Part 4 - An Introduction to Signaling

Signaling is an essential part of any railroad where multiple trains are present, helping to keep the trains apart and promoting efficient operation. In Train Simulator, the use of signals also allows more control of your traffic than provided by the game's basic AI.

The starting point for any discussion of signaling is the Signaling Guide which comes on your TRS2004 disk and which is copied to your hard drive in the \\TRS2004\docs\manuals_cd\manuals\ directory. Looking through it, you'll be surprised at the great diversity of signal systems in use around the world.

If you're modeling a real-life railroad, you'll want to pay particular attention to those signals that are appropriate for your region and road.

Beyond the manual, there is also a wealth of information, answers, and third party signaling options available on the Trainz website. Spend some time on the Route Builders forum and perhaps search on 'signals' for more information.

Our purpose here is to provide those of you new to Trainz with some basic information to get you started. It is not intended as an exhaustive treatise on the subject. Read the information here, then start a brand new empty route in Surveyor and place some signals of your own. Add a locomotive and do some experimenting to see how the signals work. That's how you learn. Refer to the manual or jump on the forum if necessary for help.

Remember, too, that things don't necessarily work the way you might expect the first time. When I place a new junction area, I frequently have to 'tweak' on it a bit, to get everything working correctly. Remember that a misplaced or missing signal lever can cause unexpected consequences with your signals.

Use some of the troubleshooting techniques we discussed earlier to locate problems.

Signal Aspects

Aspects are combinations of lights or other indicators (like a semaphore, for example) that provide the train's engineer with information about the track ahead and instructions on how to proceed. In their simplest form, there are three aspects:

Clear **meaning: proceed.**

Caution **meaning: proceed at reduced speed, be ready to stop short of the next signal.**

Stop **meaning just what the name implies.**

Given those three states, there are many additional aspects, such as Limited Clear, Approach Medium, Medium Clear and so forth. These vary considerably by region and local practice. The signaling guide discusses a number of them.

The game defines the following eight aspects.

1	**0**	**Stop**
2	**1**	**Full stop, then proceed at restricted speed**
3	**2**	**Caution and left diverge**
4	**3**	**Caution and right diverge**
5	**4**	**Caution**
6	**5**	**Proceed and left diverge**
7	**6**	**Proceed and right diverge**
8	**7**	**Advanced Proceed**
9	**8**	**Proceed**

It's important to remember that AI trains can only use the three basic aspects: zero, four and eight. If they encounter a signal displaying some other aspect, they default to the *next lower* of the basic three: zero or four. For example, if the AI train gets a signal with an aspect of six (proceed with left diverge), it will default to a four (caution). If it gets a three, it will drop back to zero (and stop). Get the idea?

So then, it appears you can build a basic signaling system in Railroad Simulator with just the three basic aspects and it will work fine. In fact, it's not a bad place to start. Later, after you become more comfortable with signals, research the specific aspects and signals common to your local area and learn to work with them.

And, noted above, there are many options for signaling available, such as third party rules and scripts. The forum is the place to go to find out about them.

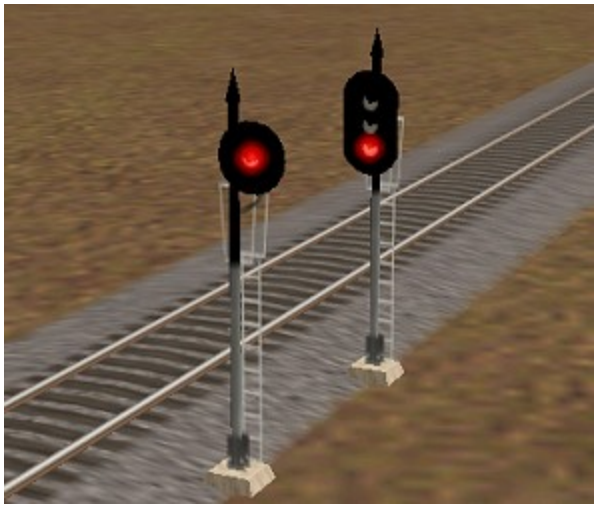
Basic Signals

In the discussion that follows, I'll refer to USA signals, since those are what I'm familiar with, but the same principles usually apply to other areas.

Earlier we said that there were three basic aspects: Stop, Caution and Proceed. In Train Simulator terms, a Proceed aspect allows the train to run at full speed. A Caution aspect limits the train to half speed.

What are the most basic signals than can display those aspects?

In the USA, we have two different signal types available in the out-of-the-box game: USA and USA 2. They function exactly the same; which you use depends on your personal preference and/or the road you're emulating. Let's take a look:

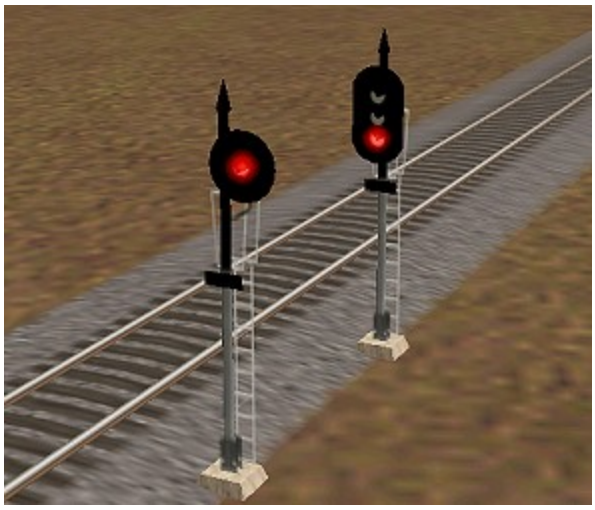


These signals are USA-04, on the left, and USA 2-04. (In Surveyor, they are called 'Signal USA 04' and 'Signal USA 2 04'). These signals can display all three aspects, with the USA 04 changing colors as necessary.

You could build a simple railroad with just these signals if you wish, but without too much additional complexity you can make things much more prototypical. Let's introduce two new terms: Absolute and Permissive (or Automatic).

Absolute means a red signal cannot be passed under any circumstances: stop means stop. With a permissive signal, the driver must still come to a complete stop on red. Then, however, he is allowed to proceed at a speed slow enough to stop within the distance he can see directly ahead of the train.

The ‘04’ USA signals above (and many ‘04’s’ for other areas as well) are absolute signals; they cannot be passed. Now check out the drawing below:



These two signals are USA 05 and USA 2 05. They look similar to the ‘04’, except they have the nameplate halfway up the mast. These signals are permissive; after a stop, the driver can continue at restricted speed. As with the ‘04’ signals, the ‘05’ signals for other regions probably work in a similar manner.

When would you want to use an ‘04’ as opposed to an ‘05’? Well, since the ‘04’ is an absolute signal, you’d use it where you want the driver to absolutely, positively, no-kidding stop. How about an open drawbridge, for example? You’d surely want him to stop there, wouldn’t you?

You’d also use an absolute signal where tracks join at a switch, like at the end of the pass track below.

As you see in the drawing, it’s critical that the train stop if the turnout is facing the wrong way, so we use an ‘04’ or other absolute signal.

If, on the other hand, we’re in open country, on a track that’s one-way in a given direction, it would efficient to allow trains to follow each other more closely than

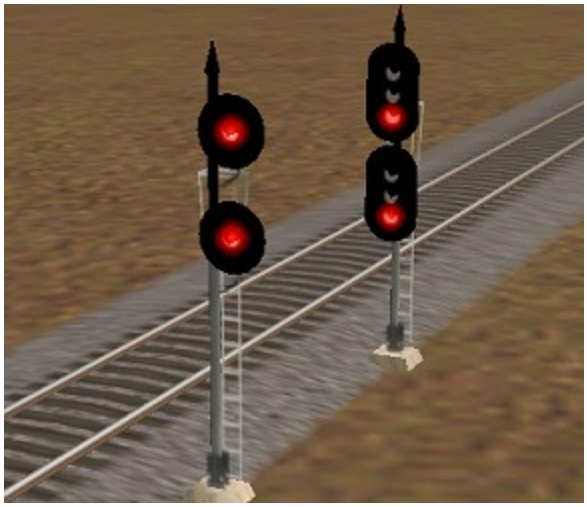
the signals might ordinarily permit, especially if the signals are two miles apart. In that case, we'd use a permissive signal, like the '05'.

In practical terms, though, if the signal is red, Train Simulator AI trains will stop at an '05' and stay where they are on red. If you're driving the train yourself, passing the signal is permissible after a full stop.

<u>The '02' signals</u>

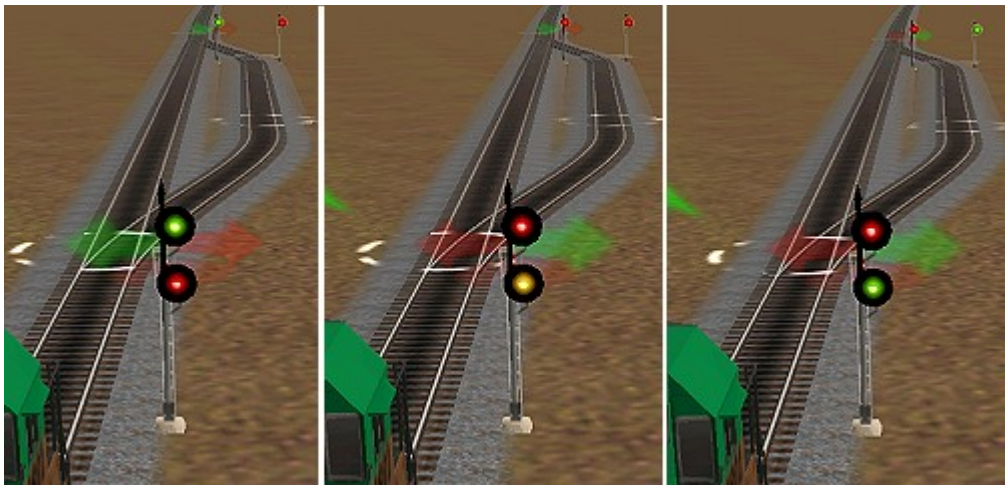
As we've seen, the '04' and '05' signals are used where tracks join, in open country, or when you require a positive stop. The '02' signal, and its close cousins, the '01' and the '03', are used where tracks diverge.

The '02' signal, in addition to showing an aspect, can also signal the train is to turn off the mainline. To do that, it usually has second signal head or some other means of indicating a divergence.

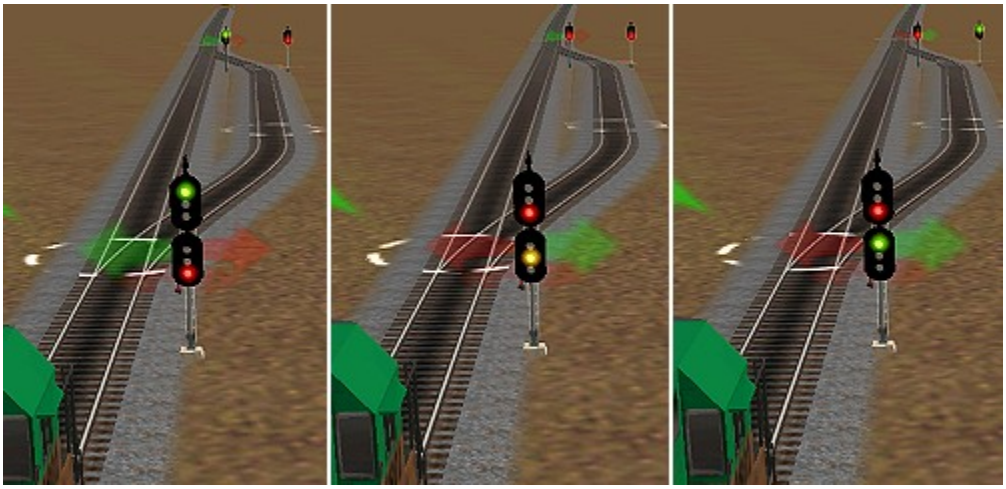


The signals above are USA 02 and USA 2 02. They probably have the same equivalents in other signal systems. In typical use, the upper head shows the aspect for the mainline and the lower head is for the diverging path.

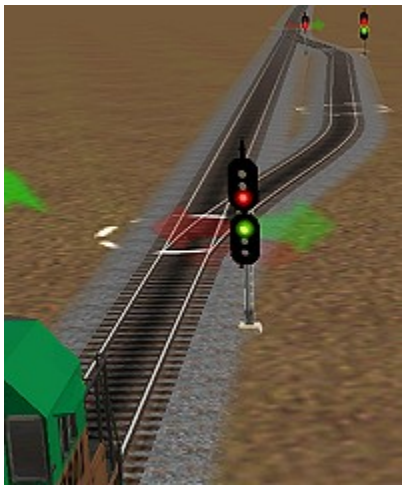
In the drawing immediately below, we see the USA 02 in action. In the left picture, the path is straight through, so the driver gets a green-over-red, indicating a clear. In the middle picture, pass track switch is open, so the lower head activates, showing the diverging path. In addition, since the switch at far end is closed, the driver will have to stop. The red-over-yellow, then, indicates a diverging path at restricted speed. Finally, in the right picture, the red-over-green indicates a clear through the diverging path. We might see this indication if a second train is stopped on the main opposite the pass track, and the switch at the far end is already open.



In the drawings below, we have the same indications for the USA 2 02 signal, also using USA 2 04's at the far end.



If you're following along in the Signaling Guide, they talk about using an '02' signal at the far end of the pass track as well. Like this:

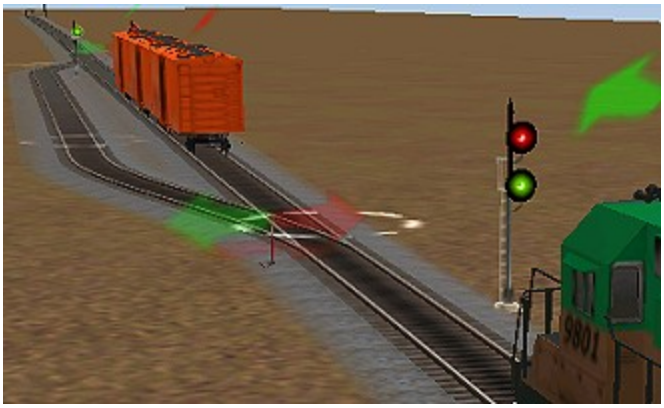


The intent here, I guess, is to show a merging path, and since the '02', like the '04' is an absolute signal, it would work fine there. If you like that concept, help yourself. On my railroad, I just use '04's—unless, of course, the second track continues beyond the crossover. That's a different matter entirely. :-)

<u>The '02' caveat</u>

The '02' actually has two versions, depending on the direction of the divergence. If the divergence is to the right, we use the regular '02', as we did above. If the path diverges to the left, however, we have to use 'L02'. The official names are "Signal USA L02" and "Signal USA 2 L02". They have equivalent versions for other regions.

Here's one in action:



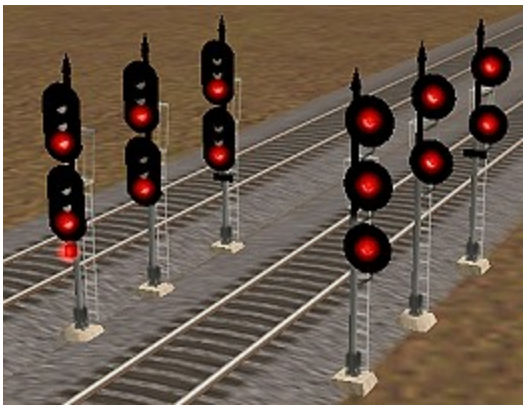
Even though the mainline is blocked by a string of boxcars, the train still has a clear path through the pass track, and the 'L02' shows a diverging path clear aspect.

It's important that you use the correct signal ('L' or no 'L') at any diverging path. If you don't, they won't work correctly.

A further note: If you plan to use the '02' signals at the far end of your pass tracks, be sure to check the drawing in the Signaling Guide. '02's placed at the far end are *opposite* from those at the entrance. For example, if you use a 'L02' at the near end, like the drawing above, you have to use a straight '02' at the far end. And vice versa.

<u>The '01' and the '03' signals</u>

Pictured below are two groups of signals, with the 'USA 02' and its cousins on the right, and the 'USA 2 02" and it's relatives on the left. The '01' signal, with three heads, is at the front of each group, with the '02' in the middle.



At the rear of each group is the '03' signal, and, since it has a nameplate on the mast, that makes it a 'permissive' or 'automatic' type of signal. These signals are typically used ahead of a divergence, with the '03' giving the engineer an advance warning of the state of the junction. Check out the drawing below:

In the pictures above, we have an '03' signal just in front of the loco. The next signal is a 'L02' (since the junction diverges left) and there are '04's down at the end of the pass track. (Hmm. Looks like I used 'USA 2 04's' instead of regular '04's' down there, but that's okay, they work the same way.)

In the left picture, both switches are set for the mainline. As you would expect, the '03' and the 'L02' both show clear. The '04' at the far end shows caution, but that will go to green once the loco passes the '03'.

In the right picture, the first switch is set for the loco to enter the pass track. The second switch, however, is still set for the mainline, so the loco is going to have to stop at the far end of the pass track. Both the '03' and the 'L02' now show caution. The mere presence of an '03' warns the engineer of a coming divergence, and the caution aspect calls for a speed restriction. In fact, if the GP38 is an AI train, it will slow to half the posted speed limit as soon as it passes the '03'.

This leads to an important point. In placing your '03' or any signal ahead of a divergence, be careful not to place it too far away. Why? Because no matter where the signal is placed, the train will slow to half speed once the '03' is passed. If the signal is a mile from the divergence, the train will run at half speed the whole distance.

So, you need your signal far enough away to give the train reasonable time to slow down, but not so far away as to delay the train excessively. A few test runs by your favorite train will determine the distance for a given situation. (Maybe some of you old-timers would care to comment on typical distances we might find on a real railroad. A long, heavy train on a downgrade might need that full mile!)

Oh, one last thing, about the '01' signals with three heads. For most purposes, they are identical to the '02'. Like the '02' they are absolute, so they cannot be passed on red. The manual says that the '01' is capable of displaying additional aspects, but these can currently only be utilized by programming in a scenario.

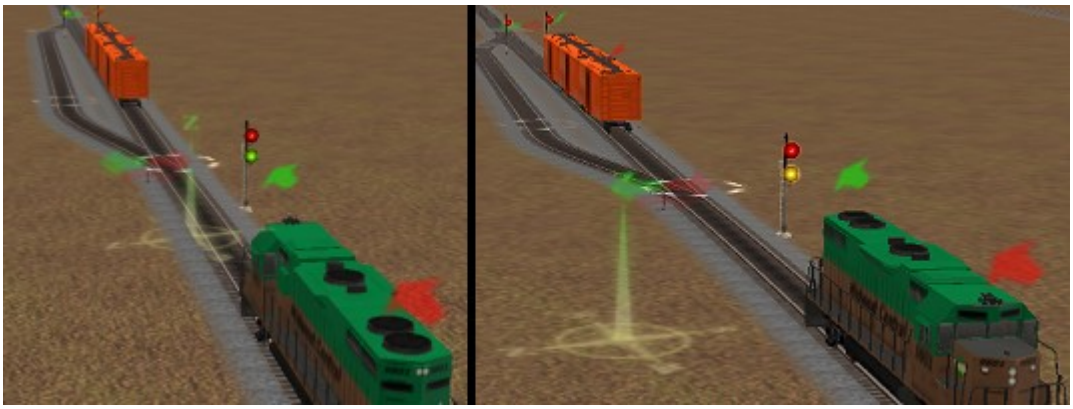
Installing and testing signals

Whenever you install a new section of track that includes turnouts and signals, it's always a good idea to test that junction from all directions to make sure it's working correctly. If you're new to Train Simulator, build yourself a test route and do some experimenting. Go to Surveyor and start a new, one board route. Call it 'test' or you can just accept the default, "New Route", name.

Once on the map, lay some track, switches and add your signals, just enough for what you want to test. Then place a locomotive near the first turnout and select the 'junction direction' tool from Trackside Objects.

With the tool selected, click on the turnout you want to test. You should see the green/red switch indicator change from one side to the other, an indication the switch is working. If there's a signal associated with the turnout, you'll see the signal change as well.

There's an important 'gotcha' here, however. *The locomotive must be facing the turnout!* If it does not, you will get a *false* signal indication. Check out the drawing below:



The two pictures above are of the same junction, but there is an important difference between them. In the left picture, the loco is facing *toward* the turnout. The signal indication is correct. In the right picture, the loco is facing *away* from the turnout. In this case, the signal is behind the locomotive instead of in front of it, and the signal indication is for a train moving away from the switch.

I learned this gotcha the hard way. Several times early in my Surveyor experience, I spent an hour trying to 'fix' a problem with the junction. The signals weren't working right and I couldn't figure out why. I replaced the signals and adjusted the switch levers—all the normal troubleshooting things I do; nothing worked until I found the loco direction problem. So, if you're having trouble with your testing, *always* remember to check the direction of your locomotive.

In truth, you can use any piece of rolling stock to test with and the switches and signals will work correctly. Using a boxcar, though, is more difficult than a loco,

because you can't tell which end is the front! You can't rely on the green and red arrows positioned over the rolling stock; they seem to have more to do with track direction than the car direction. Look at the drawings above. Notice the green arrow faces toward the turnout in both drawings, even though the loco faces in opposite directions!

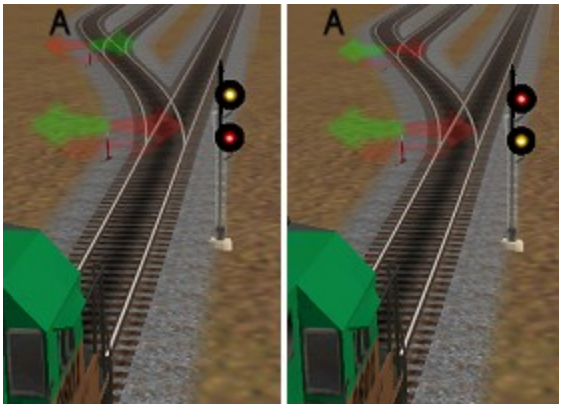
My advice: Use a loco that only has a cab on one end, like the GP38 above. If you pick a double-ended loco, you'll have the same problem as the boxcar. :-)

<u>Signaling with diverging routes</u>

Earlier, we said that at turnouts, we use an '02' or a similar signal that has a second head, or some other way to indicate a divergence. In the '02' signals, the upper head is for the mainline and the lower head is for the divergence.

Let's say that a particular '02' turnout is set for a diverging path. In that case, you'd expect the lower signal head to show an indication for the diverging route, wouldn't you?

Well, not necessarily. There is a small passage in the signaling guide that makes an exception for a diverging route that has a *further, un-signaled* divergence. It's easier to show it than talk about it:

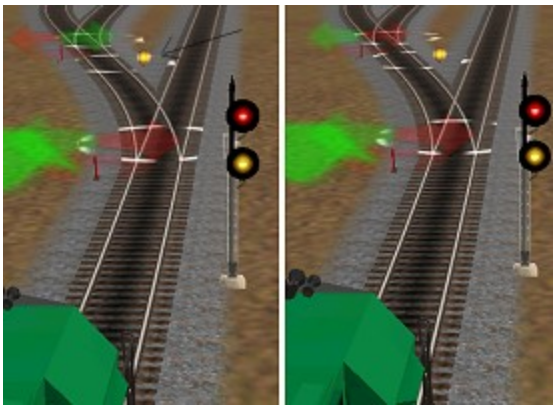


In the drawings above, we have a small industry area branching off the mainline. With the mainline switch aligned toward the industry, you would expect to see a red-over-yellow (or perhaps red-over-green) signal, indicating the divergence. Instead, in the left picture, we see yellow-over-red, which appears to be a normal mainline caution signal.

Here's why. In the Trainz signaling system, the signal will only indicate a *left* divergence when the switches are aligned toward the *leftmost* track. Otherwise, the indication looks the same as the mainline. In the left side of the drawing above, switch A is aligned toward the first industry track. In the right drawing, switch A is aligned to the second industry track and the signal gives the correct, diverging route indication.

The same thing applies to a right divergence, and only when the switches are aligned to the extreme right will you get the red-over-yellow or green indication you expect for a divergence.

If, however, we use an intermediate signal, such as the dwarf signal in the drawing below, then '02' signal works correctly.



Notice that no matter which way the second switch faces, the mainline signal still gives the correct red-over-yellow indication.