Turnouts

A “turnout (track switch) is the piece of track that lets a train travel off the main line and onto a siding, transition between parallel tracks, or change track routes. Most model railroaders prefer using the name “turnout”, rather than “switch”, to avoid confusion with electrical switches, which are also common on model railroads. This prevents confusing statements like, “I use this switch to switch the switch.”

Turnouts are necessary items on nearly every model railroad.

If you are content to simply watch a train go around in circles, or perhaps two trains go around two loops of track, then you won’t need any turnouts. However, if you want to do anything beyond that, even being able to transition between the two loops, you’re going to need turnouts. Which kind of turnout to buy can be a bit confusing.

On the forum, and in advertising, you may hear references to such terms as “current routing” turnouts”, “isolated frog” turnouts, “insulated frog” turnouts “live (or powered) frog” turnouts, “DCC compatible, or friendly”, turnouts “Wye” turnouts, “Insulfrog” turnouts, “Electrofrog” turnouts“ Unifrog”turnouts, etc., etc. ad infinitum! You will also see some turnouts referred to as, “a #4 turnout, or a #6 turnout.”

Another thing you may see on the forum is discussion concerning the merits, or deficiencies, of different brands of model turnouts. No wonder then, that new model railroaders can easily become confused about turnouts!

I'll do what I can to explain what each of these terms mean.

The parts of a turnout have names, of course, and the turnout part name that comes up most often is "frog."

The frog can be found near the middle of a model turnout. It is the plastic, or metal, part of a turnout where four pieces of rail come almost together, and form an 'X' shape. The main purpose of the frog is to let a train's wheels pass onto either of the two routes through the turnout.

The metal variety may be "powered", or "live" meaning that the frog can carry electricity up to a locomotive's wheels, just like any other piece of rail. Not all metal frogs are powered however. Some metal frogs, and all plastic frogs, do not pass any electricity to the locomotive's wheels. This fact can sometimes cause a loco to stall on the frog. Typically this only happens when the loco is a very short, yard switcher type, and/or has few of its wheels wired to pick up power from the rails. Locomotives that can pick up power from all, or most, of their wheels will normally pass smoothly through a non-powered frog.

Metal frog turnouts can have their frogs wired in two different ways. Some have the frog electrically connected to the "points." The points are the two movable, inside rails of a turnout. They pivot at one end, and are connected to a plastic "throwbar" at their other end. Moving this throwbar from side-to-side moves the points, which determine which route the train will take.

Turnouts that have their frog electrically connected to the points are usually "current-routing" turnouts. This means that the points take on a second task. In addition to routing the train onto one track or the other; the points of a current-routing turnout also act as an electrical switch. When a point touches the outer ("stock") rail, it passes current only to the selected route. The non-selected route does not get any power through the turnout. This feature can be used to park a locomotive on a siding. That loco will stay stationary until the current-routing turnout is set for the siding that the loco is on. Then power will pass through the turnout to the selected siding and on to the loco so it can now move.

Note: Plastic frog turnouts can also be wired as "current-routing" turnouts. A common example is the Peco Company's "Insulfrog" turnout. "Insulfrog" is Peco's trade name for their plastic frog turnout. This makes sense since the plastic frog is an electrical insulator. Peco calls their metal frog turnout an

“Electrofrog.” The metal frog of Peco’s Electrofrog turnout can be wired to provide electricity to a locomotive. Recently Peco has introduced a new type of turnout called a “Unifrog” turnout. It is intended to ultimately replace both the company’s “Insulfrog” and “Electrofrog” turnouts. The new Unifrog turnout can be wired to have its frog either powered, or not powered.

An “Isolated frog” turnout has a metal frog that is electrically isolated from all the other rails in the turnout. This isolated frog gets its power from a feeder wire attached to the frog. A Micro-switch, mounted below the table, connects the frog’s feeder wire to operate with one, or the other, routes through the turnout. This micro-switch is operated by the movement of the turnout’s throwbar and points.

If you look carefully at any turnout, you’ll see that the frog will be used as the left rail through one route, and as the right rail through the other route. This is why the Micro-switch is necessary. It changes the polarity of the frog to match the selected route.

The terms “DCC compatible”, “DCC friendly” and any other verbiage concerning a particular turnout’s ability to work on a DCC controlled railroad are sometimes used in advertising too freely. They are ambiguous at the least. The fact is that any

turnout can be made to work just fine with DCC, or with traditional DC.

The possible problem that “DCC compatible/friendly” turnouts are designed to deal with is a short circuit that can occasionally happen when a metal wheel accidentally makes contact with both the running (stock) rail, and the point rail. In most turnouts the running rail, and the point rail nearest to it, are of opposite electrical polarity. If a metal wheel does make contact with both rails simultaneously, then it will create a short circuit. On DC controlled layouts this wasn’t a problem, since the short circuit was very brief. The slow circuit breaker in a typical DC power pack would not have time to react. DCC however, uses very high-speed circuit breakers, and so such a brief short circuit might temporarily shut down the DCC system.

If you have all the wheels on your railroad gaged correctly, and the turnouts were all modified to meet the NMRA specifications concerning flangeway width* (both of which you should do anyway) then this short circuit might well never even happen, because the wheel would not be able to get into a position to short the two rails.

*[Nearly all commercial turnouts have flangeways that are too wide to match the NMRA specs. I recently bought two Micro Engineering brand turnouts that came close. In fact,

the guardrail flangeways on these M/E turnouts were actually very slightly too narrow, rather than too wide. A simple pass with a Dremel tool widened them just enough to meet the spec.]

This brings us back to the isolated frog turnout. It can be wired so that the point rail, and stock rail, are the same polarity, and therefore the short circuit would never even be able to occur at all. That is the only electrical difference between a "DCC compatible turnout" and any other turnout.

I know of some commercial turnouts that come from the factory wired with isolated frogs. Both Atlas, and Micro Engineering, brand N-scale code 55 turnouts are wired this way. Peco's Electrofrog, and their new Unifrog, have this option. There are likely others, including perhaps Atlas's equivalent turnouts in other scales. and possibly some other turnouts as well. The Atlas and Micro Engineering N-scale, code 55, turnouts are just the only ones I have had personal experience with.

"Wye Turnouts" have both their routes diverging at equal angles from the centerline of the turnout. They are designed to save a little space when constructing a "wye."

A "wye" is an arrangement of three turnouts connected by three tracks in a triangle. Wyes are used to let a locomotive, or

train, perform the railroad equivalent of the “K-turn” an automobile uses to turn around on a narrow street.

Brands of Model Turnouts

There are several brands of commercial turnouts available. It is also possible (and much easier than most modelers think) to make your own turnouts. Let’s look at your choices.

[Atlas Turnouts] are, by far, the most common brand used on first layouts. This is because they are somewhat cheaper than other brands, and also because of a very effective marketing strategy used by Atlas. The track plans published by Atlas, in their track plan booklets, and online, all specify Atlas track sections, including Atlas turnouts. This is hardly surprising, since these track plans are primarily a form of advertising by the Atlas Company. Like all advertising it is going to promote only the advertiser’s products, and not their competitor’s. It will also fail to mention any deficiencies, or faults, in the advertising company’s own products. Most model railroaders build their first layout using one of these track plans. I did, and so have many others.

In reading the forum, you will likely find varying opinions on the quality of Atlas brand turnouts in general, and their “Snap

Switches” in particular. Atlas actually makes two separate lines of model turnouts, “Snap Switches” and “Custom Line.”

The “Snap Switches” are part of Atlas’s “Snap Track” line of products. The “Snap Track” line is designed for easy assembly. The “Snap Track” turnouts are designed to fit in place of a section of either straight track, or curved track. In HO-scale, for example, a “Snap Track” turnout can be used in place of a 9” straight section, or an 18” radius curved section.

While this makes it easy to plug together a track layout, in my opinion (and that of many other experienced modelers) there is a problem in this design. An 18” radius curve is a pretty tight curve in HO-scale. While shorter locomotives and cars can get around such a curve, some longer equipment may not. All rolling stock, short or long, will exhibit some very unrealistic overhang on this tight a curve and coupling/uncoupling may be difficult.

In order to fit their “Snap Switch” turnout into an 18” radius curve, Atlas had to include a short segment of straight track, (the point rails) the tight curve, and a built-in kink between the two. This arrangement can work, but it tends to push some locomotives and cars to their limits, and can cause derailments.

The other “Snap Switch” design issue was to accommodate the Atlas switch machine. This is the big black mechanism attached to the side of a “Snap Switch.” It does not produce the same

amount of force as other switch machines do. In fact, it's quite weak. To let this machine move the points at all, the point rails had to be very "loosey goosey". Atlas included rivets at both ends of the moving point rails to make things easy enough for their switch machine to move them. Over time these rivets can wear out the plastic they are set into. This gradually loosens the parts they join.

NOTE: The attached file "Improving Atlas Turnouts" has info on the potential problems of Atlas "Snap Switches" and some fixes for most of them. I (and many others) have had bad experiences with Atlas "Snap Switch" turnouts and no longer use them. The Atlas switch machine has a history of burnt out coils, which melt part of the plastic case. Some of these overheat failures are caused by shorting of the internal contacts in the poorly made "blue button" electrical control that comes packaged with Atlas snap switches. Most are caused by human error. Holding the blue button down for more than a second, or two, will burn out a coil. There are things that can be done to prevent coil burnout. More on that later, when we get into the information on "switch machines."

However, there are plenty of other modelers who do like Atlas turnouts and use them successfully on their model railroads. Time Warp is one forum member who comes to my mind who is an advocate for Atlas turnouts. There are many others as

well. If you are planning on purchasing turnouts, I suggest you look around the forum for the various opinions and then make your own informed choice. Also look around online for the best price. There are discounts available.

The other Atlas turnout option is their “Custom Line” turnouts. They are not made to fit in place of an 18” radius curve; in fact they have no curved route. Like most real turnouts* and all other brands of model turnouts* the Atlas Custom Line turnouts have two straight routes that split at an angle. This angle is described by a number. Called a “frog number” the number found on the package, and in advertising, may indicate that this is a “# 4 turnout, # 6 turnout, etc. The frog # shows the amount of sideways diverging movement a wheel will take in a certain number of units of forward travel. For example, if the wheel will be moved sideways one millimeter in eight millimeters of forward travel then that is called a, “# 8 turnout.” The simple explanation is that the higher the frog #, the gentler the split between routes of the turnout will be.

{*The exception is a curved turnout where both routes curve.}

Conversely, small frog # turnout, like the # 4 will have its routes split pretty sharply. Like the radius of a curve, the frog # of a

turnout can affect the performance of cars and locomotives. Some longer locos and cars may have trouble negotiating a small frog # turnout. Here is a final note concerning Atlas "Custom Line" turnouts. Make sure that any "Custom Line" turnout you buy actually has the frog # on the package. I have seen some Atlas turnouts labeled "Custom Line" that were identical to "Snap Switches."

I have not used Atlas "custom line" turnouts, so I can't really rate them from personal experience. Again, I suggest you ask about them on the forum, and get opinions from members who do have experience with them.

Micro Engineering Turnouts are noted for their very realistic appearance. They offer only a very limited line of turnout choices. They have a #6 right, and a #6 left. Recently the company has released a "yard ladder" (a series of turnouts connected in a row) in HO-scale. I rate Micro Engineering turnouts, as excellent. I think they are equal in overall quality to the excellent Peco turnouts.

Peco turnouts are renowned for their near perfect reliability, few, if any, derailments, and rugged construction. Modelers who use them swear by them. I have some on my layout and they work extremely well. If you are looking for a good brand of commercial turnout, I highly recommend Peco, or Micro Engineering.

Walthers/Shinohara Turnouts (made by Shinohara, and sold by Walthers*) have good realistic appearance and generally reliable operation. My personal experience with them goes back many years to my membership in an N-scale club. They had dozens of the Shinohara code 70 N-scale turnouts. The only problem encountered concerned the tiny copper contacts attached below the moving point rails. These contacts were intended to slip under the stock rail when the points were thrown. This passed power to the point rails. Sometimes they got bent upward enough to hit the stock rails and prevent the point rail from snugging up to the stock rail. I suspect some of the problem was caused by heavy-handed track cleaning by the club members. The point binding problem was easily fixed by pushing the copper contacts down with a small screwdriver. The copper contacts were also somewhat spotty as far as conducting power to the points. The club used micro-switches, mounted under the table, to power the points; instead of relying on the contacts. Looking at photos of current production, it looks like the same design may still be being used. I'm not sure though, so it would be something you should check for yourself.

*Recently the agreement between Walthers and Shinohara has ended. You may have difficulty getting a good supply of Shinohara turnouts, until they find a new U.S. distributor.

Scratchbuilt Turnouts have the advantage of being much, much, less costly than commercial turnouts. (Less than $5 ea. for materials vs. approx. $25- $30 ea. for a good-quality commercial turnout)

The trade off to saving lots of money is investing lots of time. It is also possible to build a turnout which, in terms of reliability, is as good as the best commercial turnouts, like Peco, or Micro Engineering, and much better than many other commercial offerings. You can also build in a better frog which will provide a smoother ride for the wheels than any commercial turnout can, even the excellent Peco. Another advantage is that you can build any shape turnout required to fit into that awkward spot on your layout where no commercial turnout quite fits.

NOTE: The attached file, “How I scratchbuild turnouts” explains the idea in depth.

Switch Machines

Each turnout on your railroad will need some sort of mechanism for moving the points. These are called “switch machines.” I have already given some information about the Atlas switch machine. It is another factor in many newbies decision to use Atlas turnouts. It comes attached to the (“Snap

Switch") turnout. With an Atlas "Custom Line" turnout, or nearly any other brand of turnout, the switch machine must be purchased separately and installed by you. This makes the Atlas "Snap Switch" look like a bargain to a new modeler. Perhaps, after reading my opinion concerning the Atlas "Snap Switch" you may see that it's really no "bargain" at all. So let's look at some other choices.

[Twin-coil Switch Machines] are basically an electric solenoid with two coils. (Hence the name) Appling power to one coil pulls a movable steel slug to that end of the solenoid. Applying power to the other coil draws the slug to the other end of the solenoid. The action is instantaneous. Some folks don't like this snap action, preferring the slow movement of the stall motor or servo types. A mechanical linkage connects the slug to the throwbar and points of the turnout. Twin coil machines can easily burn out a coil that is energized more than a second, or two.

Using a simple electronic circuit called a "Capacitive Discharge Unit" (C.D.U.) will prevent coil burnout. Atlas, and Peco, are both designed to use twin-coil switch machines. The Peco twin-coil is much stronger than the Atlas, and uses thicker wire that may not burn out quite as fast. However, it certainly can burn out, and it should still be protected by a CDU. A turnout control called a Stapleton 751D, has a built-in CDU, and is a much

better choice for operating twin-coil machines than the Atlas "blue button" control.

The Peco twin-coil machine attaches directly to the bottom surface of their turnout. It typically requires a large rectangular hole be cut under the throwbar before the turnout is installed. Peco turnouts can also be operated by many other types of switch machine.

[Stall Motor Switch Machines] These contain a DC motor geared down to slow speed. They are very powerful, and can be adapted to use with any brand of turnout. Typically stall motor machines are mounted directly below the turnout's throwbar.

Before installing turnouts on your layout, pick your favorite brand of switch machine, and read the manufacturer's installation instructions. Most switch machines require a large hole or slot be drilled directly under the throwbar. This is immensely easier, (and safer for your expensive turnouts) than trying to drill the hole from below, after the turnout is installed. The "Tortoise" motor made by Circitron is a very popular stall motor machine.

[Servos] are another option. They work a bit similar to stall motors in that both types move the points slowly, and hold the point tightly against the stock rail once in place. I have not used

them, but CTValley, here on the forum, does. He can answer any questions about servos that you have.

There are also a variety of purely mechanical, as opposed to electro-mechanical, devices that can be used to move the points of a turnout. They are much cheaper than any of the electric switch machines preceding.

[Caboose Industries Ground Throws] are a miniature version of a similar device used on real railroads. They are grossly over scale size in order to accommodate our giant fingers. They mount right next to the turnout and therefore are most commonly used only on turnouts within easy reach. However, in a few cases, they have been mounted at the edge of a layout and connected to more distant turnouts with mechanical rod linkages.

[Mechanical Linkages] There are many varieties in use, ranging from a simple electric slide switch, rod-connected to the throwbar, to more elaborate systems. They are very inexpensive, easy to make, and extremely reliable.

NOTE: The “Five dollar switch machine” files attached below shows how to build one such machine.

Have fun!

Traction Fan