

# HOW TO OPERATE LIONEL TYPE ZW "MULTI-CONTROL" TRAINmaster TRANSFORMER

115 Volts          60 Cycles          275 Watts  
Alternating Current Only

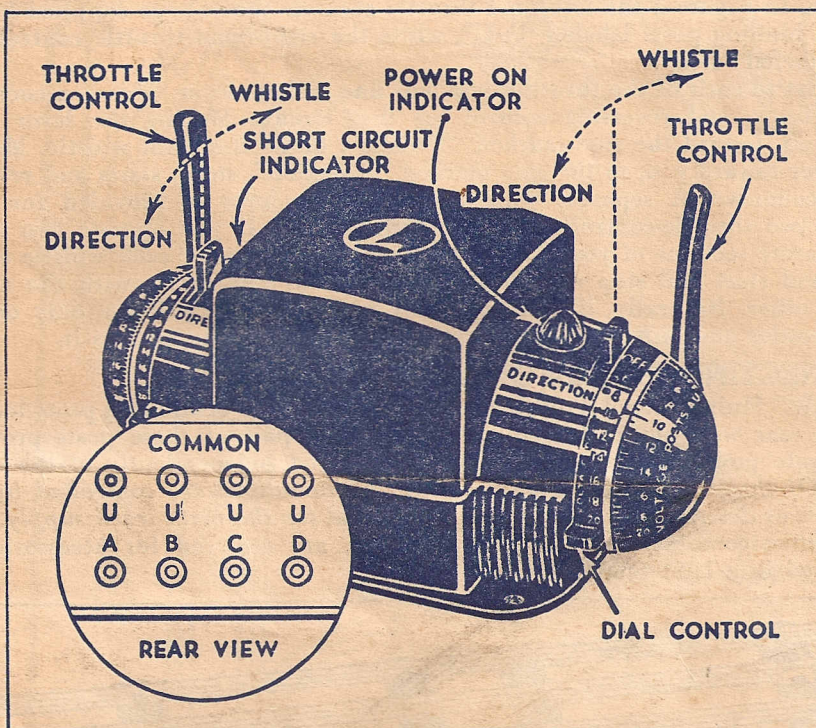


Figure 1—Type ZW "Multi-Control" Transformer.

Lionel electric trains operate on low voltage, ranging from 8 to 18 volts, depending on the size and type of the locomotive and the number of cars and accessories used. Lionel Transformers reduce, or *transform*, the available house voltage to the low voltage required. The plug at the end of the transformer cord is plugged into any convenient wall outlet of required voltage and frequency and the low voltage is then obtained from the output terminals at the rear of the transformer.

Type "ZW" Multi-Control Transformers are made to operate on 115-volt 60-cycle alternating current, which is the normal house power supply used in the United States. The wattage rating of the "ZW" Transformer is 275 watts. The wattage of a transformer is a measure of its *capacity*, or ability to furnish power. While your house current determines the rated voltage and frequency in cycles of the transformer, the wattage of the transformer you need is governed by the kind and number of trains and the number of lights and operating accessories in your model railroad system. The larger the train and the greater the number of accessories, the more power you need and the higher should be the wattage rating of the transformer. To assist you in planning your railroad

system, the Instruction Booklet lists the power in watts required by each Lionel locomotive and accessory.

## MULTI-CONTROL TRANSFORMERS

"ZW" Transformers have been given the name of "Multi-Control" transformers. This means that all the controls necessary for operating your locomotive and whistle are built into the transformer itself.

"ZW" Transformers are so designed that two trains can be operated and controlled independently of each other without any additional equipment. On each end of the transformer there is a long throttle-type lever. This is the speed control. By moving this throttle you can regulate the voltage supplied to the track so that the train can be gradually accelerated or retarded in a realistic fashion. In Figure 2 the left-hand throttle controls the voltage supplied by the output binding posts labeled "A-U", while the right-hand throttle controls the pair labeled "D-U".

Next to each of the throttles you will find a short lever. This is a combination whistle and reversing control for that circuit. Moving the lever away from you, toward the side marked "Whistle", blows the train whistle. Moving the lever toward you, to the side marked "Direction", stops, starts and reverses the locomotive. A separate whistle and reverse lever is provided for each of the two throttle-controlled train circuits so that if you operate two trains on separate sections of your model railroad you can sound each whistle separately and start and stop each locomotive without interfering with the action of the other. Naturally, if you have only one train you will use only one of the throttles and only the whistle and direction controller next to it.

## CONNECTING TRANSFORMER TO TRACK

"ZW" Multi-Control Transformers have four pairs of binding posts located on the rear wall of the transformer case. Each pair of these posts provides a separate power source which can be controlled independently of the other three. *Of these the "A-U" and the "D-U" combinations are controlled by the throttles as described above and should be used for the main track supply. The two center combinations, "B-U" and "C-U", are reserved for accessories as described in a later section.*

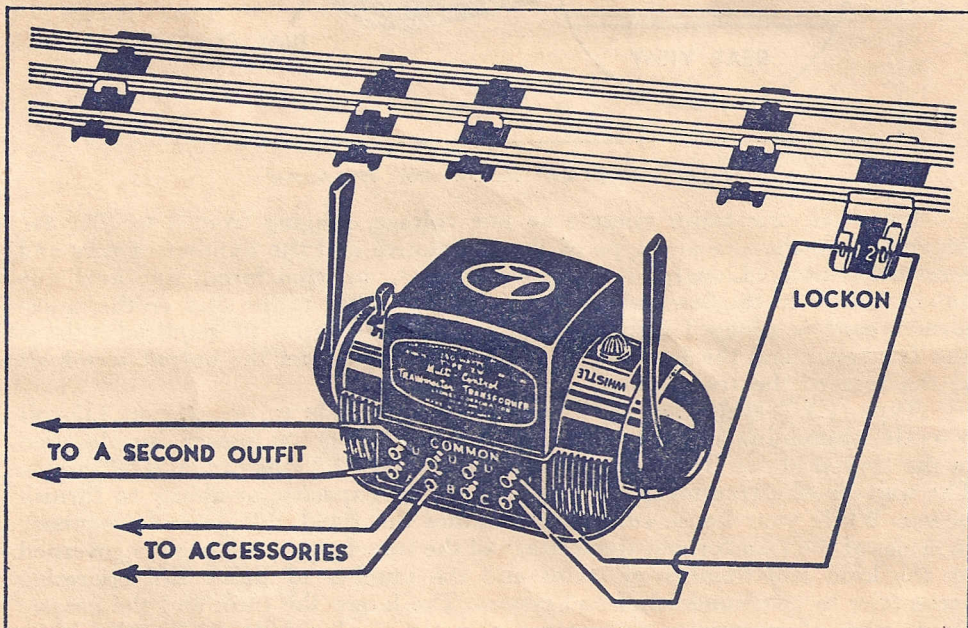


Figure 2—How to Connect the Transformer to Track.

In order to get current from a transformer to the track a pair of transformer binding posts must be connected to the track. This connection is generally made by means of a track Lockon, although in permanent installations the wires are sometimes soldered in place. The Lockon is clipped onto a convenient section of straight track and its terminals are connected to the binding posts by means of two lengths of insulated wire.

1. Strip the rubber insulation from the ends of two pieces of wire.
2. Wrap the end of one wire around one of the "U" binding posts of transformer and tighten thumb nut. Wire should be wrapped around post in clockwise direction, so that it doesn't slip out as you tighten the nut.
3. Connect other end of this wire to No. 2 Lockon clip. Push down upper half of clip until metal loop projects through the slot on top. Insert bare end of wire into this loop and release clip. No. 2 Lockon clip makes connection to the outside or "ground" rails of the track.
4. In the same manner connect No. 1 Lockon clip to either "A" or "D" binding post and tighten thumb nut. No. 1 clip makes connection to the center or "power" rail of the track.

After the transformer is properly connected to the track, push the plug at the end of your transformer cord into a wall outlet. The green pilot light on the transformer should now go on. This indicates that the power is flowing into the transformer and that you have no "short circuits."

## HOW THE CIRCUIT BREAKER OPERATES

To protect the transformer from overheating and damage due to short circuits "ZW" Transformers are equipped with built-in automatic circuit breakers. Whenever the current drawn from the transformer exceeds a certain limit the red warning light flashes on and the circuit breaker opens, cutting off power to the track. In a few seconds the circuit breaker automatically closes and the red light goes off. If, however, the short circuit which caused the overload still exists, the red light will go on again and the circuit breaker will reopen. This sequence will continue without damage to the transformer until the cause of the short circuit has been removed.

A short circuit is an excessive load on the transformer caused by a direct connection between the center rail and one of the outside rails. A derailed car or locomotive is the most frequent cause of a short circuit so make sure that all the wheels of locomotive and cars are properly set on the rails. If your transformer shows a short circuit even after all the rolling stock has been removed from the rails it is probably due either to incorrect wire connections or to broken insulation on the power rail.

It is important to understand that the purpose of the circuit breaker is to protect the transformer itself. It operates only if the transformer is overloaded. It is possible, therefore, particularly in very large layouts, for the track to be "shorted" without causing the circuit breaker to operate or the red light to flash. In this case, although the transformer voltage may drop below the operating point of the trains, the transformer will not be injured because it is not being overloaded beyond its safe limit.

**NOTE:** After your transformer has been operating for a while you will find it warm to the touch. It is the nature of all electrical power equipment to become warm when in use.

**WARNING:** Do not attempt to blow the whistle while there is a short circuit or you may damage the whistle controller.

## HOW TO CONNECT ACCESSORIES

While transformer binding posts "A-U" and "D-U" are reserved for train control, "B-U" and "C-U" are intended to supply power for lights, switches and other accessory equipment. The voltage supplied by these two combinations is regulated by the two dials located next to the throttle controls and

may be set to any figure indicated on the dial. Most illuminated accessories operate on 12-14 volts, while operating accessories work on voltage ranging from 10 to 16 volts depending on the condition of the accessory, the higher voltage being frequently necessary when the accessory is new and its working parts stiff.

To determine the proper voltage for your accessories connect the accessory terminals to "B-U" or "C-U" posts of your transformer and slowly move the corresponding dial control from zero to the point where you get the desired brightness of illumination or satisfactory operation of the mechanism. Be careful, particularly in the case of illuminated accessories, not to set the voltage too high, or you will burn out the lamps. If you operate with the lowest voltage possible you will greatly extend the life of your lamps and other equipment. In the event that you have several accessories requiring the same voltage, it is possible to use the same transformer binding posts for all. A simple method for wiring a number of lights, etc. in "parallel" is shown in Figure 4. Two "feeders" to the transformer and individual leads from the feeder to each accessory eliminate unnecessary wiring. If your railroad is operated on a table or platform, the feeders may be concealed by attaching them underneath the platform and boring small holes for leads to each accessory. Remember that if two or more 12-volt accessories are wired together in "parallel", the voltage required is still 12 volts regardless of whether two, three or more accessories are so connected.

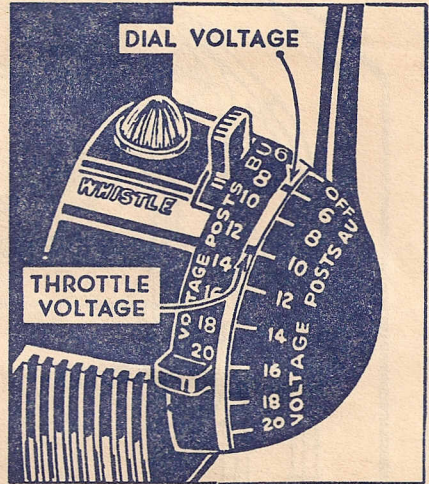


Figure 3—How to Read Voltage. Top Line Indicates Dial Voltage; Bottom Line Throttle Voltage. In this case the Accessory Voltage is Set at 8 Volts While the Track Voltage is 10 Volts.

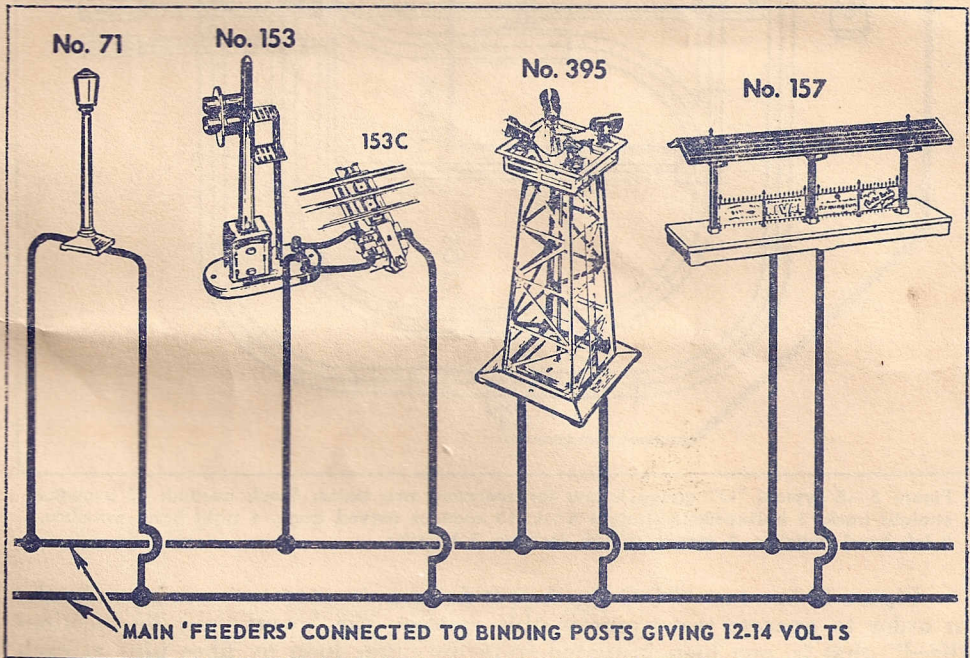


Figure 4—How to Connect Accessories in "Parallel."

## HOW TO OPERATE A TYPICAL TWO-TRAIN LAYOUT

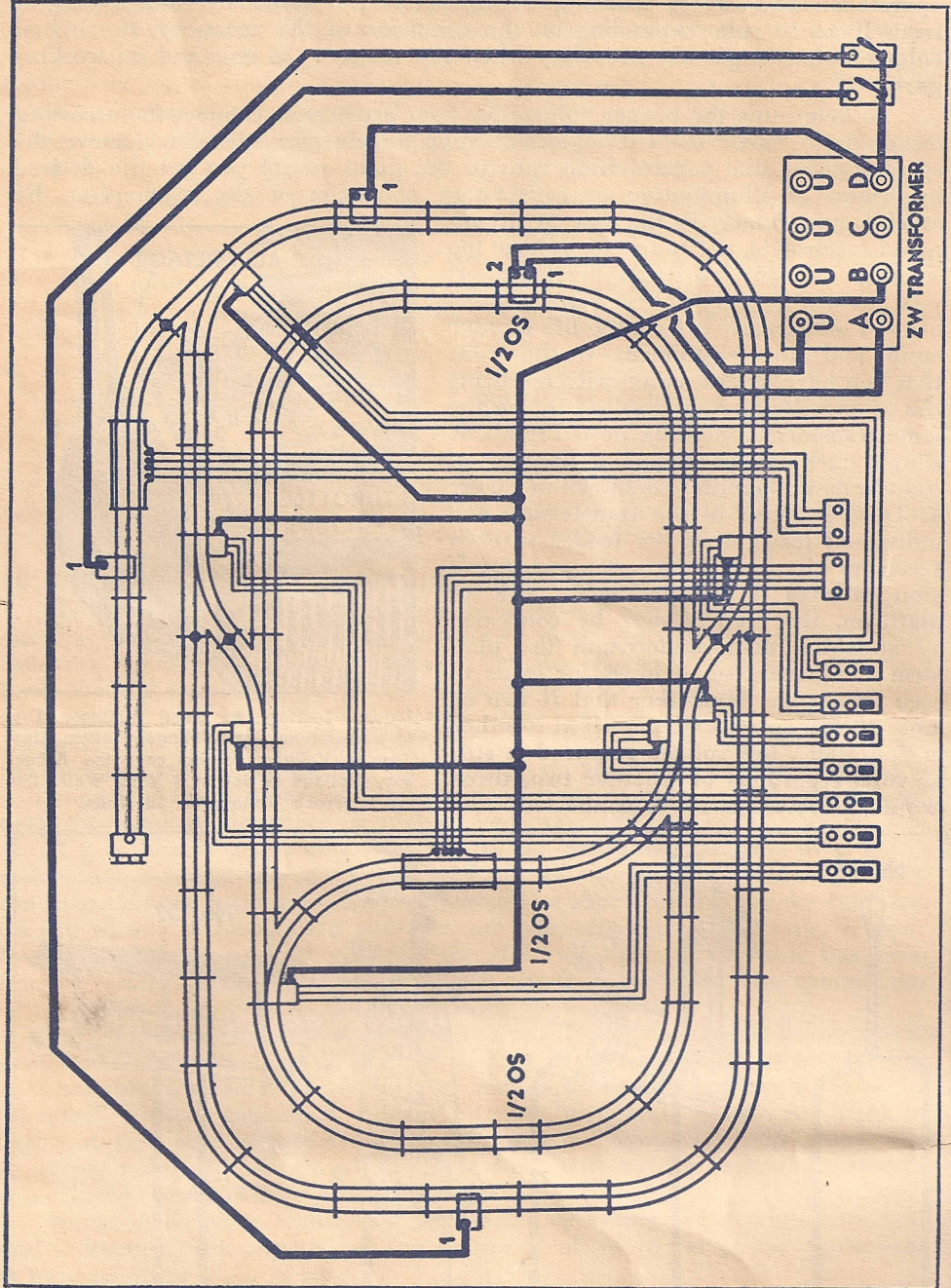


Figure 5—A typical "O" gauge layout for operating two trains. Track needed: 33 sections straight track, 3 half-sections straight track, 18 sections curved track, 4 right hand switches, 3 left hand switches, 2 remote control sections, 1 bumper.

Figure 5 shows an "O" Gauge layout for running two trains independently. In order to operate two trains in this manner, the layout must be "sectionalized", that is, one loop insulated from the other loop by fibre pins at each of the points indicated by dots. These fibre pins are in addition to the regular

fibre pins found in No. 022 non-derailing track switches. Each loop is controlled by a separate throttle lever, while the accessory binding posts are used for switches and other accessories which may be in the railroad system. Although this layout shows seven switches, three of these may be eliminated by leaving off the siding in the upper right of the diagram, and the connecting track in the center of the inside loop. Each switch has its own controller. For convenience all controllers should be mounted on a centrally located panel board. Two sections of Remote Control track used for uncoupling and for unloading are also shown on the layout.

When crossing from one loop to another it is important that the voltages supplied to the inner and the outer loops are approximately equal. This is done by setting both throttles at the same point. Unless this is done, the contact rollers of the locomotive crossing the insulating pins which separate the two circuits will bridge two dissimilar voltages causing a short circuit and stopping the train.

In the lower right hand corner of the diagram are shown two electrical toggle or knife switches. The purpose of the left hand switch is to cut the current in or out of the siding, as desired. The other switch sectionalizes the left half of the outside loop. It will be convenient when you desire to stop a train on the left half of the outside loop while a second train crosses over from the inside loop to the right half of the outside loop.

## OPERATING ADDITIONAL TRAINS

Since "ZW" Transformers have four independently variable circuits, as many as four trains can be operated independently of each other with a proper layout. However, in order to control the whistles and directions of the two additional trains, external No. 167 Whistle Controllers have to be added to the "B-U" and "C-U" circuits, since these two circuits do not have built-in controls. For directions on connecting and operating the 167 Whistle Controller see the Instruction Booklet or the leaflet supplied with controllers.

## SERVICE INFORMATION

This transformer was inspected at the Factory and is in perfect operating condition. Like all Lionel products it is guaranteed against defects in material and workmanship to the extent that if any such transformer is returned to the Lionel Service Department or to any Lionel Authorized Service Station within one year of the date of purchase it will be repaired or replaced.

If in the future it should ever require servicing, you may either send it to the Factory Service Department or to the nearest Lionel Approved Service Station listed in the back of the Instruction Book.

If you decide to mail the transformer to the Factory, be sure to pack carefully to avoid damage in transit. Use the original box, if possible, and enclose in another corrugated box or strong container. A letter in a stamped envelope stating fully the service desired must be pasted to the outside of the wrapper. Postal regulations do not permit any written instructions to be placed inside of the package.

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