

DESIGNED BY 

Proto-DCRU(WD) Electronic Reverse Unit Installation Instructions

DCRU means DC motor Reverse Unit and is designed specifically for 'O' Gauge and 'S' Gauge locomotives that are equipped with DC or "Can" motors. The "-WD" suffix means it is specifically designed for one or two motor diesels using DC Can motors, such as Williams, Weaver, MTH, Kline, Lionel and others.

Like its companion reverse unit for Lionel AC motors (the ACRU), DCRU's provide the familiar forward-neutral-reverse direction sequencing and the three second reset capability to allow multiple headed trains. Both the ACRU and the DCRU use two heavy duty 10 Amp relays (large square parts on top of circuit board) to control the train direction. In addition, the DCRU has special electronics to provide excellent low speed control for operation with AC train transformers. There are a number of versions of the DCRU which are different in size and current rating but all are connected to the DC motors in the same manner.

All DCRU's are easy to install. Use the diagram and follow the simple steps listed below:

1. Remove any reverse unit that is installed.
2. Mount the DCRU-WD on the chassis with the bridge rectifier (black square part on the back of the circuit board) against the metal chassis surface. See page two for specific mounting instructions.
3. Solder the color coded wires to the motors, rollers and chassis ground as shown in figure 1. If your engine does not have two motors, tape the ends of the extra blue and yellow wire to prevent shorting to anything and coil them up under the DCRU-WD to store them out of the way. Connect the brown wires to ground using any convenient connection on the motors or trucks. See page three.

Except for the mounting screw, make sure no metal from the chassis, loose wire ends or any other metal parts can contact the DCRU circuit board or any of its electronic components.

4. Test the unit on the track using the directions on page 4.

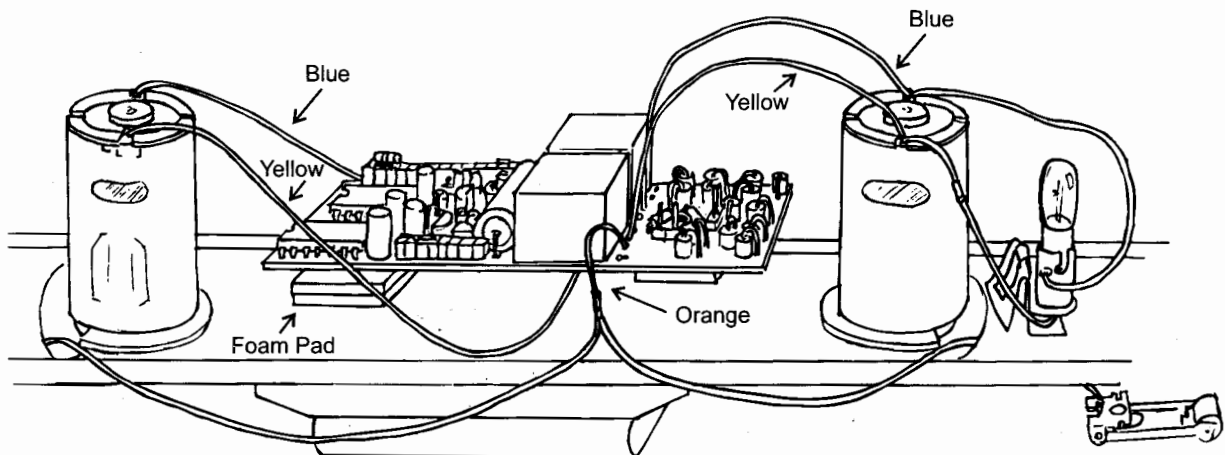


Figure 1: Wiring the DCRU-WD into a diesel chassis

Positioning and Mounting the DCRU:

A number of electronic power devices have been included on the DCRU circuit board to match the high voltage range from powerful three rail train transformers (like the type ZW) to the lower voltage requirements of DC "Can" motors; this allows excellent low speed performance at low voltage settings and also prevents over-loading the motors at high settings. Since the motor current flows through these devices, the area around the bridge rectifier (square black part on back of circuit board) can get warm. It is important to mount the unit with the bridge against a metal surface to dissipate the excess heat and it is advisable to avoid having this area of the board directly contact any plastic parts on the locomotive.

To mount the DCRU-WD in a Williams diesel place the unit between the two motors (or lead weights if installed) and mark the location of the bridge rectifier hole on the chassis with a pencil or scribe. It is a good idea to adjust the location of the mounting hole to cause the least interference with the fuel tank or other under-body detail parts. Set the DCRU aside and drill a #32 hole (1.8" drill bit is also acceptable) through the chassis (and fuel tank if necessary). Once drilled, position the DCRU rectifier over the hole and insert the 4x40 machine screw from underneath the chassis through the hole and bridge rectifier and into the pressed-in nut on the circuit board. Cut the double sticky foam tape into two square sections and attach under the area farthest from the relays on the DCRU-WD (see figure 1) to support the board when it is screwed down. Do not remove the protective sheet from the bottom of the pad until you have tested the unit as described on page four.

Planning ahead for option boards:

The DCRU and ACRU are designed to accept electronic "option boards" that will plug into the unit as shown in figure 2. These boards will include sound effects (horn, bell, diesel motor, etc.) and other remote control effects. It is best to leave enough room to mount these extra electronic boards when you install the reverse unit. The diagram shows the extra dimensions required. It is also a good idea to leave as much as possible for a speaker. The speaker can be mounted in the custom fuel tank or inside the engine cab.

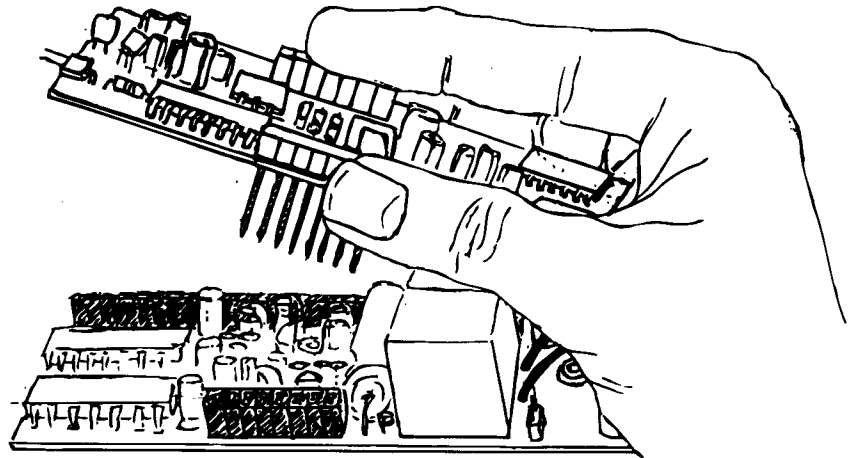


Figure 2

Permanent Installation:

Now that you are satisfied with the operation of your engine, remove the mounting screw and remove the protective sheet on the foam pad. Make sure that the reverse unit is aligned properly over the mounting hole before you press the foam pad to the chassis -it sticks like crazy.

Wiring the DCRU-WD:

After the DCRU-WD has been positioned, simply follow the wiring shown in figure 1:

1. The orange wires connect to the roller pickups. Any headlights or accessories (horn, etc.) that require power from the center rail should also be connected to the rollers. Use the heat shrink provided to cover the common joint.
2. The brown wire connects to chassis ground. Use the ground lug provided for a terminal connection. Attach the ground lug with any convenient screw that is already installed on the chassis or drill a new hole and mount the solder lug with a #2 machine screw and nut (not provided). On older Williams engines containing Pittman motors, you can attach the brown wire to the mounting screw on the top of the motor case. On newer engines the brown wires can be soldered directly to the motor case. To insure the best possible ground connection, slice the brown wire and attach to both motor cases.

3. Attach one yellow and one blue wire to each motor as shown. The motor brush connections on the right side of the engine are attached to the same color wire. Likewise the brush terminals on the other side of the engine are attached to the other color wires.

Connecting up the Headlights:

If your Williams engine already has directional headlights wired to the two motors, leave these connections in place when you connect up the DCRU-WD as shown in figure 1. If you prefer that the front headlight stay on in all states (Neutral, forward and reverse) then disconnect the front headlight wires to the motor, remove any fiber paper or plastic insulator from the chassis metal tab under the lamp base and connect the bulb wire directly to the roller connection. Note that the directional headlights may be less brilliant than before the DCRU-WD was installed since the voltage to the motors is reduced by about 2v at low transformer settings. You may consider putting in a lower voltage bulb.

Constant Brightness Reverse Lighting:

This DCRU-WD reverse unit is equipped with a power supply for constant brightness directional reverse lighting that easily plugs into pins on the DCRU-WD as shown below. The kits are available at a nominal cost from ProtoSound Electronics or authorized dealers and include a special 1.5 volt GOR (Grain of Rice) bulb, wires with plug. The lighting is bright even at the lowest transformer settings. Reverse lighting is appropriate for all engines that have back-up lights such as FM's, SD-45's, and the reverse facing F7 in F unit pairs.

Lighting Installation:

The 1.5v GOR bulb in this kit provides a brilliant and concentrated light that is designed for only one light lens fixture; It is not intended to light up all the number boards, marker lights and other lights that may be on the rear of the diesel locomotive. The best advice is to leave the normal bayonet lamp in place and wired to be on in all directional states as described above; this way the number boards and marker lights remain lit but the reverse light only comes on in reverse.

One way to mount the GOR lamp is to tape the bulb directly behind the lens in the cab or drill a small hole in the lens to allow the bulb to face directly forward. Next connect the lamp wires to the wire and plug assembly and use the enclosed heat shrink to insulate the connection. You can add any number of bulbs in parallel up to four bulbs. Now push the plug directly onto the pin connector on the circuit board as shown in figure 3.

Before cutting the wires to shorter lengths, check to be sure you left enough wire to allow full side to side movement of the motor/truck assembly.

The special high flexibility wires connected to the DCRU-WD are manufactured with a large number of very small diameter wire strands. Do not strip the wire ends over the DCRU-WD where small pieces of these wire strands might fall on the circuit board.

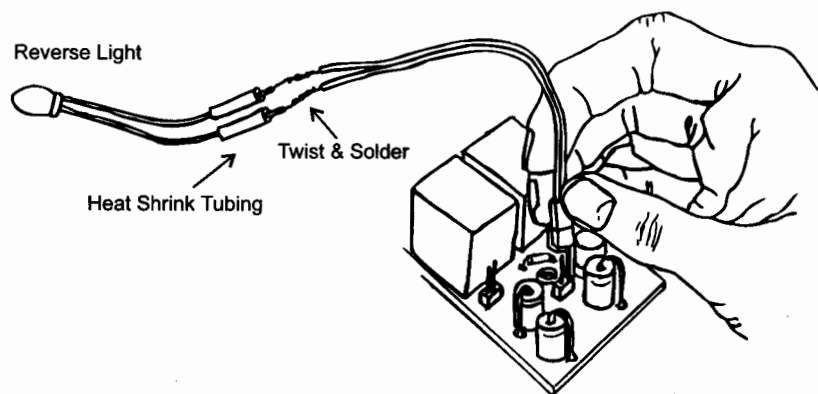


Figure 3: Directional Reverse Lighting

DO NOT RUN YOUR ENGINE YET!

Now that the DCRU-WD is securely fastened to the chassis and all wires connected, take the time to:

1. Check to be sure all loose wires are insulated with tape or heat shrink..
2. Look for and remove any solder that may have splattered onto the DCRU-WD while you were soldering the wires.
3. Make sure no small pieces of wire were dropped into the DCRU-WD when the wire ends were stripped.
4. If you mounted the DCRU-WD with a screw, be sure you used only the screws and spacers provided.
5. Double check that the DCRU-WD is physically secure and cannot come loose.

You are now ready to test your engine and DCRU-WD.

Testing and Operation:

Place the locomotive on the track and turn on the power. The DCRU-WD comes tested from the factory and will start in neutral (before forward) when first powered up. Your subsequent interruptions of track power will produce the familiar Forward-Neutral-Reverse-Neutral-Forward sequence. Note that quick interruptions of the track power may not cause the engine to change directional state. This because the DCRU has a built-in time delay which prevents it from changing directional state from momentary interruptions of power from dirty track or switches. This means you will need to hold the direction button down a little longer in order to change to the next direction

Whenever you turn the power off for three seconds or more, the engine will "reset" to "Neutral Before Forward". This reset feature allows you to run multiple-headed trains by insuring that all engines of the train will start up and go through direction changes in synchrony.

Trouble Shooting:

The following list of problems and solutions may be useful if your engine does not behave as described above.

- * Engine Motors run but locomotive does not move or lacks power: One motor is not connected or the two motors may be running in opposition to each other. Swap the brush terminal connections on one motor.
- * Engine resets to "Neutral Before Reverse": The yellow and blue wires that come from the DCRU-WD should be swapped at the brush connections on each motor.
- * Engine does not stall at the minimum transformer voltage: If you want your engine to run slower at the lowest throttle setting, turn the power off and remove mounting screw for the DCRU-WD. Turn over to reveal a wire strap. Cut this wire as shown in figure. Proceed to permanent installation.

Guarantee

This item is warranted for one year from the date of purchase against defects in material or workmanship. We will repair or replace (at our option) the defective part without charge for parts or labor. The item must be returned to us within one year of purchase and be accompanied with a proof of purchase and letter of explanation for the return. Our obligation is limited to the cost of the replacement unit only, any shipping charges incurred by the customer will not be covered. In addition, if within thirty days of purchase, you are not completely satisfied with your ProtoSound product, please return it to the retailer it was purchased from for a complete refund. Send all defective units directly to ProtoSound Electronics c/o MTH Electric Trains. If you would like to have the unit installed in your locomotive, please consult our list of qualified service centers. Call or write before you send your engine for upgrading.

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