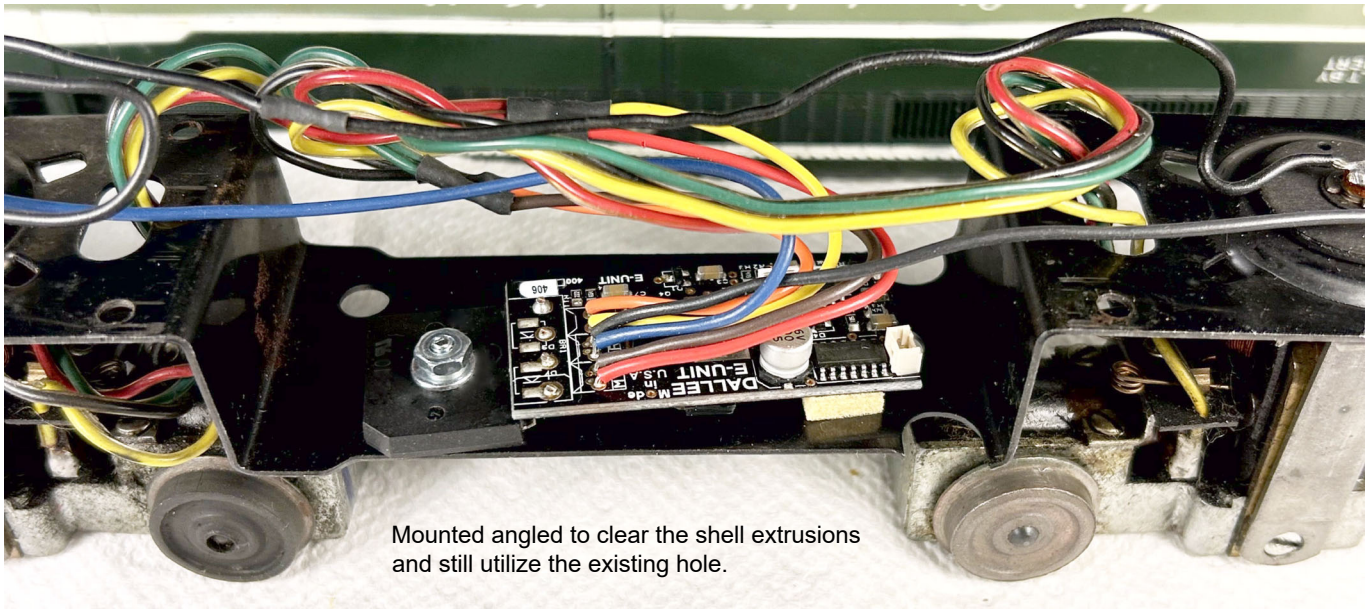
Original	Dallee
Green	Brown
Yellow	Red
Red	Yellow
Black	Orange

Headlight: Wire directly to the track power pickup as originally wired. Various LED headlight wiring is shown on our web site as seperate instructions.

Incandescent White LED Headlight kits (contain all parts and drawings necessary for flicker free, super bright, operation).

Item 1236 - T1 (3mm)

Item 1237 - T1¾ (5mm)



Mounted angled to clear the shell extrusions and still utilize the existing hole.