

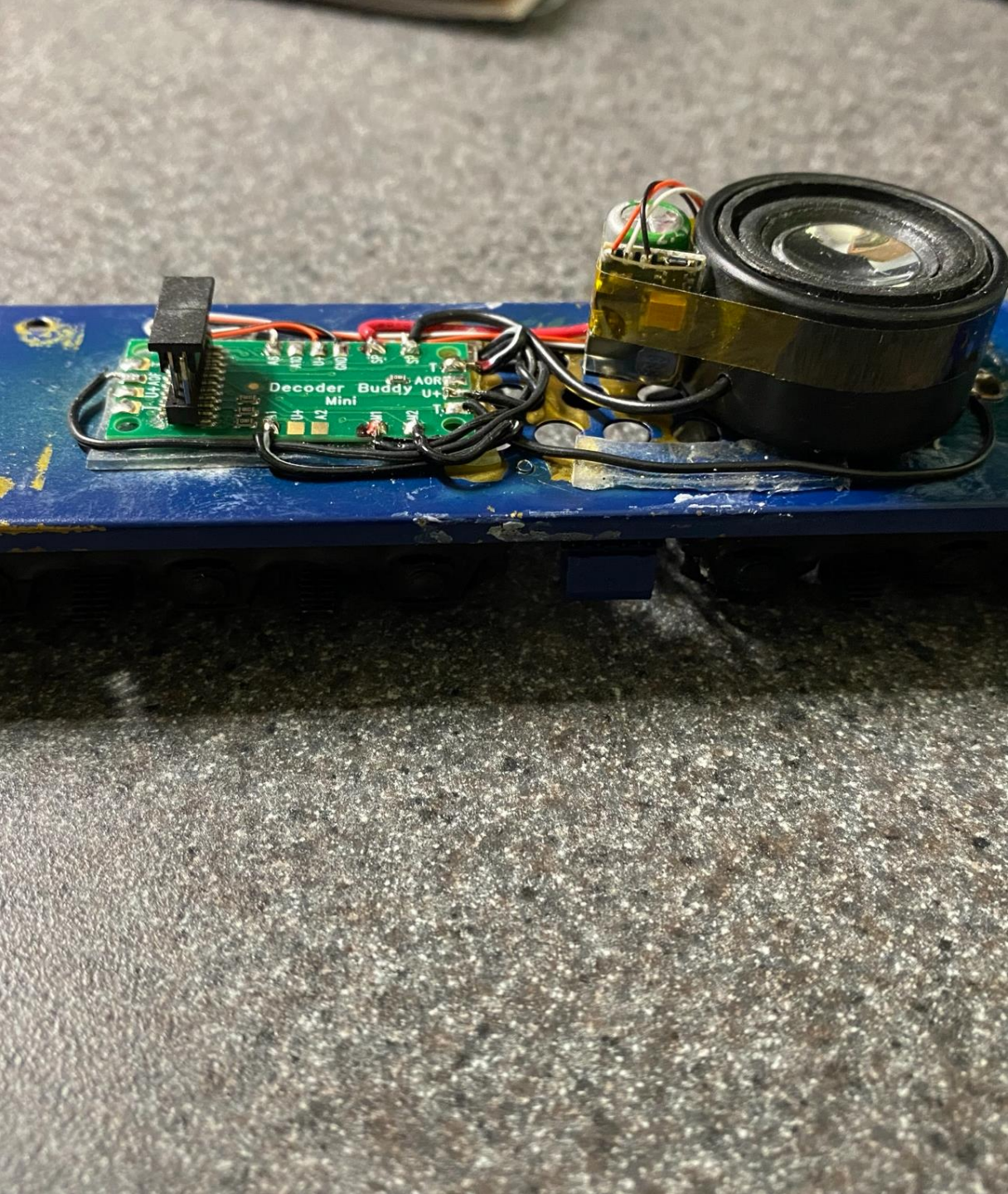
Adding DCC and/or **Sound to Brass Locomotives**

Carl Marchand
NMRA DCC Working Group Manager

Agenda

- Getting Started – First Steps
- Lighting
- Electronics
- Resolving power pickup issues
- Accessories and Parts
- Final tips & takeaways





First Steps

How to get started

First Steps

- Model must be running trouble free using DC – This is a MUST!
- Test the current draw of the motor
- Verify the motor can be electrically isolated (from the frame)
- Examine the model for places to install the decoder, speaker and temporary power storage device (will discuss later)
- If your model is scheduled to be painted, take care of that process first! Otherwise your install may have to be redone!

Tools



Screwdrivers



Multimeter



General Tools

Soldering Station

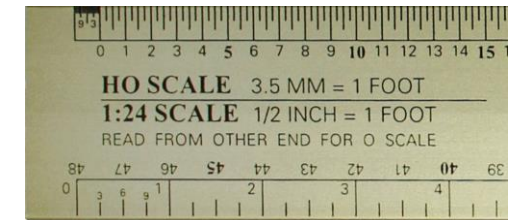


Optional : Resistance Soldering Station



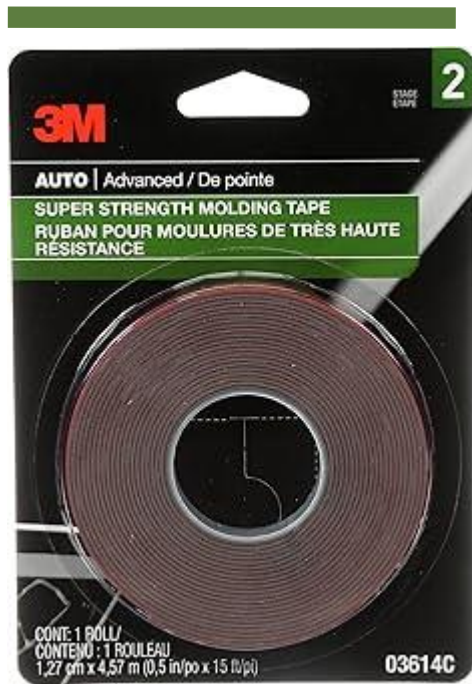
Wire Stripper

S&G Tool Aid® 19000 - SAE 22 to 12 AWG Pistol Grip Wire Stripper

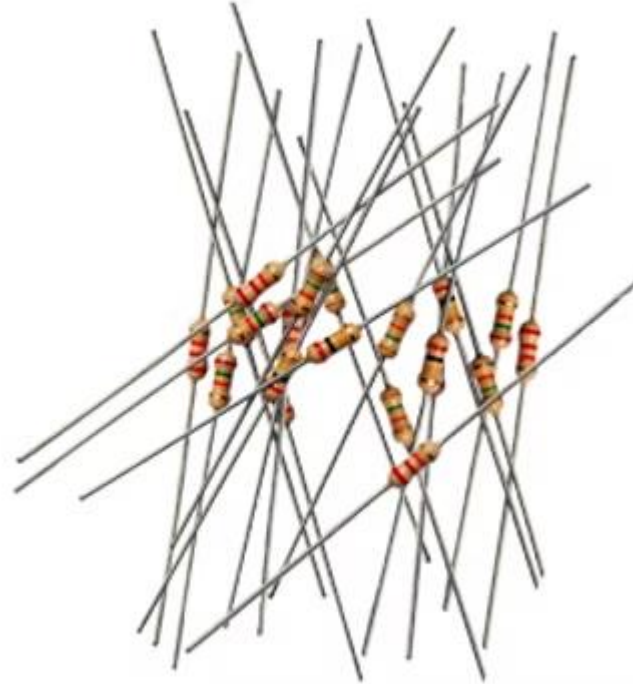


Standard Ruler OR Scale Ruler

Accessories/Fasteners/Adhesives



Accessories/Fasteners/Adhesives



Check the stall current of the motor

- Use 2 meters, one to measure current (ammeter) and one to measure voltage (voltmeter)
- OR
- Measure source voltage at 12 Volts, then change meter to measure current at 12 Volts while holding the motor shaft to prevent rotation (simulating the stall).
- Current levels below 1 ampere at stall are suitable for DCC

Why TWO Meters?

In some cases, you may need to measure **Current (I)** and **Voltage (E)** simultaneously



11 Function Digital Multimeter With Audible Continuity

Item #61593



Only: \$21.99

Compare to \$54.99,
Craftsman 82334



7 Function Digital Multimeter

Item #63604



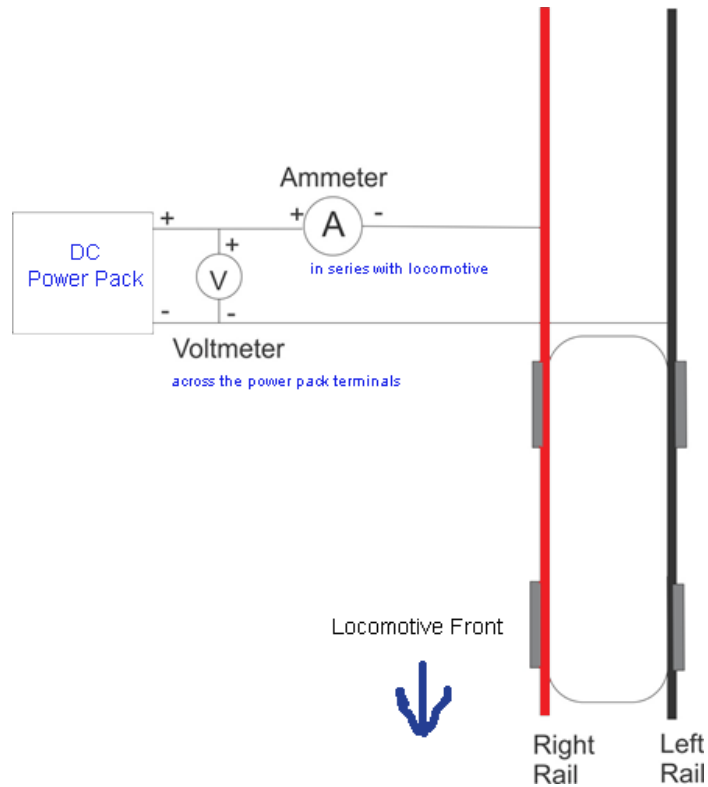
Only: \$5.99

Compare to \$13.51,
Commercial Electric MS8132A

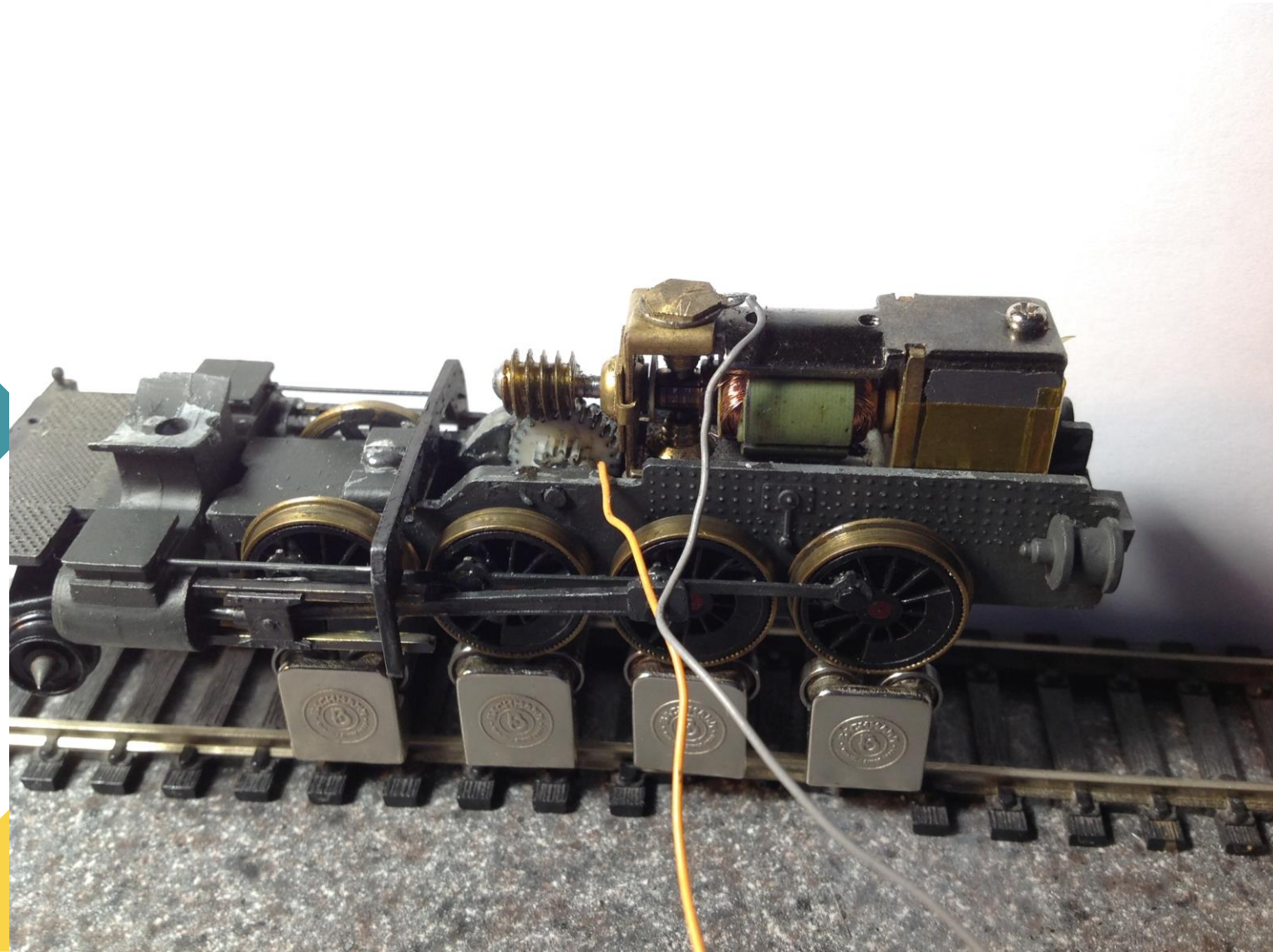
Meter Requirements:

- Measure DC Voltage /Current
- Measure AC Voltage / Current
- Measure Resistance

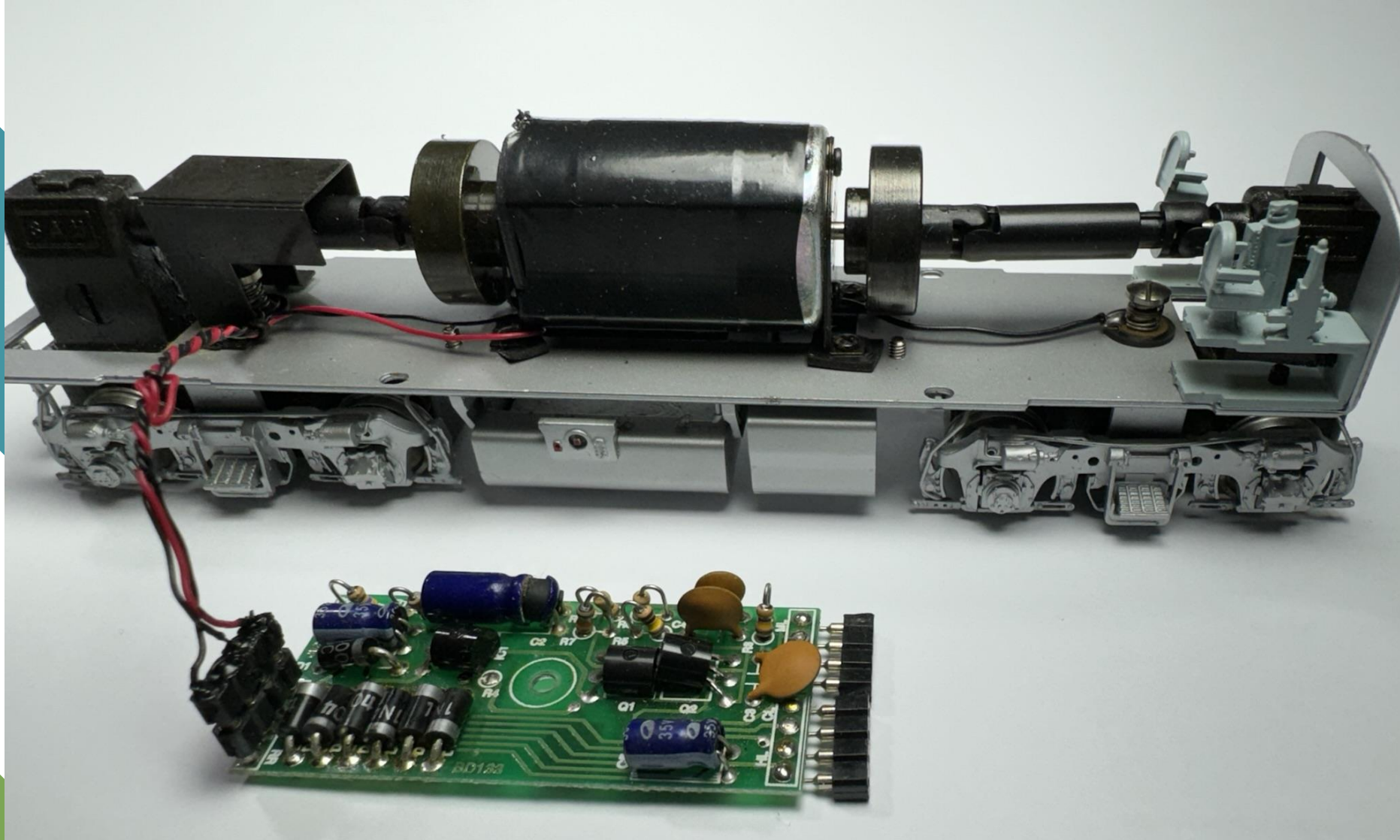
How to Measure Motor Current



Check motor isolation from the frame



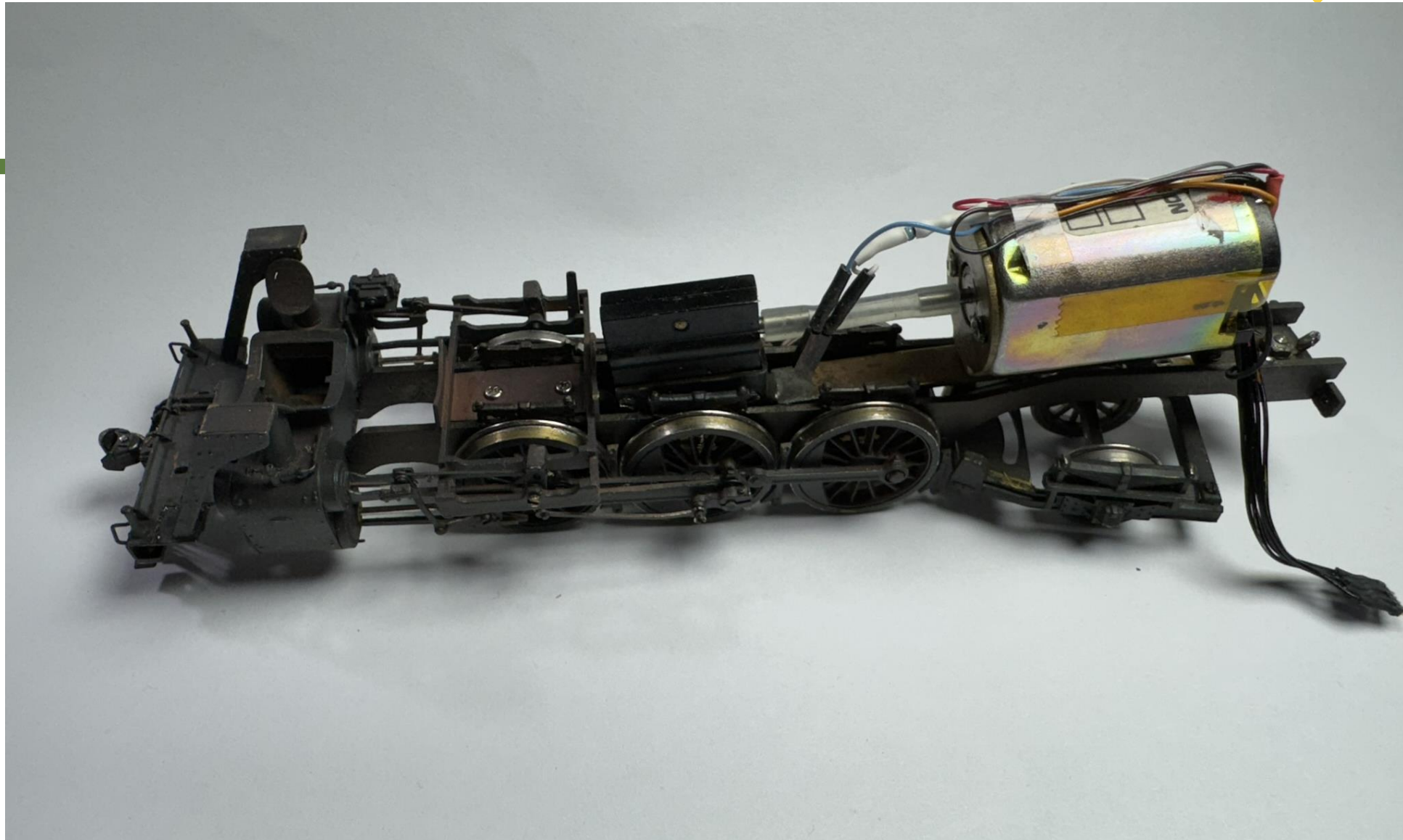
Check motor isolation from the frame



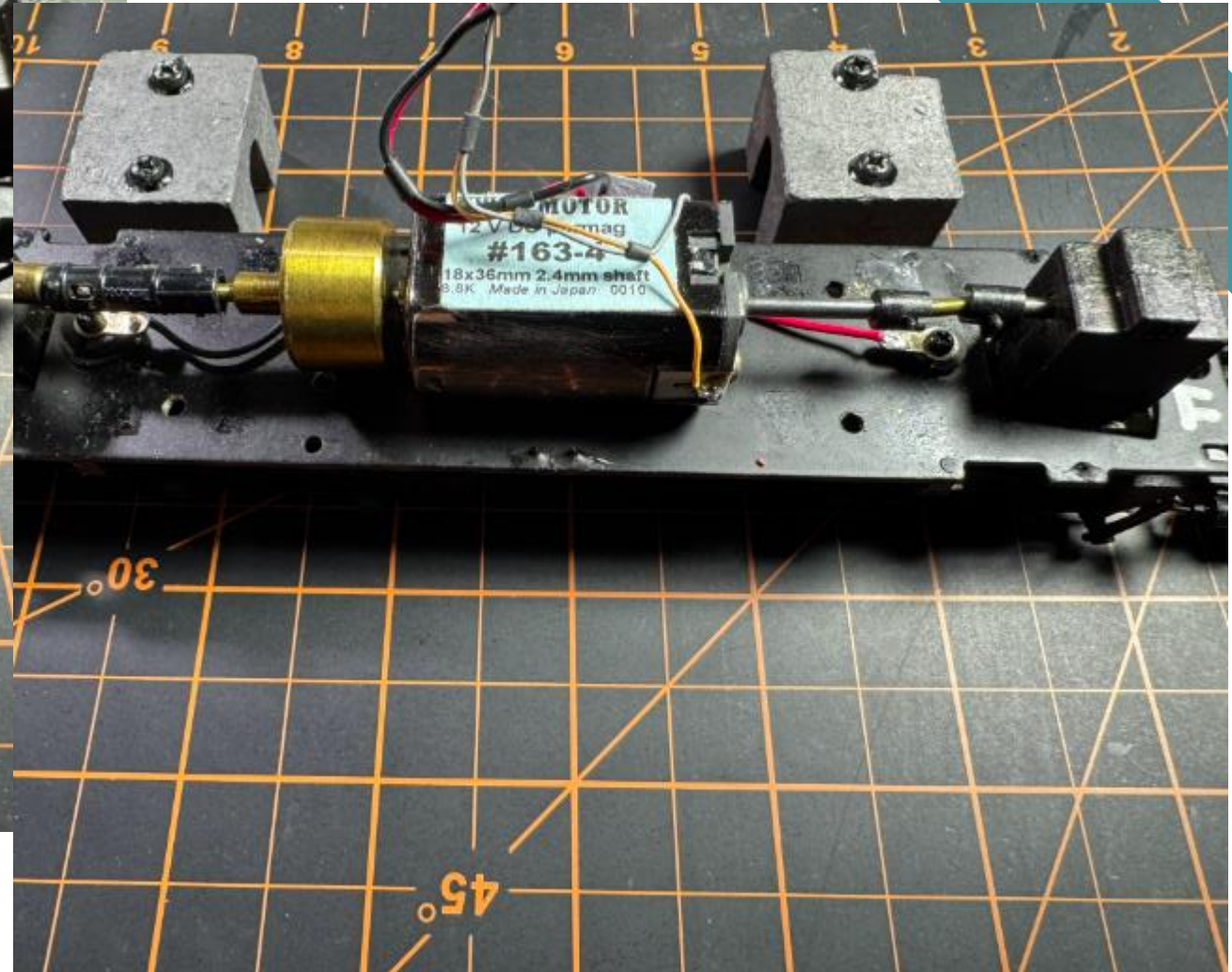
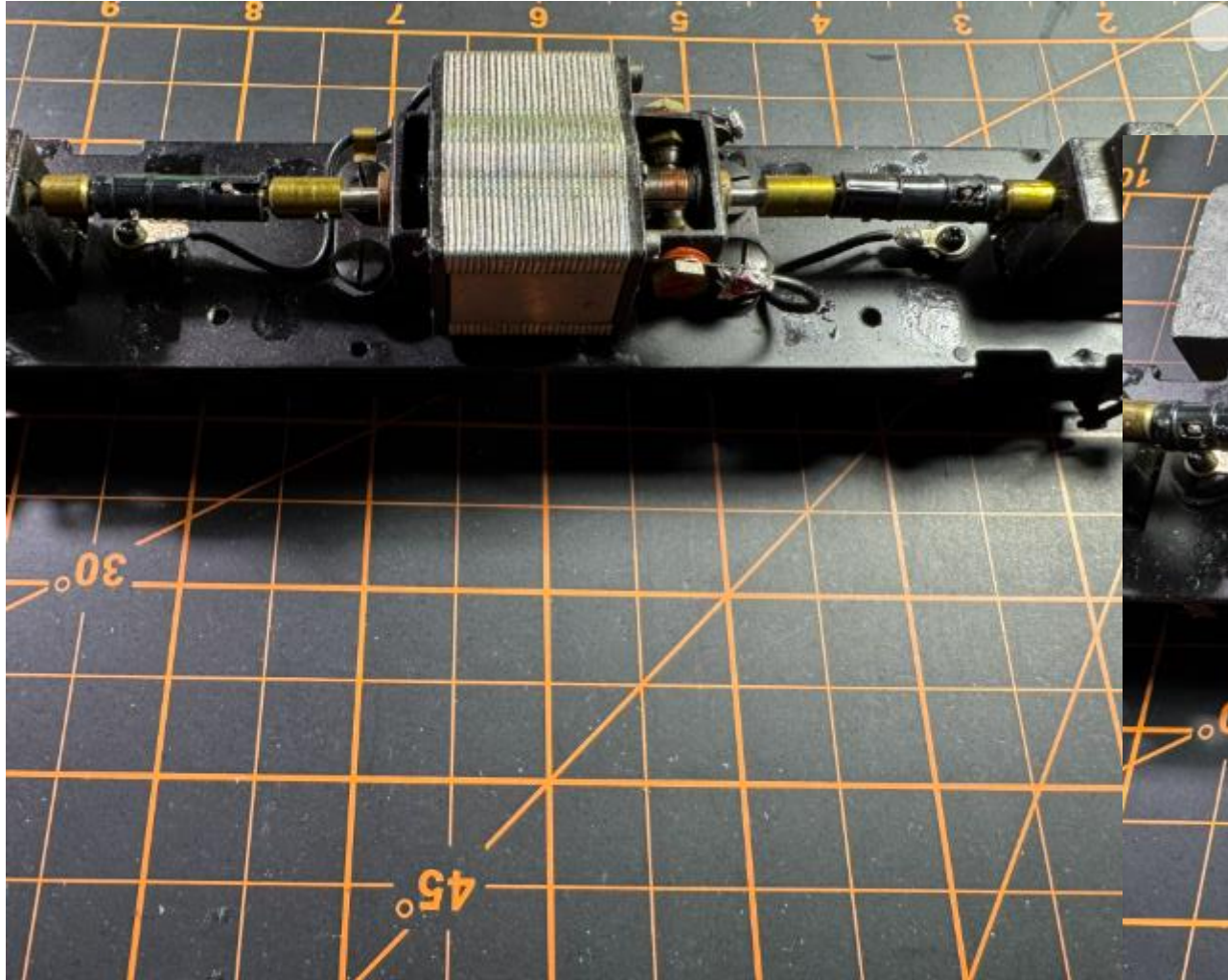
Where to buy replacement motors

- EBay
- Proto Power West, aka A-Line: <https://ppw.aline.com>
- NorthWest Short Line: <https://www.nwsl.com>
- Kato USA: <https://katousa.com>
- Your local hobby shop

DCC Compatible Motor



DCC Compatible Motor





Lighting

Lighting



- Recommend replacing ALL incandescent lamps with LEDs.
- Use .0201 or .0402 LEDs with leads for best results
- Make sure to coat the LED contacts with canopy glue or similar to avoid short circuits
- Connect to motherboard that include resistors or add 2.2K Ohm resistor in series to each LED.

Lighting



Use Plastruct FOP-40 .040 fiber optic cable to make lenses.

Lighting



Use Plastruct 90291 1/16" clear rod for lenses.

Lighting



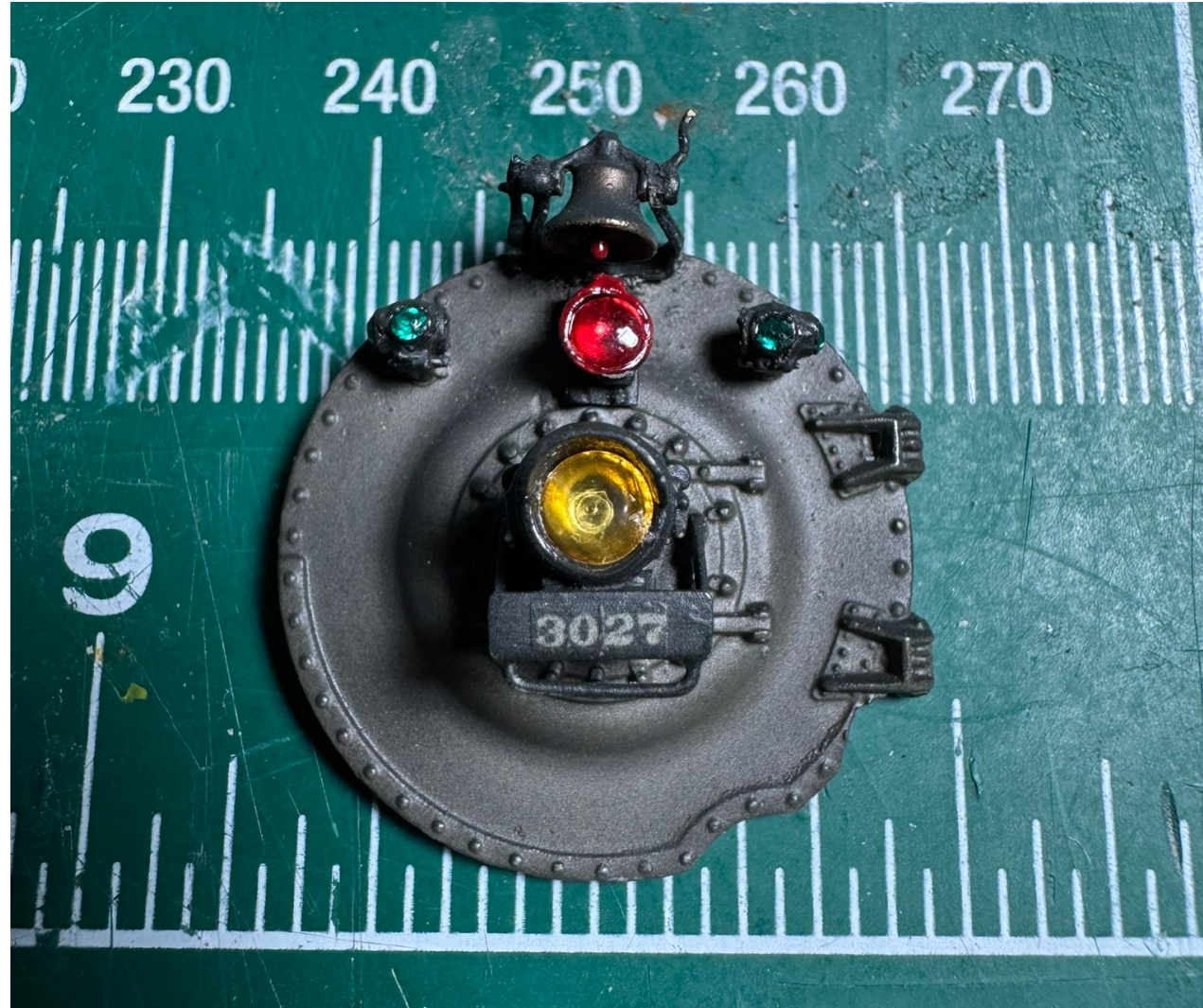
Fabricate lenses from styrene sheet. These sheets from Evergreen come in various thickness: .010", .015", etc.

Lighting - Tips



1. Remove old MV/static lenses with Solvaset
2. Replace dingy/amber colored lenses with new ones using aforementioned materials
3. Fabricate a “bulb” using a micro LED and canopy glue
4. Test the LED before installing it.

Lighting - Tips



Lighting - Tips



Lighting - Where to buy LEDs and resistors



- EBay
- Amazon
- Your local hobby shop

Lighting - Where to buy LEDs and resistors



20pcs 0402 0603 0805 1206 Pre Wired SMD LED Light Emitting Diode Micro Litz Length 7.8in. Soldered White Red Green Yellow Blue Orange Pink UV (20pcs DC 3V 0402 Warm White Prewired Mini Lights)

Visit the EDGELEC Store

4.6 ★★★★★ (639)

Overall Pick

50+ bought in past month

\$9⁹⁹ (\$0.50 / count)

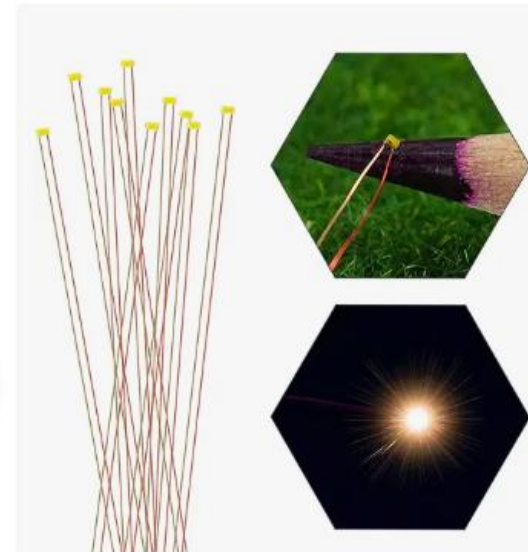
Get Fast, Free Shipping with Amazon Prime

FREE Returns

Color: [2] Warm White



Click to see full view



Evemodel 10pcs Pre-Wired 0201 SMD LED Warm White Copper Wire LED (Warm White)

4.4 ★★★★★ (15)

\$14⁹⁹

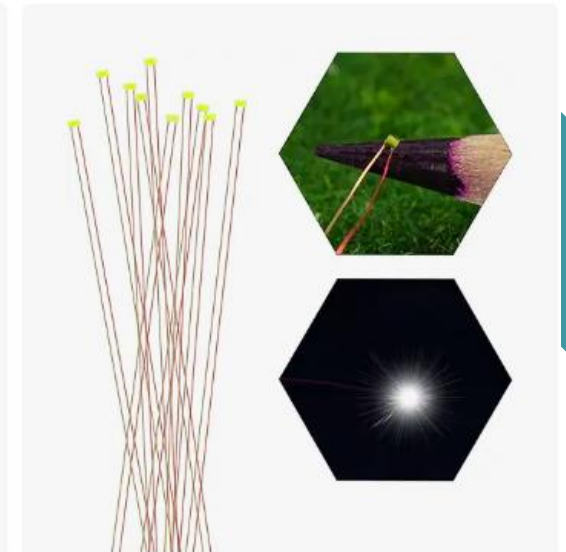
FREE delivery **Sat, Jan 10** on \$35 of items shipped by Amazon

Or fastest delivery **Thu, Jan 8**

Only 4 left in stock - order soon.

Ages: 14 years and up

Add to cart



Evemodel 10pcs Pre-Wired 0201 SMD LED Bright White Copper Wire LED (White)

4.4 ★★★★★ (15)

\$14⁹⁹ (\$1.50/count)

FREE delivery **Sat, Jan 10** on \$35 of items shipped by Amazon













Or fastest delivery **Fri, Jan 9**

Only 6 left in stock - order soon.

Ages: 14 - 14 years

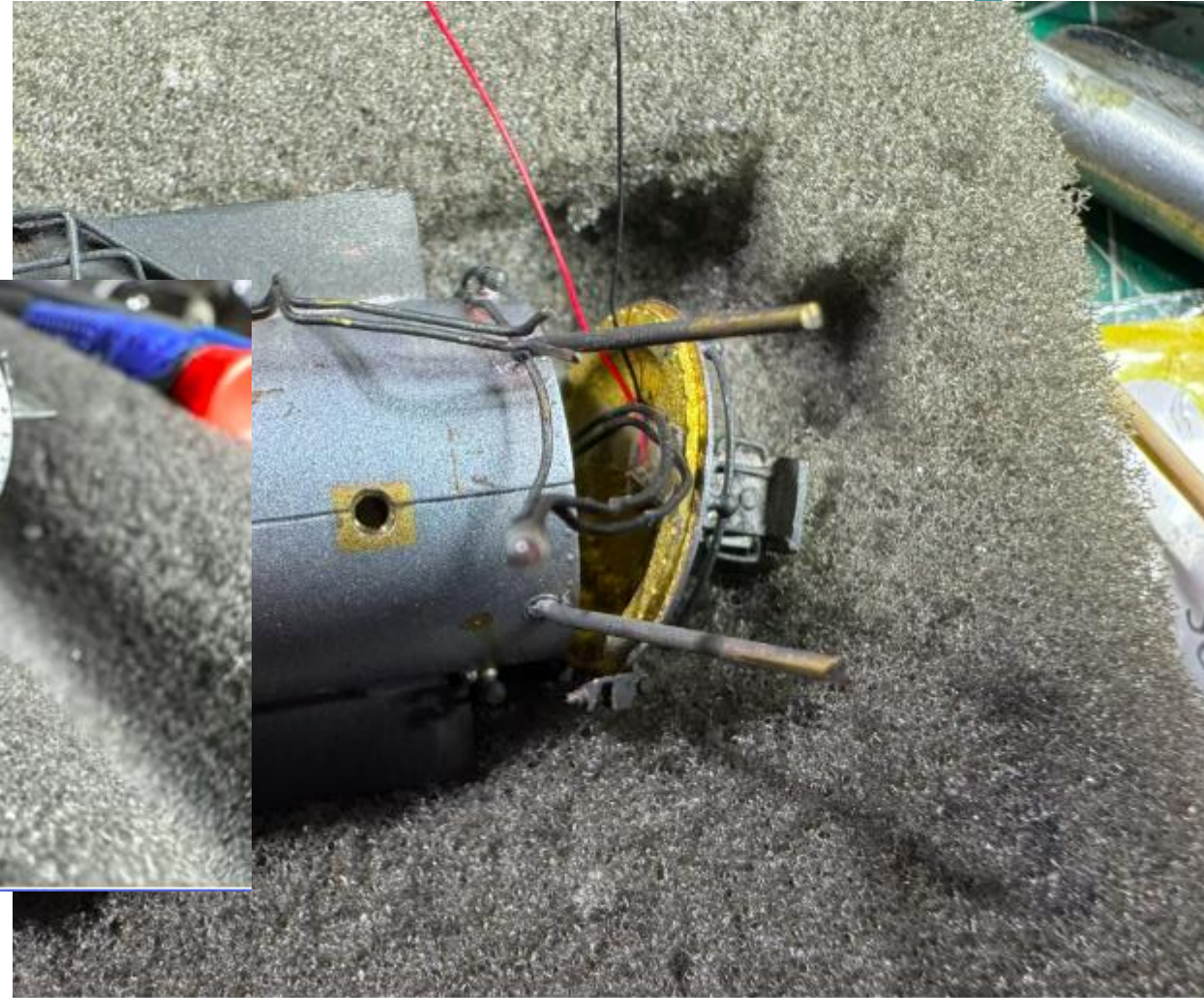
Add to cart

Lighting - Where to buy LEDs and resistors

<input type="checkbox"/>	  	<p>CF18JT2K20 RES 2.2K OHM 5% 1/8W AXIAL <i>Stackpole Electronics Inc</i></p>	<p>145,010 In Stock 70,000 Factory </p>	<p>1 : \$0.10000 Cut Tape (CT) 5,000 : \$0.00730 Tape & Reel (TR)</p>
<input type="checkbox"/>	  	<p>CFR-12JB-52-2K2 RES 2.2K OHM 5% 1/6W AXIAL <i>YAGEO</i></p>	<p>2,271 In Stock</p>	<p>1 : \$0.10000 Bulk</p>
<input type="checkbox"/>	 	<p>RN55D2201FB14 RES 2.2K OHM 1/8W 1% AXIAL <i>Vishay Dale</i></p>	<p>2,487 In Stock</p>	<p>1 : \$0.44000 Bulk</p>
<input type="checkbox"/>	  	<p>CFR-12JR-52-2K2 RES 2.2K OHM 5% 1/6W AXIAL <i>YAGEO</i></p>	<p>8,961 In Stock</p>	<p>1 : \$0.10000 Cut Tape (CT) 5,000 : \$0.01231 Tape & Reel (TR)</p>

DigiKey Electronics
<https://digikey.com>

Lighting - Tips



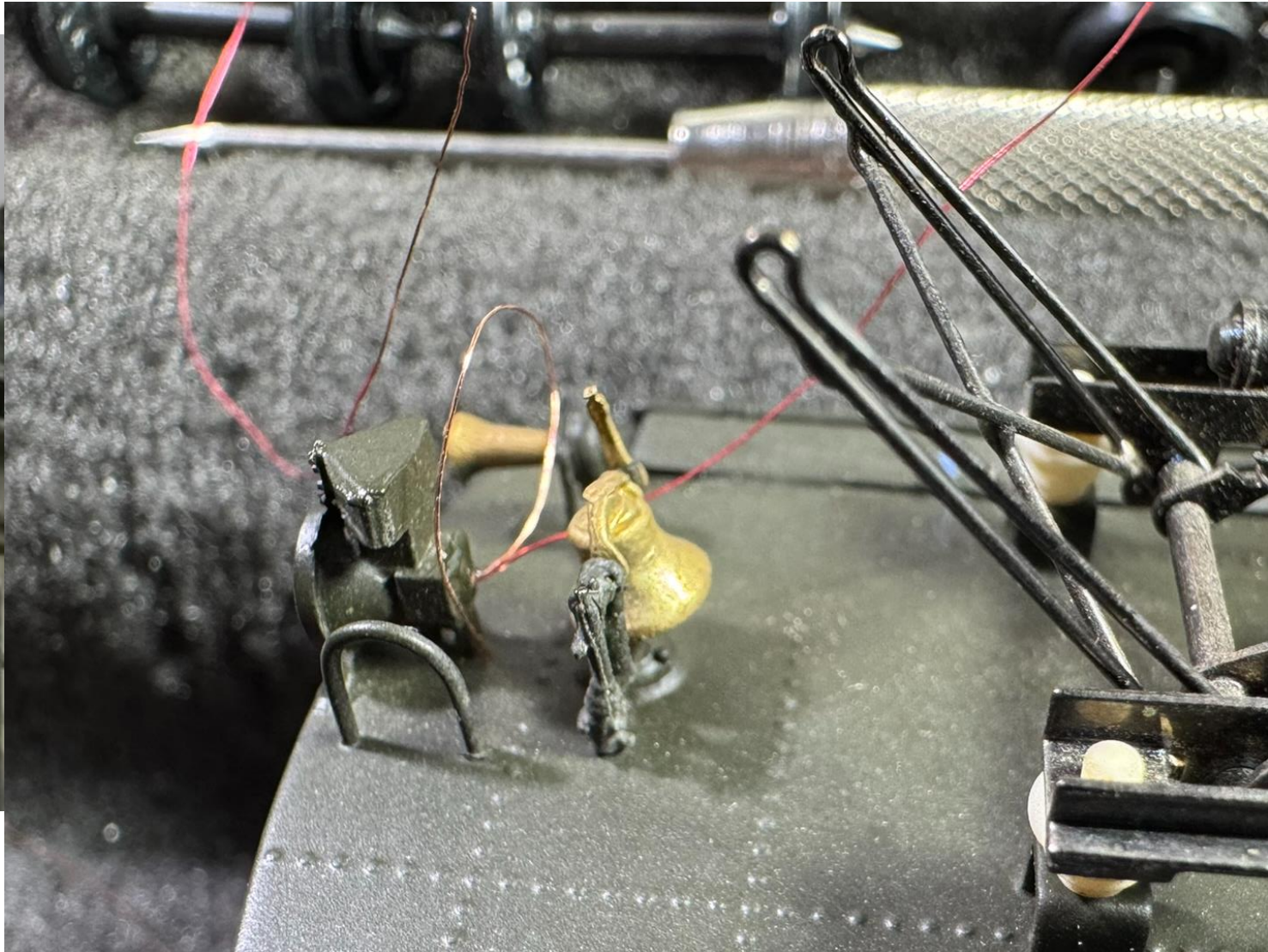
Lighting - Tips



Lighting - Tips



Lighting - Tips

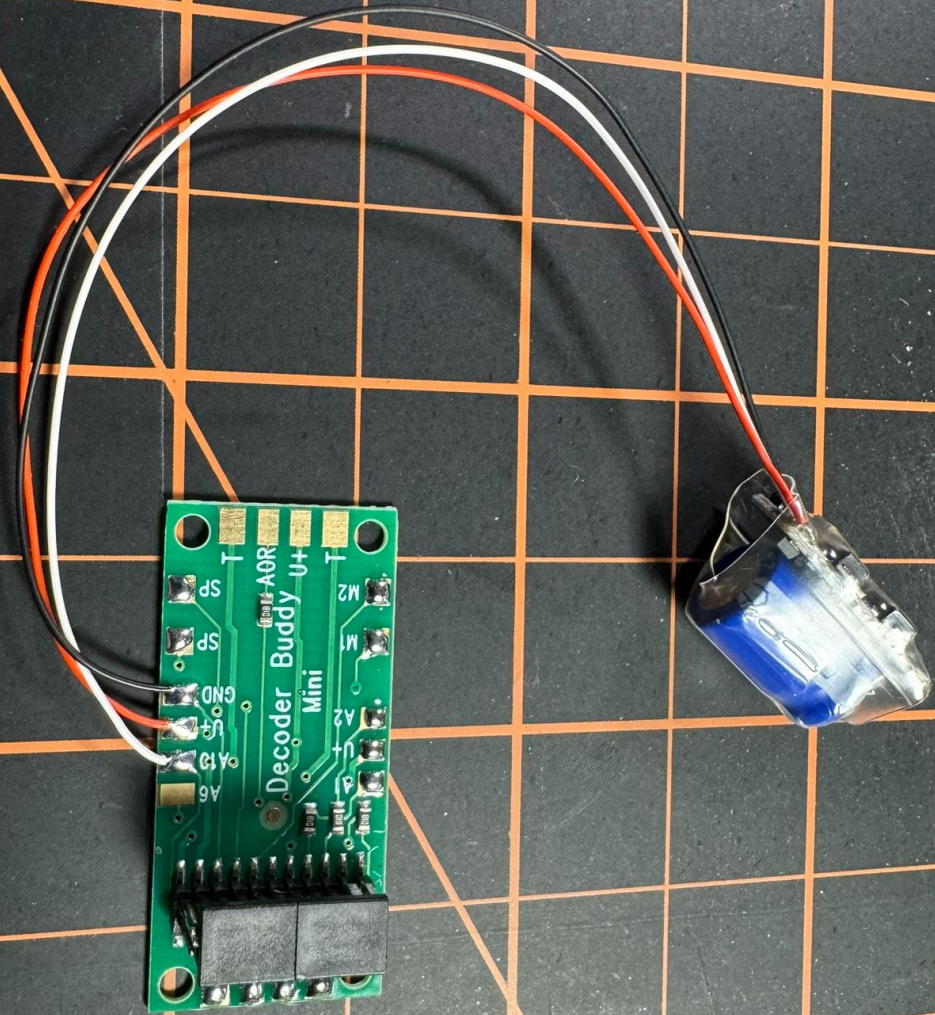


Lighting - Tips



Lighting - Tips





Electronics

Where to place the Electronics?



For steam locomotives, either the tender or boiler, where space allows
NOTE: the sound effect is best when the boiler sounds come from the boiler.

For diesel locomotives, mount the electronics on the frame if possible; use the shell for mounting if the frame installation is not practical.

Where to place the Electronics?

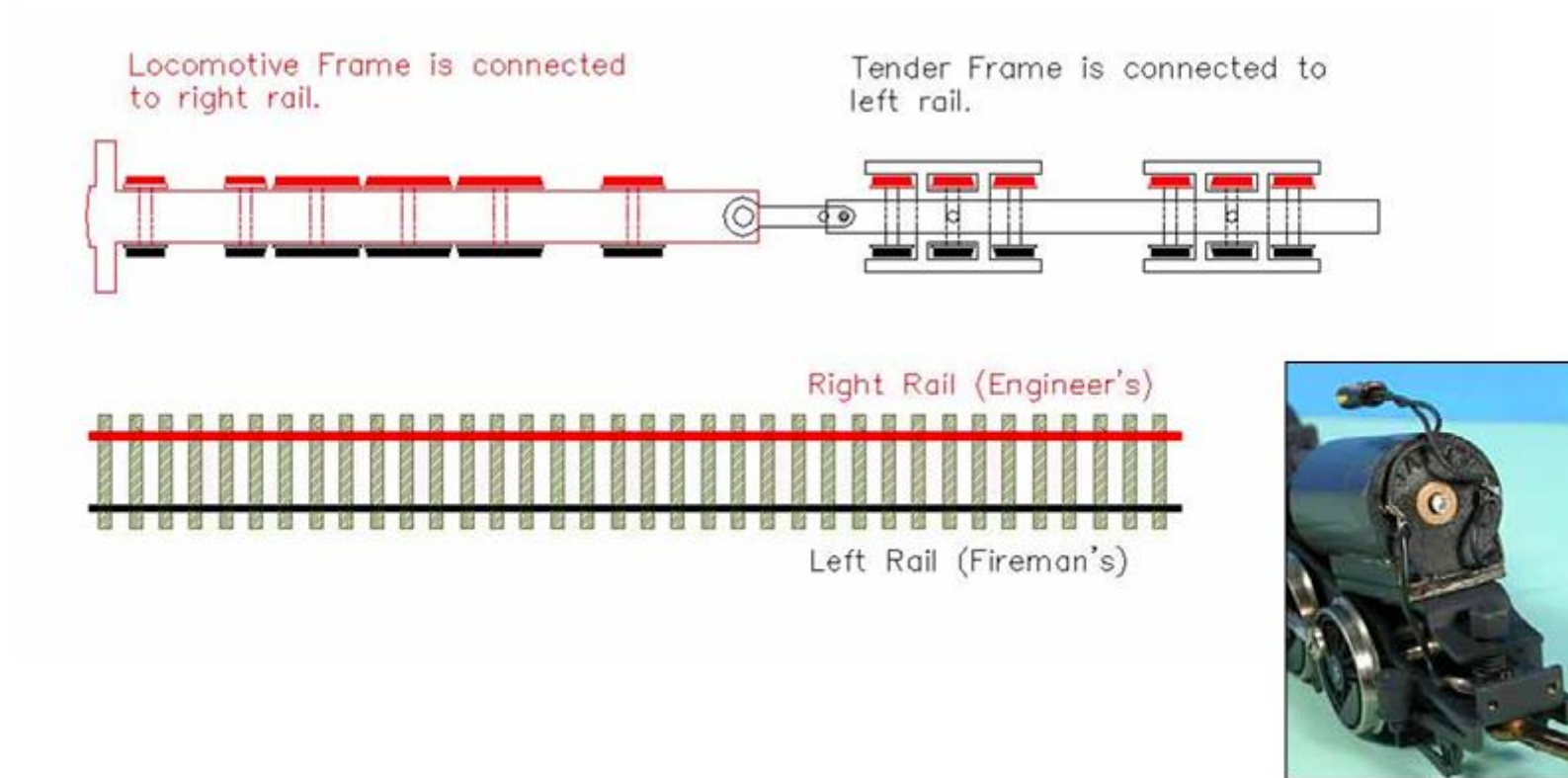
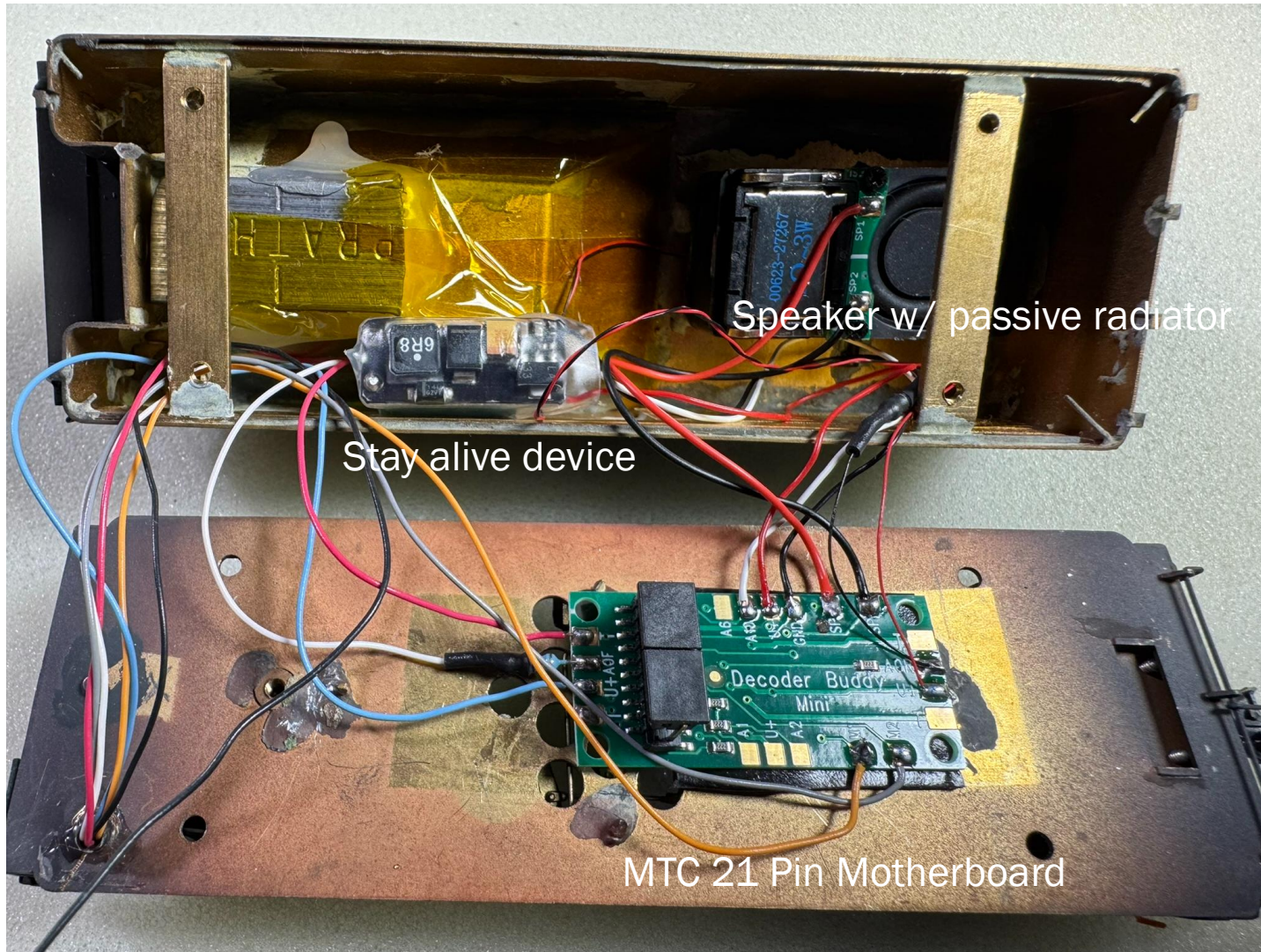


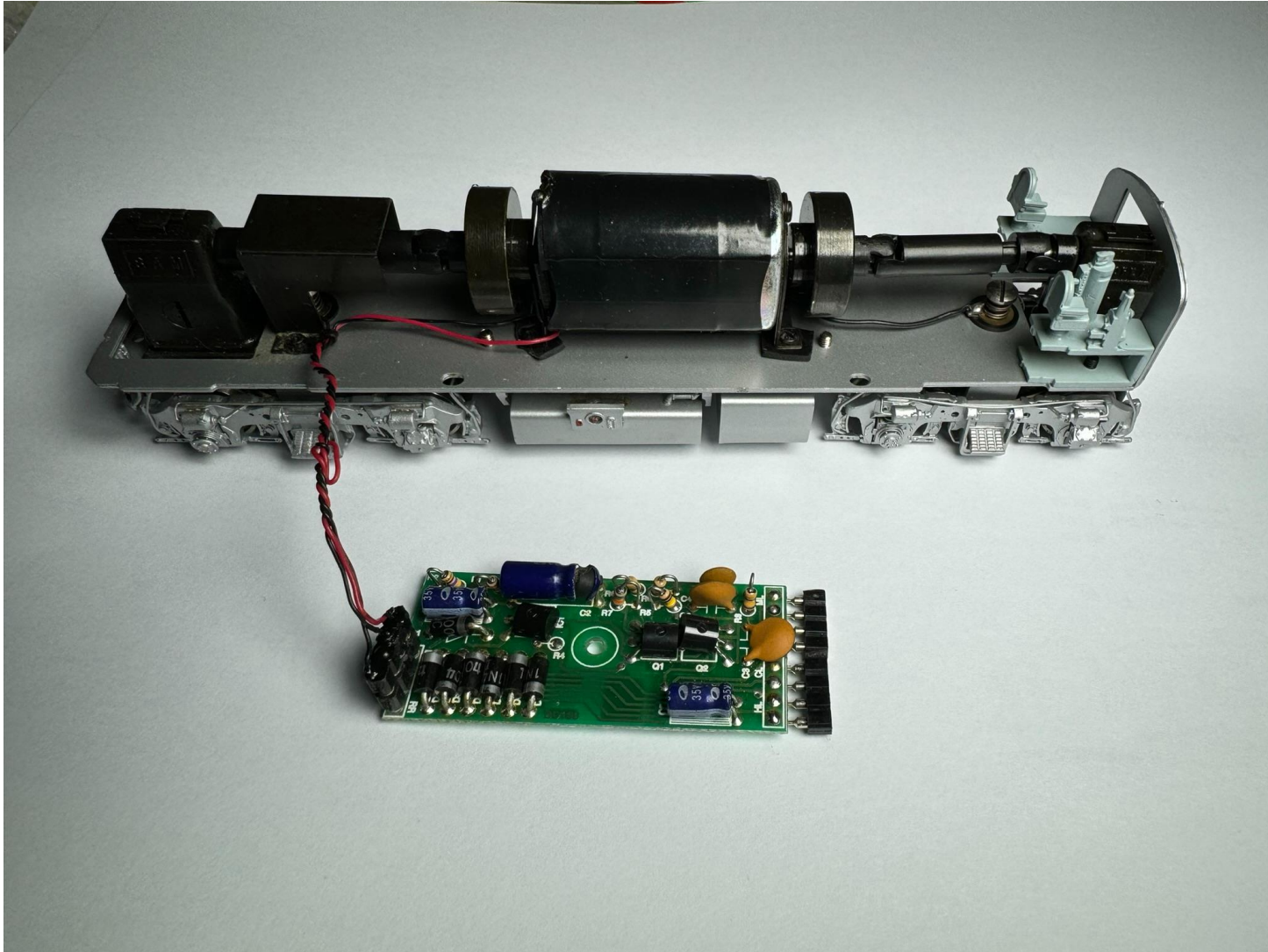
Image courtesy of Mark Schutzer (<https://markschutzer.com>)

Where to place the Electronics?



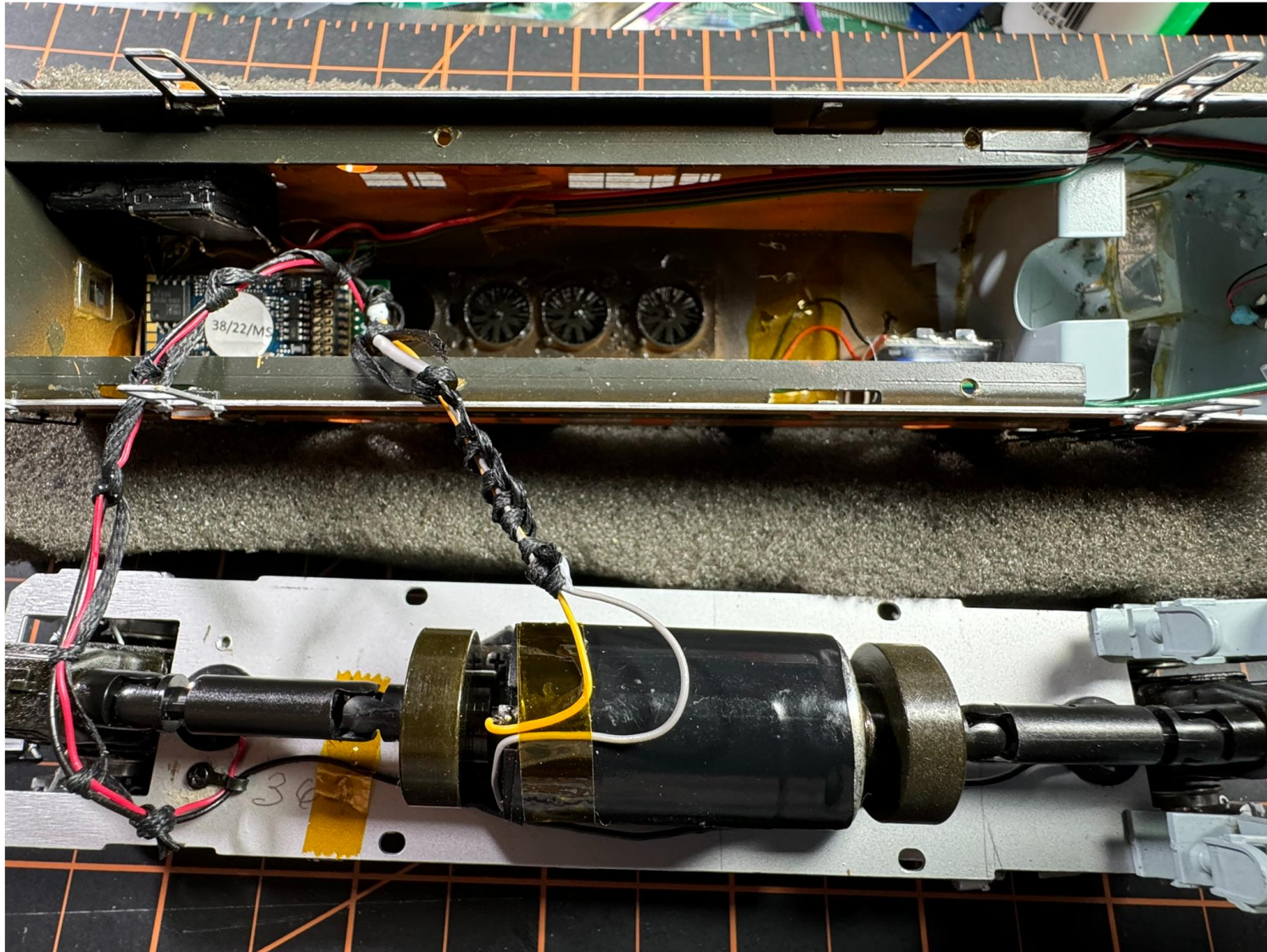
**steam locomotive
tender**

Where to place the Electronics?



diesel locomotive

Where to place the Electronics?



**diesel locomotive
shell**



Sugar Cube Speaker

Decoder Buddy and ESU
21 pin decoder

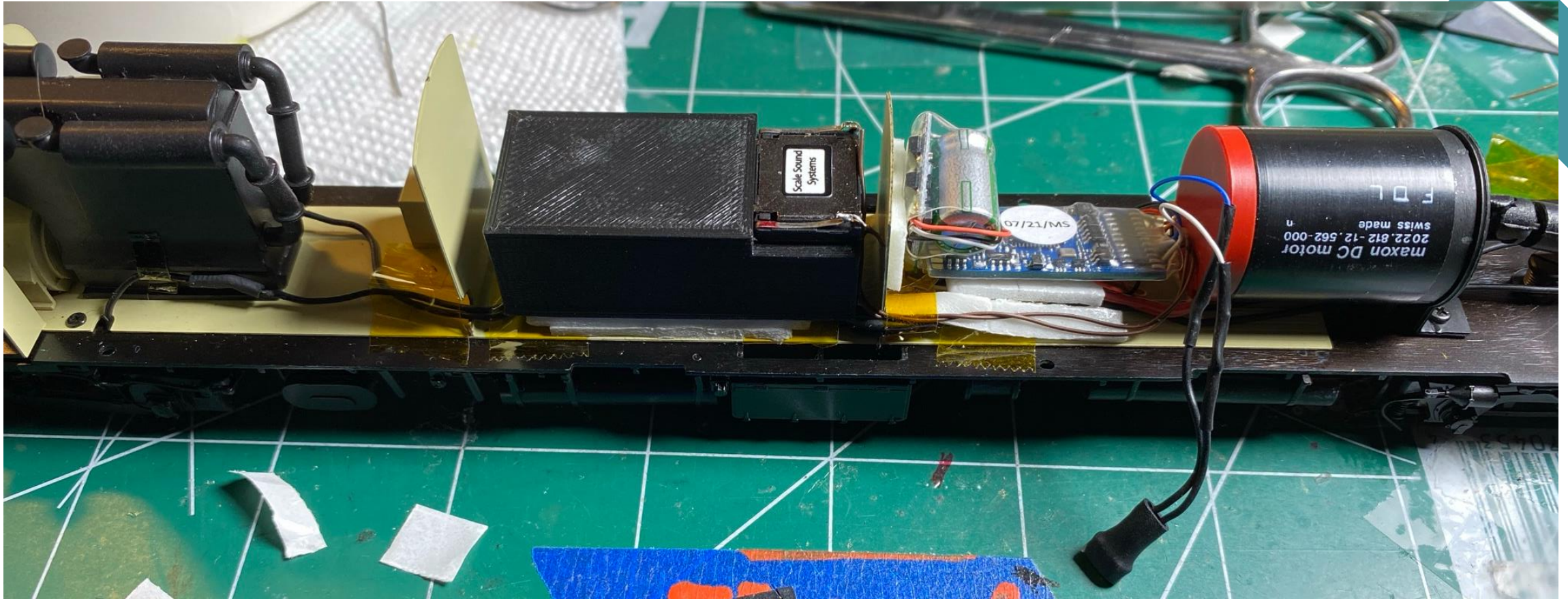
ESU Power Pack




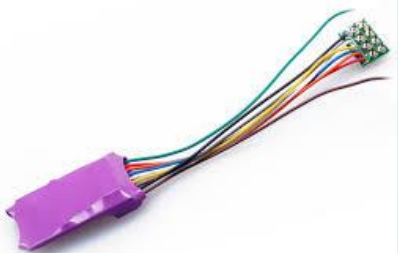

Where to place the Electronics?



Where to place the Electronics?



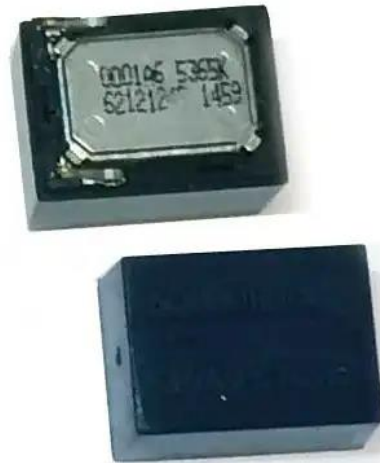
Various Decoder types

 A small blue printed circuit board (PCB) with various electronic components. It features a gold-plated 18-pin connector on the right side. The text "ESU LSSN" is visible on the board.	<p>Next 18 – can fit smaller locos; requires mating motherboard or wiring harness; good for N, TT, HO, OO scales</p>
 A small green PCB with a purple plastic connector housing on one end and several multi-colored wires extending from the other end.	<p>Shrink-wrap decoder with leads; some may come with NMRA 8-pin connectors or without for direct hard wiring; sizes vary from types supporting N, TT, HO, OO, S and other scales.</p>
 A blue PCB with a white circular label in the center that reads "SWT1/60". It has a 21-pin connector on the right side and various components on the board.	<p>MTC-21 pin – the most common, recommended decoder type for HO scale; can be used in OO, S and O gauge units that draw less than 1 amp stall. Used with a variety of wire harnesses and motherboards for connectivity.</p>

Speakers



Bowser 691-1294



SoundTraxx #810154



ESU - 50345 4 ohm, 50347 8 ohm



Streamlined Backshop Speakers




Scale Sound Systems Round Speakers

Adding Electrical Pickups



Stay-alive units (temporary energy storage devices)



Highly recommended for brass locomotives!

Greatly improves power pickup and operation

Better alternative to adding more pickup shoes/wipers to locomotive wheels

Resolves issues with dead-frog turnouts

Stay-alive units (temporary energy storage devices)



Active Type



Passive Types



Stay-alive units (temporary energy storage devices)

Active Types – have an electronic control circuit and can be controlled by the connected decoder

Passive Types – are fundamentally capacitor arrays that may have a few additional components but are always in the circuit (cannot be turned off).

Wiring Harnesses Types

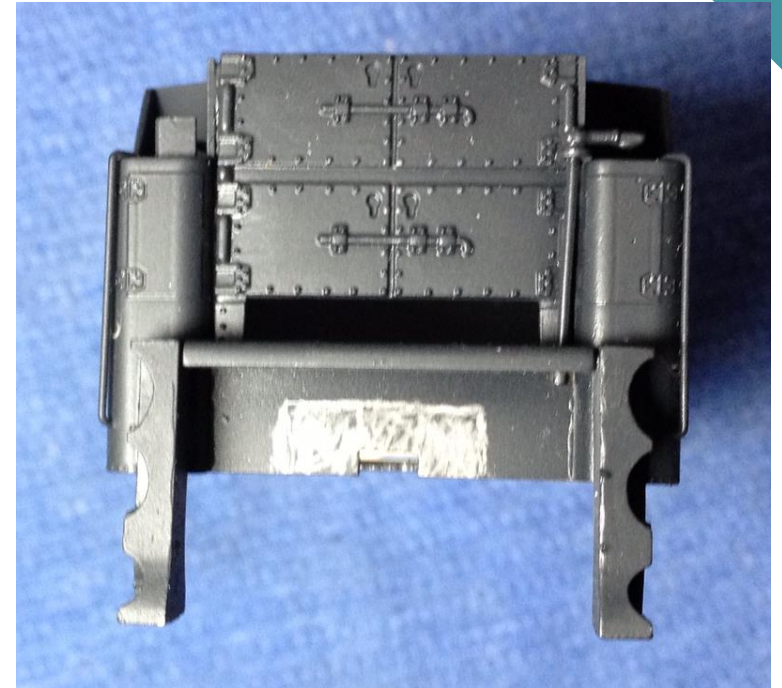
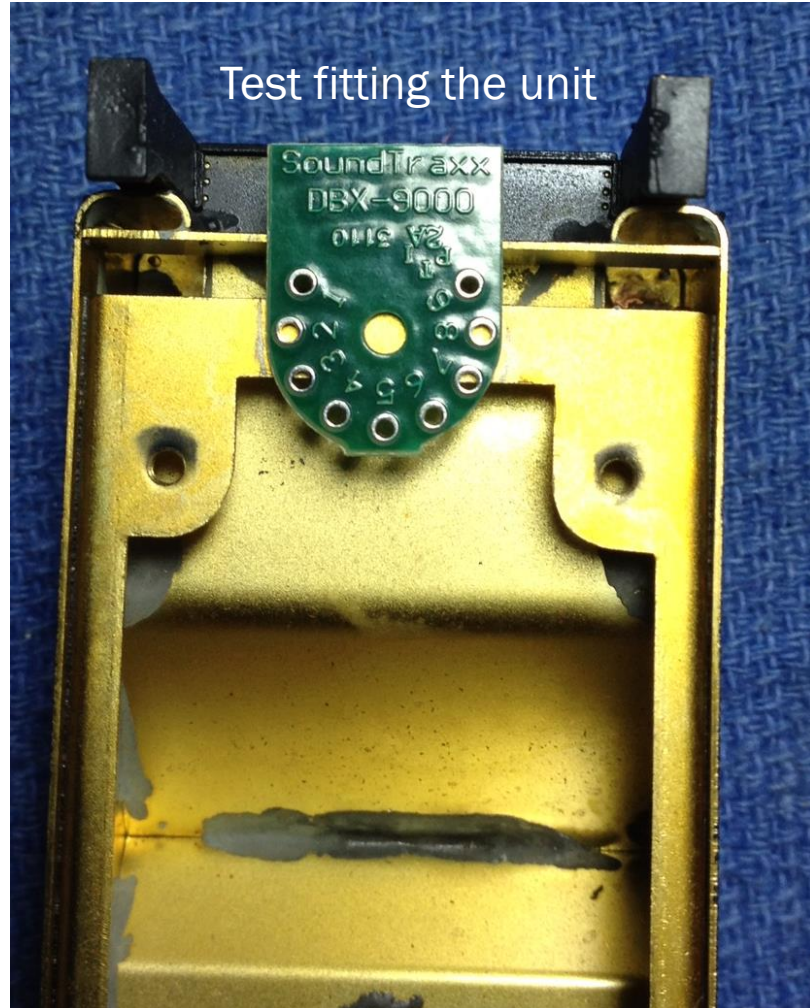
1. Homemade harness
2. OEM harness
3. Accessory /decoder manufacturer harness



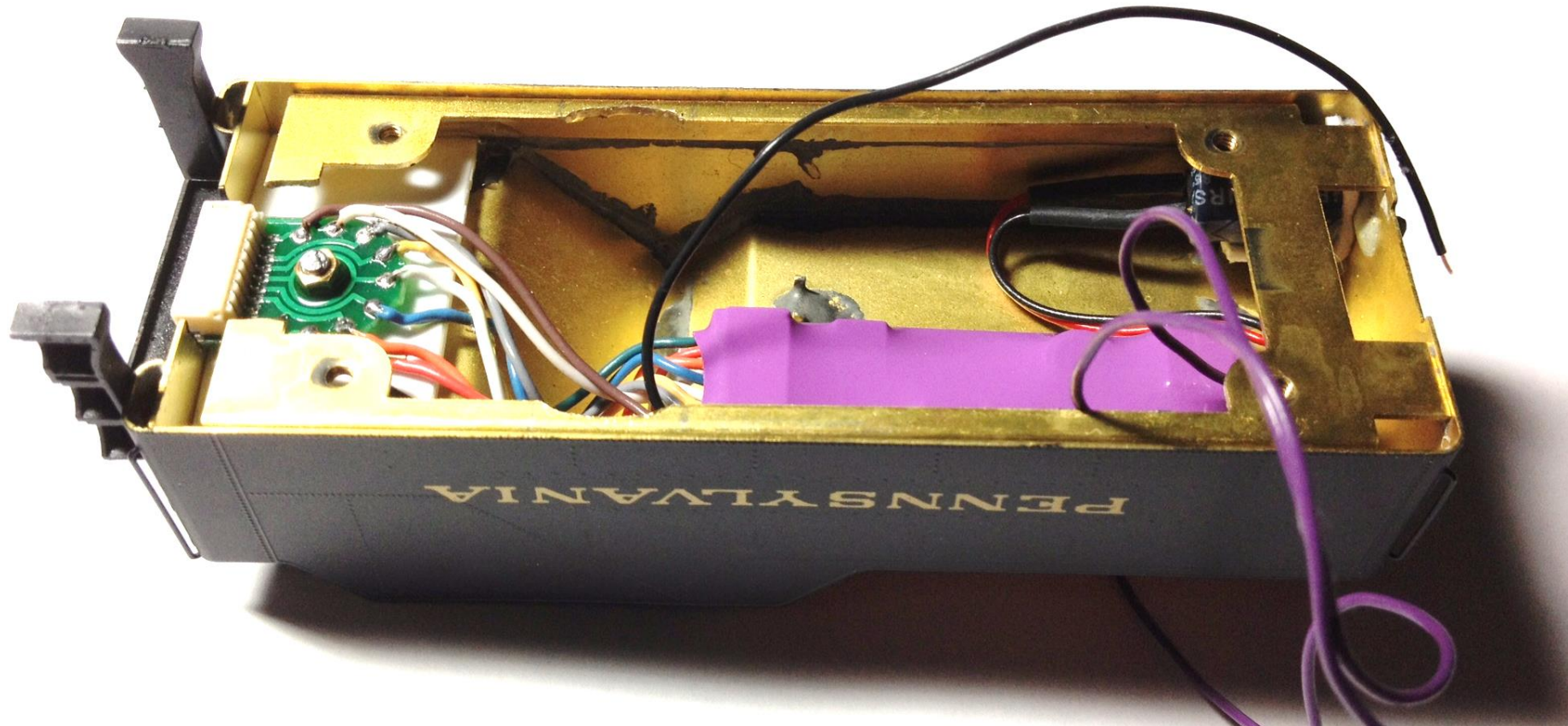
Wiring Harnesses Types



Wiring Harnesses Types



Wiring Harnesses Types



Wiring Harnesses – Where to buy



- TCS: <https://tcsdcc.com>
- Scale Sound Systems: <https://scalesoundsystems.com>
- Digikey: <https://digikey.com>
- Miniatronics: <https://miniatronics.com/collections/micro-mini-connectors-1>
- Local Hobby Shop (ESU, Soundtraxx, others)

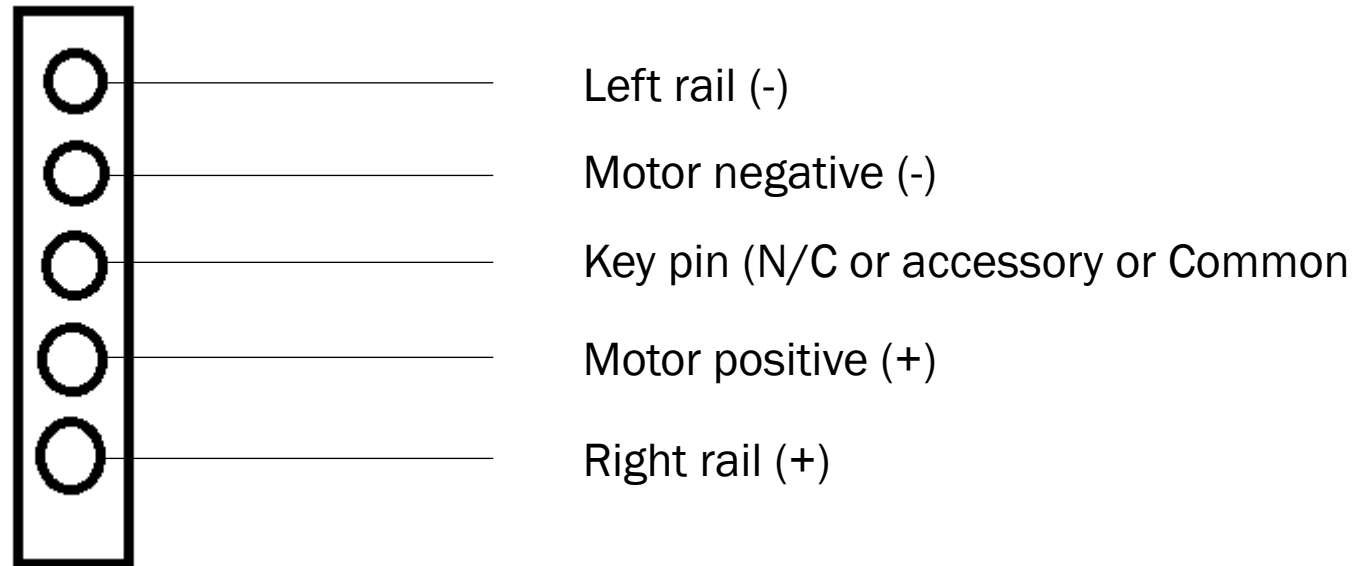
Wiring Harness - Tips

1. When possible follow the NMRA color code (S-9.1.1)



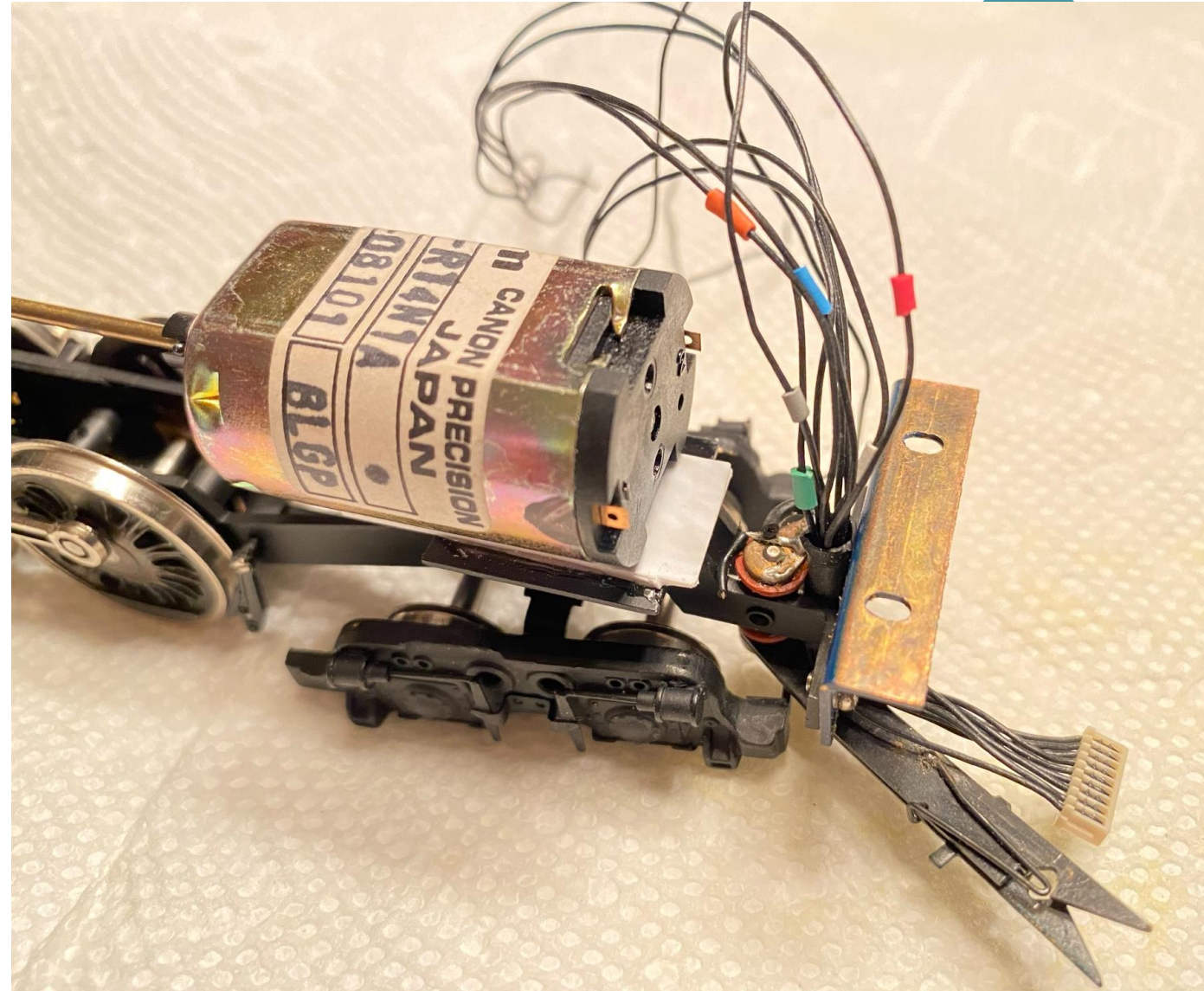
Wiring Harness - Tips

2. Use odd number connectors and/or wire them so an accidental reverse connection will not hurt the decoder or LEDs



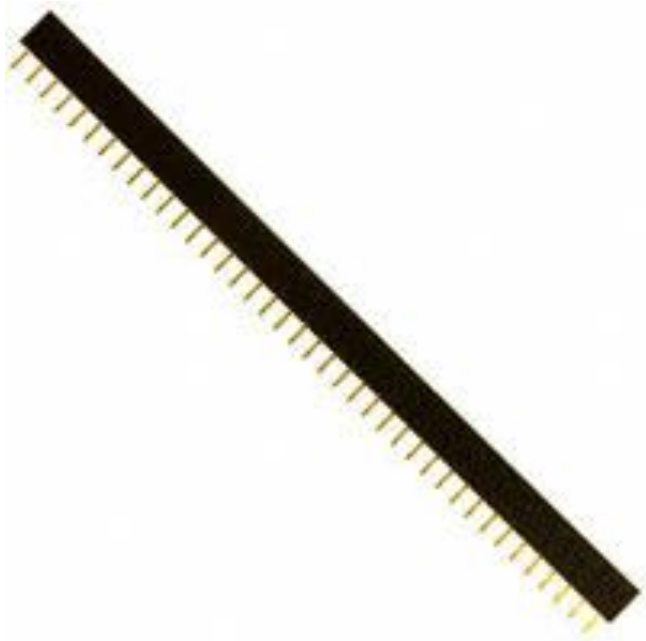
Wiring Harness - Tips

3. If all the wires are the same color in a harness, use bits of colored heat shrink tubing to identify them.

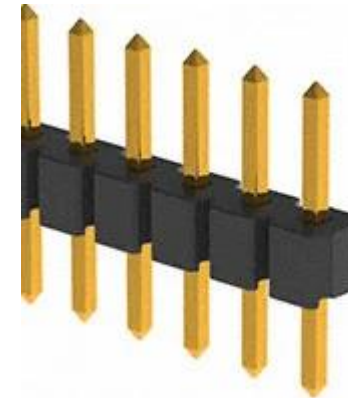


Accessories/Fasteners/Adhesives

<https://digikey.com>



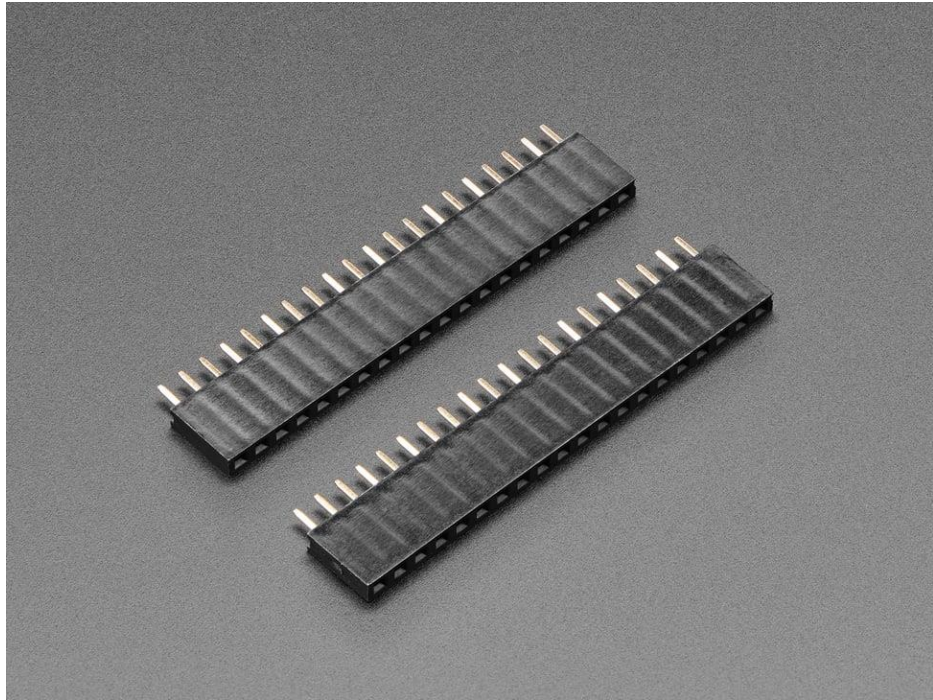
40 Position Header Connector 0.079" (2.00mm)
Through Hole, [Digikey Part # S5751-40-ND](#)
Price: \$2.88 each (quantity discounts)



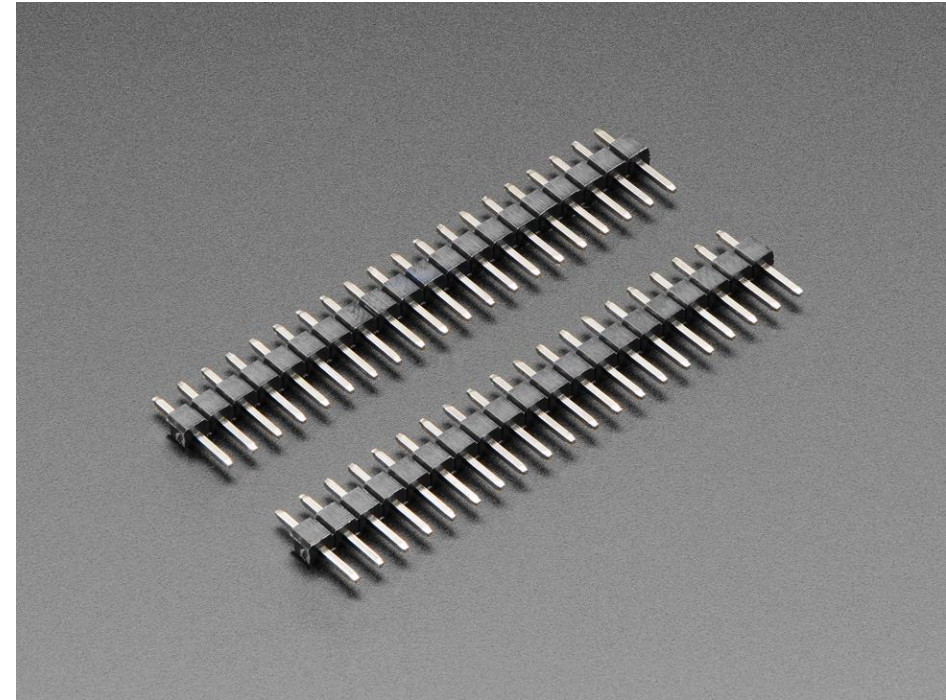
Connector Header Through Hole 40 position 0.079"
(2.00mm), [Digikey Part # S5800-40-ND](#)
Price: \$1.05 each (quantity discounts)

Accessories/Fasteners/Adhesives

<https://adafruit.com>



Socket Headers for Raspberry Pi Pico - 2 x 20 pin
Female Headers
Product ID: 5583
\$0.95



Short Plug Headers for Raspberry Pi Pico - 2 x 20
Male Headers
Product ID: 5584
\$0.95

Final tips & takeaways

- If you are new to installs, try a non-brass install first
- Join DCC groups on Groups.io and Facebook
- Check out Mark Schutzer's website; <https://markschutzer.com>
- Check with your local model railroad clubs for members with DCC experience.
- Take your time; try not to rush the install.
- Have fun!



Thank you

<http://www.dccgeek.com>