Transponding

Introduction

In the past, block detection could only tell whether or not a train was in the block. It couldn't tell you which train it was. Transponding gives you the ability to know which train is being detected. Idealistically, this could be used for several things. Realistically, in my opinion, there is little use for it. We'll discuss all the things it can be used for, then we'll discuss what you have to do to achieve that. You be the judge as to whether or not it's viable for you and your layout.

First, signaling does NOT require transponding, and as far as I know can't even use it to any benefit. Transponding provides information (loco addresses) that is not needed to do signaling. We have one customer who wants to use it so his computer can operate the train order boards for some engines and not others. Here's a legitimate use for it if this is to work with trains that are being controlled by engineers, and not by the computer. If the computer is controlling the train, transponding is not needed for the computer to know that the train is coming up to the train order board.

Transponding can be used for a Stopping Track. When the loco is detected, the system can bring that loco to an orderly stop by throttling it down gradually. When the signal turns green, the system can then throttle it back up, gradually, to its former speed.

But a stopping track can also be achieved without transponding. To do that requires decoders that have Automatic Analog Control turned off. The stopping track is powered with DC power when the signal is red. When the loco gets onto that track, the decoder will bring that loco to a stop according to the Deceleration Momentum programmed into that decoder. When the signal turns green, DCC power is restored to the stopping track and the decoder brings the loco back to its former speed according to the Acceleration Momentum programmed into that decoder.

There are two drawbacks to this wiring method, both of which can be handled. 1) The stopping track must be such that it will stop the train if another train turns the signal red just before the that loco passes the signal, and 2) If running long MU lashups, the first loco in the lashup will start slowing down before the last loco enters the stopping block to make it start slowing down.

While both of these problems can be reduced or eliminated by tricky wiring (depending on your track plan), using Transponding can eliminate them altogether. Because Transponding controls the train by its address, rather than by track power, all locos in an MU can be stopped together, and the train can be stopped to wait for a green signal even if the signal turned red an instant before passing the red signal.

There is one more problem with the DC/DCC wiring solution for a stopping track sound. Throttle Up!'s sound units do not work with DC power they must have a DCC signal in order to work. This can be handled if you're using a Chief system. The Chief has a stopping track option using the programming track outputs. To make this work, you connect another booster to the programming track output and set the appropriate OPSW. When not in the programming mode, the Chief puts out an all stop signal. Any DCC loco receiving the all stop signal will come to a stop. Since it's still getting DCC signals, Throttle Up! sound decoders will stop and continue to make sound. The stopping track itself still has to be wired like the DC/DCC solution. The difference is that instead of connecting DC power to relay in, you relay in the stopping track booster power.

Routes and Schedules can be done without Transponding. By using software such asWinLock, you can program routes and schedules that trains will keep while you operate way freights manually keeping out of the way of the scheduled trains. The computer will know which switches to throw or close as the train it's controlling comes to them because you will have programmed all that information into it. All you need is a few more detection points so the computer can keep track of the train's progress around the layout.

Transponding can be useful here. With the computer being able to confirm which train is where on the layout, the need for extra detection points can be reduced.

Broken trains can be detected with Transponding. If you have a transponder in the loco and another one in the caboose (or last car), those two transponders should never be found in two different blocks that do not adjoin each other. If the computer finds them in non-adjoining blocks, it could sound an alarm that the route-controlled train is broken and needs attention.

Staging yards can be automated without Transponding. By designing the staging yard with adequate detection and stopping blocks, it can be automated to almost any amount you want even to the point of automatically finding the smallest available staging track that an approaching train will fit in, and automatically going there and stopping when it reaches the far point. And when starting a train from the staging yard, it can exit automatically. All you have to know is the train's address.

However, Transponding could provide some advantages here. For example, to select a train from the staging yard, you will have to know which address to select. If you don't know that, you'll have to look at the trains. But if it's a hidden yard, that could be cumbersome. With Transponding, you can tell which trains are there. And there are other things Transponding might help you with here.

Some of the things listed above, such as a stopping block, can be achieved without Transponding and without a computer. Some things, such as routes and schedules, can be achieved without Transponding but will require a computer. If using Transponding for any of these things, a computer WILL be required, and you will be required to program it to use the Transponding in whatever way YOU deem necessary.

Today (March, 2002), some computer software supports Transponding, some doesn't. Even those that support it do not support it in a way that can take full advantage of it's capabilities such as some of those things listed above. Some software takes into account that not all blocks will be transponded. To accommodate this it will keep track of which direction the train is going and will assume that that transponded address has moved from the transponded block to the next block when it gets the block detection message that it has been entered. In some cases, it will do this for three or four blocks, or until it's transponded again whichever comes first.

In any case, there is NOTHING that is out of the box about any of this. Since each layout, situation, operation, person, etc. are different, there's no one way to do any of this. All of this takes a great deal of forethought, ingenuity and time. It's not something you can learn with a phone call to somebody about every detail there are just too many of them. If you're not capable of figuring out things on your own (with a minimum of phone help), or are not proficient in using computers and software, you may have a hard time of it and probably shouldn't try to tackle this sort of thing.

Now let's get into the hardware requirements of Transponding.

First, occupancy detection via Digitrax's BDL162 or BDL168 is required. If you have block detection with any other type of block detectors, they will have to be removed and replaced with BDL162s or BDL168s.

The BDL162/BDL168 provides detection for 16 blocks. It plugs into LocoNet to be able to communicate with the computer, command station, or any other device on LocoNet that needs to know what the BDL162 or BDL168 has to say.

BDL162s and BDL168s also have a connection to accept and use one RX4 (BDL162) or two RX4s (BDL168). You can have 8 transponder receivers per BDL168, or 4 per BDL162.

With block detection and Transponding receivers in place, the last key to the system is transponders in the locos and/or cars. Some of Digitrax's decoders come with Transponders included, some don't. All decoders with numbers that end with "2" or "3" have a built-in transponder. The only decoder that ends with "1" and DOES have a built in transponder is the DZ121. All other decoders that end with "1" do NOT have a built in transponder. For decoders that have transponding built in, all you have to do to use it is turn it on. That information is included with the RX4 Transponding receiver.

So far, no other manufacturer provides a built-in transponder. And since Transponding is a Digitrax proprietary product, it's highly unlikely that any other manufacturer will offer this feature even though it could be licensed. Because of this, Digitrax has four stand alone transpondersyou can install: TD1 (Transponder only), TL1 (Transponder with one light function), TF2 (Transponder with two light functions), and TF4 (Transponder with four light functions).

These stand alone transponders are easy to install. They both have the standard red and black wires for power pickup. This is all that needs to be connected to make it transpond. However, the TL1 also has one light function. As such it also has blue and white wires. The TL1 is provided with a light function so it can be installed in a caboose, passenger car, or last car with FRED. The light function can be mapped to F0, F1, F2, F3, or F4, and is programmable to be a standard on/off light, flashing light (such as a FRED), strobes, Mars Lights, and others. The TF2 and TF4 also have additional wires and similarly programmable light functions.

Transponders do need to have their address programmed. If installing one in a loco that already has a decoder, it should have the same address as that decoder. However, this is not required. If you wish to have it transpond under a different address for some reason, you can. Transponders in cars also need an address different than that of the loco.

Here's How it all Works

First it's assumed that locos and cars that are to be transponded have transponders that are turned on. It's also assumed that you understand that control packets are sent to active locos and cars many times per second.

When a transponder receives a control packet (many times per second), it responds with a "ping" on the tracks. This ping happens during a time, between packets, when the command station allows such things to happen without affecting packets.

BDL162/BDL168 occupancy detectors monitor track power to decode the address of all packets sent. Therefore, they always know which address was last sent. When the Transponding receiver receives a "ping" back, it notifies the occupancy detector that it received a ping. Since the occupancy detector knows which block the Transponding receiver is connected to, it knows which block that pinged address is in, and sends that information out over LocoNet. Any device that is interested in transponding can then pick up that information for whatever use you've designed it for.

The BDL162/BDL168 has a certain amount of memory to keep track of which loco addresses have been reported for which blocks. This way, when it gets another ping for that same address in the same block (which will happen many times per second), it will not send more messages over LocoNet doing so would bog LocoNet down with nothing but Transponding messages. It will only send a LocoNet message when an address is first pinged in each block.

Equipment Requirements for Transponding

This has been covered in the text above, but we'll go over it again.

If you want Transponding, you must have block detection with BDL162s or BDL168s, RX4 Transponding receivers connected to those BDL162s or BDL168s, and Transponders in each loco or car you want transponded.

All of Digitrax's current systems can program any value into transponding CVs.

Transponding is not intrusive. If you have decoders with transponding, you do not need to turn it off to not use it they come with transponding turned off. You can even use a TL1 or TF4 (transponder with light functions) for their light functions without using their Transponding capability. You can do block detection with BDL162s or BDL168s and signaling without transponding. BDL162 or BDL168 block detectors work just fine for block detection without RX4 transponding receivers.