T-TRAK
N-Scale Modular Railroading

North American T-TRAK Organization

Tips N SCALE Techniques

What You Need to Know About Kato Unitrack Turnouts

June 1, 2020

Kato produces several types of Unitrack turnouts — #2 wye turnout, #4 left and right, #6 left and right, and #6 crossovers (double, left and right). These are power-routing turnouts (the #4 can be optionally set for non-power routing), and the machines to operate the turnouts are pre-wired and built-in. Unlike most turnout machines that have three wires, Unitrack turnouts use a bi-polar solenoid drive that has only two wires and are operated by reversing the polarity. The #4 turnout comes with a two-wire control cable with plugs at each end, while the #6 turnouts and the double crossover do not have a plug at the turnout end.

Note: If for any reason you remove the bottom from any of these turnouts be very careful. Leave the turnout on a table upside down the entire time you are working on it. The internal parts can easily fall out; something will almost certainly fall out of place. As soon as you remove the bottom plate check to see if anything looks out of place, and put it back.

The #6 turnouts are reliable and work well and allow any N scale locomotives and rolling stock to run through them, whereas the #4 turnouts require "tuning" (see below) for reliable and derailment free operation. **Note that only #6 turnouts and/or the #6 crossovers can be used on the T-TRAK mainlines, with wye and #4 turnouts used on secondary and yard tracks where #6 turnouts may not fit.**

Turnout Terminology & Technology

Turnout: The collection of fixed rails, moving points and switch mechanism that allows a train to be moved to a desired route.

Points: The moving rails that actually select the route.

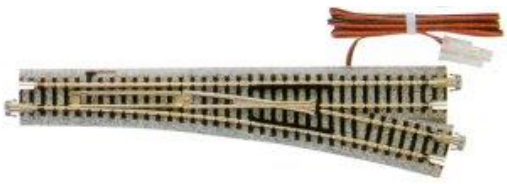
Switch: The mechanism that moves the points. Usually called a switch machine to distinguish from the electrical switch that may be part of controlling the switch. As mentioned above Unitrack turnouts are single-coil turnouts. There are also twin-coil switch machines (e.g. Atlas) and stall motor machines (e.g. Tortoise).

Types of Unitrack Turnouts

The standard center-to-center spacing of Unitrack is 33mm. The #4 turnouts and the #6 crossovers are designed to work with this 33mm spacing. The #6 turnouts are not designed to 33mm spacing, but instead to 49.5mm spacing.

Kato 20-202 #6 Left-Hand Turnout (EP718-15L)
Kato 20-203 #6 Right-Hand Turnout (EP718-15R)

Left-Hand Turnout



Right-Hand Turnout

These are power routing turnouts (similar to a Peco Electrofrog turnout) and are not DCC-friendly. The turnout power routes the frog rail. The point-to-stock rail gap is very large, so any rolling stock that stays on the track should have no trouble clearing the points.

Since T-TRAK modules can be configured in any order, in order to ensure problem free operation and configuration insulated Unitrack UniJoiners should be placed in all four rails at the frog end of the turnout, and track power feeders installed beyond the insulated UniJoiners.

Two #6 turnouts connected back-to-back as a crossover between two tracks creates a center-to-center spacing of 49.5mm, not the Kato standard 33mm; insulated UniJoiners are required in the diverging route between the two turnouts. The turnout itself can be physically hacked to make the spacing 33mm, but this is a project only for the advanced modeler.

Kato-20-210 Double Crossover (310mm)

The #6 double crossover consists of four (4) #6 turnouts and one 15° crossing, and provides the standard 33mm center-to-center track spacing. The four turnout machines are wired to a single cable coming out of the turnout, so all four turnouts will switch at the same time.

Except for the two outside stock rails, nothing else is wired through on this crossover, i.e. it is isolated in the center of the crossover. Power feeds are required to the stock rails at the four stock rail legs of the crossover. Insulated UniJoiners are not needed anywhere on this crossover.

Kato 20-220 #4 Left-Hand Turnout (EP481-15L)
Kato 20-221 #4 Right-Hand Turnout (EP481-15R)

Left-Hand Turnout

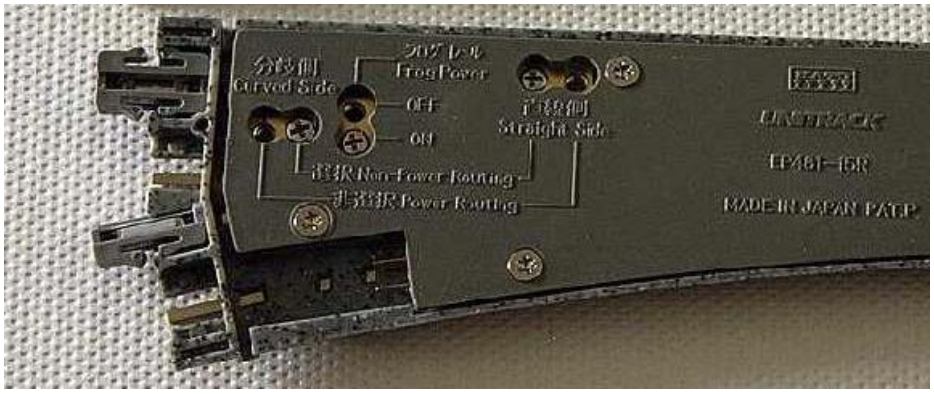
Right-Hand Turnout

These turnouts can be set to be either power-routing or non-power routing, and are thus DCC friendly. They can be operated electrically, manually or as a spring switch. The frog can be powered or not as desired.

The **Power Routing** feature switches power in the direction the turnout is thrown, with the track in the other direction dead (just like a Peco Electrofrog turnout). The **Non-Power Routing** feature supplies power to both lines of track without interruption (just like a Peco Insulfrog turnout). **Frog Power** ON prevents the stalling of small locomotives while passing over the turnout and is the recommended setting; the frog power is always power-routing to prevent short circuits. The factory settings for the #4 turnout are Power Routing and Frog Power ON.

When used as a Spring Switch set the turnout to Non-Power Routing and Frog Power OFF.

Note: The power routing screws on the bottom of some #4 turnouts are mislabeled, as are the directions that are included with those turnouts. If your #4 turnout is one of the mislabeled ones, please see the correct explanation below.



The frog itself can be set to either fully insulated or power-routing; for our T-TRAK purposes it should be set to power-routing using the screw on the bottom of the turnout — set to the ON position.

There are two additional screws for power routing, which do not do what you think. See the tables below; note the terminology may seem wrong, but it is correct in view of the mislabeling of the screws mentioned above.

1. Power Routing Functionality — When "Non-Power Routing" is Selected

	Straight Frog Rail	Divergent Frog Rail
Straight Route Selected	Powered w/appropriate polarity for that route.	Dead
Divergent Route Selected	Dead	Powered w/appropriate polarity for that route.

2. Power Routing Functionality — When "Power Routing" is Selected

	Straight Frog Rail	Divergent Frog Rail
Straight Route Selected	Powered w/appropriate polarity for that route.	Powered w/appropriate polarity for that route.
Divergent Route Selected	Powered w/appropriate polarity for that route.	Powered w/appropriate polarity for that route.

For most T-TRAK applications set the Frog power to ON and follow the settings in Table 2. This sets the turnout to be non-power routing, i.e. the same as a Peco Insulfrog turnout.

If for any reason power routing is selected, i.e. Frog power on and the setting in Table 1, be sure to put insulated UniJoiners in all 4 rails at the frog end of the turnouts, and track power feeders installed beyond the insulated UniJoiners. This is good practice even if the turnout is set to non-power routing, and is mandatory in layouts where individual DCC track buses are used.

Special Care Must be Taken with #4 Turnouts on T-TRAK Modules

Special 62mm contoured sections of Unitrack are provided in the package for use at the frog ends of the turnouts, connected to either the straight or diverging route. The special tracks are S60L for a left-hand turnout and S60R for a right-hand turnout. This enables use of a standard section of Unitrack in the other route. Use of this special 60mm section in the straight route may mean that the overall track for the module could be 4mm short, depending on the configuration of the rest of the track. It may be necessary to modify the shape of a 64mm section to match the contour of the special 60mm section. Note the UniJoiner is also modified to fit properly.

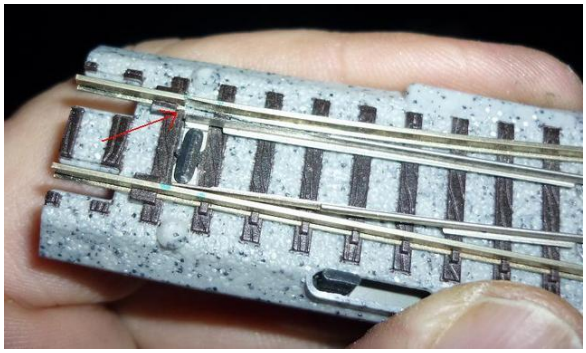
Operational Issues with Unitrack #4 Turnouts on T-TRAK modules

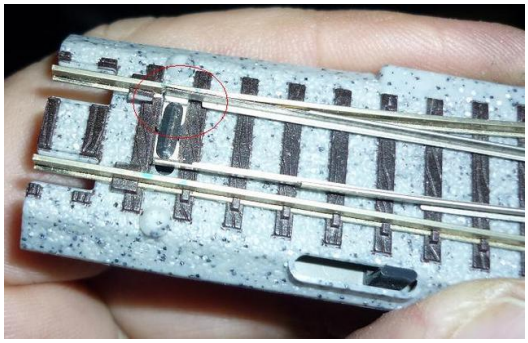
The Kato Unitrack #4 turnouts are sometimes prone to derailments, which can be fixed by tuning the points and the adjacent stock rails. A wheel can hit the end of the point, run up over the point and settle down on the wrong side, derailing the train.

The problem is the points are square, not a point, and there is no notch in the stock rails for the points to fit into. Do the following:

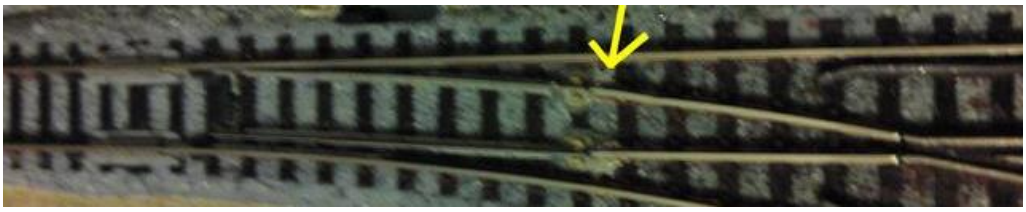
- Sharpen the points. While blocking and supporting the turnout points *carefully* file the points slightly so the points fit completely into the notch in the stock rail.

- File a notch in the adjoining stock rail for the points to sit into. This can be done by placing the points in the position opposite to the stock rail being filed, and *very carefully* carving a notch using a thin flat file. See the photos below for how the resulting notch should look.



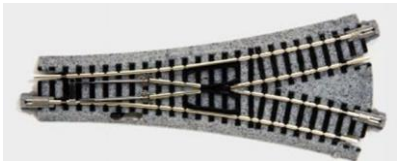


Sometimes derailments happen at the point marked by the arrow in the photo below because the end of the point where it pivots doesn't line up with the stock rail. *Very carefully* bend the stock rail slightly with a pair of long-nose pliers so the rails line up. Take special care not to damage the pivot point while doing this.



As well as tuning the #4 turnouts operation will be more reliable if the wheels on rolling stock are clean and rolling stock is weighted according to NMRA Recommended Practices.

Kato 20-222 #2 Wye Turnout (EP481-19Y)

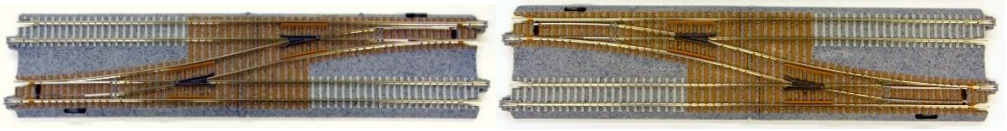


This turnout can be set to be either power-routing or non-power routing and are thus DCC friendly. They can be operated electrically, manually or as a spring switch. The frog can be powered or not as desired.

The **Power Routing** feature switches power in the direction the turnout is thrown, with the track in the other direction dead (just like a Peco Electrofrog turnout). The **Non-Power Routing** feature supplies power to both lines of track without interruption (just like a Peco Insulfrog turnout). **Frog Power** ON prevents the stalling of small locomotives while passing over the turnout and is the recommended setting; the frog power is always power routing to prevent short circuits. The factory settings are Power Routing and Frog Power ON.

When used as a Spring Switch set the turnout to Non-Power Routing and Frog Power OFF.

Kato 20-230 #6 Left-Hand Crossover
Kato 20-231 #6 Right-Hand Crossover



The #6 left and right crossovers consist of two (2) #6 turnouts and provide the standard 33mm center-to-center track spacing. The two turnout machines are wired to a single cable coming out of the turnout, so both turnouts will switch at the same time.

Except for the two outside stock rails, nothing else is wired through on this crossover, i.e. it is isolated in the center of the crossover. Power feeds are required to the stock rails at the four stock rail legs of the crossover. Insulated UniJoiners are not needed anywhere on this crossover.

The frogs on the crossover can be set to be powered or not, and the crossover can be set to be power routing or non-power routing.

Electrical Control of Unitrack Turnouts

The Unitrack turnout is moved by a turnout motor, a tiny bi-polar solenoid drive which is hidden under and inside the base of the turnout. Because it is bi-polar it operates on direct current (DC), and has only two (2) wires. Most turnouts (Atlas, twin-coil, etc.) will run on AC or DC and have three (3) wires. Because it has only two wires the Unitrack turnout is operated by simply reversing the polarity of the power feed.

The turnout motor should only be fed electricity for the moment it takes to move the points. This is very important — **feeding power for too long a time can burn out the motor**.

Manual Control

Unitrack turnouts can be controlled manually or electrically. There is a manual lever sticking out of the ballast strip next to the free end of the point rails. Simply move the lever to the other position to move the points**. Do not manually push the points. Pushing the points can damage the turnout. Use the manual slide lever.**

DC Control from a Powerpack

Unitrack turnouts can be electrically controlled using all Kato components, or you can make your own control configuration.

Using Kato Components

This involves using the Kato 24-842 DC Converter (shown at top left), the Kato 24-840 Turnout Controller (bank of 5 shown at left) and, if necessary, the Kato 24-841 Turnout Extension Cord (not shown).

For a Kato power pack the DC Converter is not needed. The Turnout controller(s) are snapped into the side of the Kato power pack.

If you are using another brand of power pack then connect the DC Converter wires to the accessory AC terminal, usually 16VAC, on the power pack. DC is fed out the snap connectors.

The Turnout Controllers are blue plastic electrical switches, with snap connectors on both sides (male on one, female on the other) which allow a row of controllers to be snapped together. The DC Controller is snapped to the left side of the first Controller to supply electricity to the entire row. A socket on the back mates with the plug on the cord from the turnout motor, or from the Turnout Extension Cord, where used.

The Turnout Controller is a momentary contact Double-Pole, Double Throw (DPDT) switch. As the control handle is moved from one position to the other, contact is made for a fraction of a second, sending DC power of the appropriate polarity to the turnout motor.

Move the control handle in a slow steady manner, but don't let it stop anywhere as it is moved; the stop position could be the point where electrical contact is made and leaving the handle too long in that position could burn out the motor.

The Kato 24-842 DC Converter is simply a standard bridge rectifier circuit. It can handle up to 17 VAC in (via the wires) and puts out 12VDC (via the snaps). Since it is a standard bridge rectifier it can be fed DC and the correct polarity power will be output at the snaps.

Constructing your own Control

You can use a momentary contact Double-Pole, Double-Throw (DPDT) switch (Momentary On / Off / Momentary On) to duplicate the operation of the Kato Turnout Controller. This Momentary DPDT switch is wired the same as a reversing switch for track power is wired, but the power coming in is fixed DC from the power pack, and the power going out goes to the turnout motor. Note the following:

- You must use fixed DC output from the power pack. Do not connect to the auxiliary AC power terminals.
- You will have to cut off the Kato connector on the cord from the turnout motor, and hardwire to the momentary DPDT switch.
- The DPDT switch can be mounted on the front or top of the T-TRAK module; the module rear may not be available if the module has a skyboard or is a full-depth module.
- If you use an ordinary DPDT switch instead of a Momentary DPDT switch you will burn out the turnout motor.
- With the use of a momentary DPDT switch you cannot tell which direction the turnout is in after it has been thrown — the position of the DPDT switch is always in the center. The Kato Turnout Controller always shows the position of the turnout. You can overcome this problem as follows:

  If you insert a momentary push button in one of the wires from the DPDT switch to the turnout you can use a normal (non-momentary) DPDT switch. The position of the toggle switch will point in the direction the turnout is thrown. You operate the turnout by moving the DPDT switch to the desired position, and then depress the momentary push button. This is a two-step process since you have to move the DPDT switch then press the button.

There are other alternatives using only push buttons that will work, but they are more complicated and will not be discussed here.

Digital Command Control (DCC) of Unitrack Turnouts

DC control of turnouts requires an additional power bus running to all modules equipped with turnouts. The additional bus can be eliminated using DCC control of turnouts since the stationary decoder used for control can connect to the track. Of course this requires the layout, or at minimum one track, to be DCC powered.

Several stationary decoders from several manufacturers are available that can control Kato Unitrack turnouts. Since Digitrax is the system of choice for T-TRAK Digitrax stationary decoders are listed, as follows:

Digitrax DS51K1 Stationary Decoder

The Digitrax DS51K1 can be mounted under the T-TRAK module below the corresponding turnout. It is rated at 0.5 Amp and measures 0.319” x 0.509” x 0.152” (8.11mm x 12.94mm x 3.88mm).

The orange and gray wires from the decoder are connected to the turnout motor, and the red and black wires are connected to track power (perhaps using Terminal UniJoiners). After installation the decoder is programmed to the desired address following the simple instructions provided by Digitrax.

Since the DS51K1 does not have a LocoNet connection it must be connected to DCC track power to receive its commands. For T-TRAK modules it is recommended to connect the red and black wires to the Red track. If the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the red and black leads so the connection to the Red track can be turned off, as DC track power will damage the DS51K1 decoder.

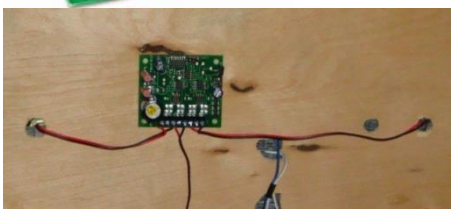
Important note: The DS51K1 stationary decoder does **NOT** have enough power to operate the Unitrack #6 Single or Double Crossovers.

Digitrax DS52 Dual Stationary Decoder

The Digitrax DS52 will operate two individual 2-wire bi-polar solenoid turnouts. Its capacitive discharge provides enough power for the Kato #6 Single and Double Crossovers. Decoder addresses can be separate or sequential.

The DS52 can be mounted under the T-TRAK module below the corresponding turnouts it will operate. It has screw terminals for connecting to track power and to the turnouts. See photo.

Configuration and programming the desired turnout address is simple and straightforward following the Digitrax instructions included with the decoder.



The DS52 can be mounted to the underside of the module top by double-sided foam tape, as shown. The red and black wires extending out each side connect to the two turnouts being controlled. The red and black wires extending down connect to red track power via terminal UniJoiners. Note the DS52 red and black wires could be connected to a separate bus if a suitable bus is available in the layout. The decoder is configured to operate the bi-polar solenoid motors in the Unitrack turnouts.

Since the DS52 does not have a LocoNet connection it must be connected to DCC track power to receive its commands. For T-TRAK modules it is recommended to connect the DS52 to the Red track. If the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the leads so the connection to the Red track can be turned off, as DC track power will damage the DS52 decoder.

Digitrax DS64 Quad Stationary Decoder

The Digitrax DS64 can operate four (4) 2-wire bi-polar solenoid turnouts (as well as other types), and the Kato 20-310 #6 Double Crossover. Each output can handle two turnout motors. Power can be track power or an external power supply such as the Digitrax PS14. As well as throttle control the DS64 can be controlled by push-button switches.

The DS64 can be mounted under the T-TRAK module below the corresponding turnouts it will operate. It has screw terminals for connecting to track power and to the turnouts, as well as push-button control switches.

This decoder will most likely have application for modules with several turnouts.

The DS64 has LocoNet connections so it can receive commands from the track or via LocoNet. If the DS64 is connected to DCC track power to receive its commands (connect to Red track is recommended), and if the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the leads so the connection to the Red track can be turned off, as DC track power will damage the DS64 decoder.

There are several stationary decoders from DCC manufacturers other than Digitrax that will work with Kato Unitrack turnouts. These are not covered here since Digitrax is NRMRC standard.

Turnout Address Assignments

For modules equipped with DCC-actuated turnouts, each turnout must have a unique address not shared with a turnout on any other module. It is recommended a register of DCC turnout address assigned to club- and member-owned T-TRAK modules be maintained. Before assigning an address to a DCC-controlled turnout on any T-TRAK module the owner must obtain the needed address(es) from the register.

References

- Documentation from T-TRAK official web site at http://www.t-trak.org and NTRAK Newsletters.
- Email communications with several people.
- Paul Musselman, “The Unofficial T-TRAK Handbook”, at http://T-TrakHandbook.com
- Kato Unitrack information from Kato official web site at http://www.katousa.com

- “Power Routing Correction” from Kato USA web site http://www.katousa.com/consumers/N-4-turnouts.html
- Wiring for DCC, Alan Gartner at http://wiringfordcc.com .
- T-TRAK Email list at Yahoo Groups
- Digitrax Users Email list at groups.io
- JMRI Users Email list at Yahoo Groups
- Kato Unitrack Email list at Yahoo Groups

Source

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