Model Train™ TECHNOLOGY

D-Signal Controller™

OPERATIONS MANUAL

LED and Fiber Version

Version 2.0a

INTRODUCTION

The Model Train Technology™ ***D-Signal Controller™*** provides an extremely simple but powerful plug-and-play system for lighting and animating ground-based signals, otherwise known as “dwarf” signals. These signals are mostly used in connection with turnouts so you will find them in abundance in freight and switching yards. This controller comes in two version: LED and Fiber Cable. LEDs should be used for O, S and G Scale where Fiber versions are not available. We prefer Fiber for N and HO Scale.

Using our existing signaling and fiber technology we incorporated some changes to accommodate the unique requirements of these signals including full ***interlocking*** capability. There are many ways that turnouts are switched so we made the ***D-Controller*** as flexible as possible. There are five different ways that the ***D-Controller*** can keep in sync with your switches:

1. Slow motion motor switch
2. Snap-like coil switch machines*
3. DCC mirroring
4. MTT Precision Detector

5. Mechanical toggle switch

** requires the MTT coil sensor.

Additional features of the ***D-Controller*** are:

1. Remembers the turnout state when power is turned off.
2. The lights can fade or change instantly.
3. The brightness of each output can be set independently
4. Link the A and B output ports. There are two output circuits but there may be times when you want both circuits to act as one.

5. Interlocking ***D-Controllers*** so that one turnout that controls access to any following turnouts will set both signals of the following turnouts to RED. This make sense when the turnout ahead is switched away from that line. You can daisy chain these all the way through your switching yard. There is a more complete description toward the end of this manual. (This is a cool feature!)

6. Three-way switches can be configured using two ***D-Controllers*** set to interlocking mode.

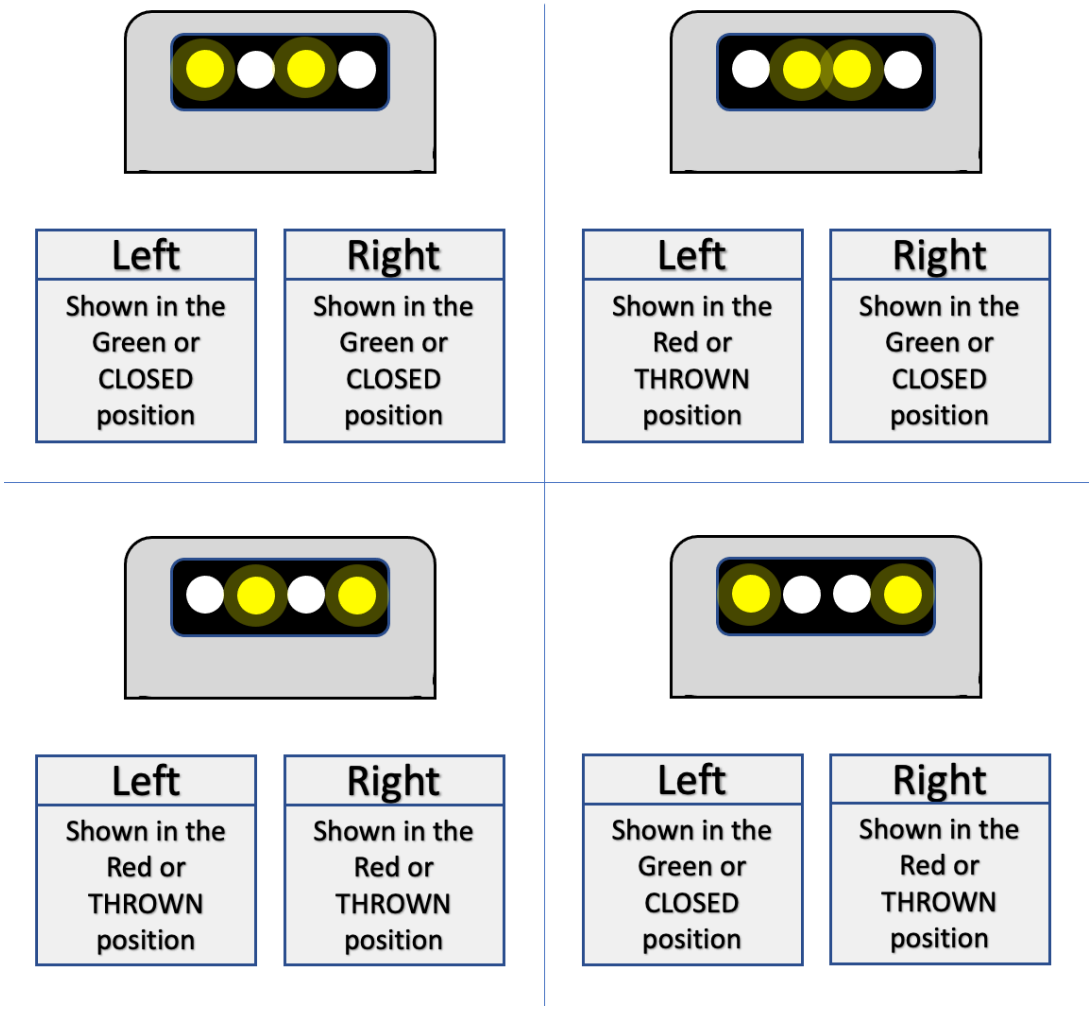
OVERVIEW

Each ***MTT D-Signal Controller*** ("***D-Controller"***) has two pairs of independent lights and trigger circuits each of which is triggered by one of the five switch methods listed above. The ***D-Controller*** has an optional magnetic base which can be mounted under the layout so that the D-Controller can be removed easily when needed.

The ***D-Controller*** also has a built in DCC decoder that allows your block signals to change automatically when you switch a turnout or route. The D-Controller has two switch addresses so that you can manage two groups of turnouts with one D-Controller. No software, computer or programming is necessary. And there is no complicated wiring. <u>You don't need DCC to run the D-Signal Controller</u> but it's there if you want it.

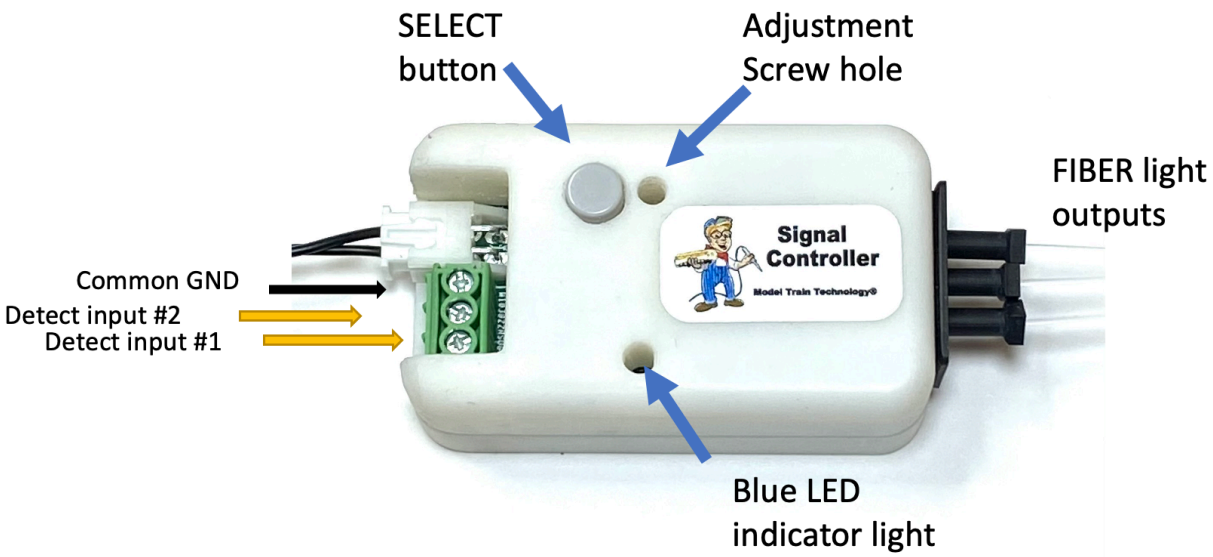
When one of the two ***D-Controller*** inputs is tripped by any one of the methods listed above, the light pair associated with that input switches Off/On. Releasing the input turns the lights back On/Off. Note that the lights (LEDs) are all "white". The Red and Green aspects are created via the colored lens on the end of the fiber inside the signal. You can also use our BLUE

fiber CTC panel light as one of the fibers with the MTT 2-core pin. See the diagram below for the display example.



The two inputs normally work independently. You can use our 2-core fiber pins and connect two dwarfs to each light. In this way you can have lights facing in both directions that work in tandem.

SETUP AND OPERATION



When you plug in power the blue internal LED will light. The CLOSED or green side of each FIBER output will light.

The D-Controller setup is simple. Connect to a 5 to 12VDC power source (or DCC power) to the topmost JST terminals as shown above. The JST connector with wire is included. Connect your Fiber pins and cable as shown on the right.

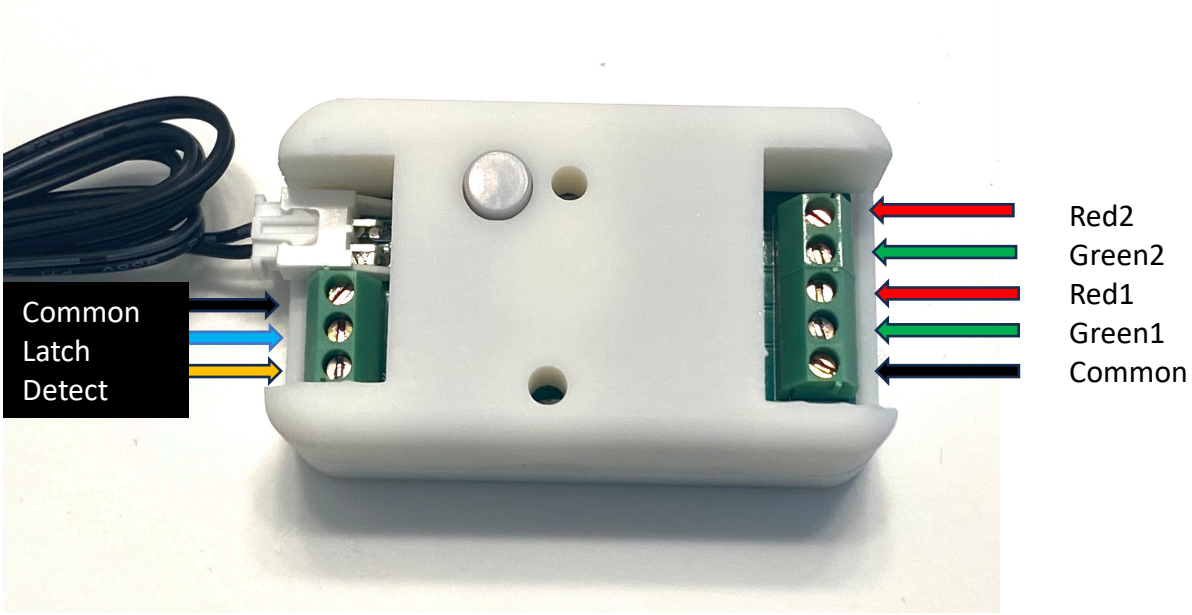
The Detect Signal input is an OPEN DRAIN (GROUND) connection. That means that the signal it's looking for is a ***digital LOW***.

NOTE: this Open Drain low is NOT the same as a LOW/HIGH from an Arduino. DO NOT connect an Arduino GPIO pin directly to the Dwarf Signal D-Controller.

If you use our ***MTT Power Module*** to power your detectors and the ***D-Controller*** you only need the single yellow SIGNAL wire to connect the trigger wire. If you are connecting many signals to the Power Module we recommend the 12V version.

If you have another kind of sensor system you can either have them share the same power supply or use the GROUND terminal. You may also "short" the ground and the signal to create the same result. In other words, a simple mechanical switch between SIGNAL and GROUND will trip the D-Controller. Very simple.

Wiring for the LED version:



Pressing the gray SELECT button on the top of the D-Controller will activate settings according to this chart:

1	Adjust Output 1	Press Select once to save the brightness adjustment.
2	Adjust Output 2	
3	Adjust Output 3	
4	Adjust Output 4	
5	Fade mode ON	
6	Fade mode OFF	
7	Standard Mode	Turns off Interlocking & Link mode.
8	Interlocking Mode	Activating one deactivates the other.
9	Link Ports	
10	Clear Interlocking	Clears the DCC interlock Addresses
11	Reverse wired input	(Toggle) Reverse Interlock wired input
12	Blue LED Timeout	(Toggle) Blue LED off after 60 sec.
13	RESET	Set everything to defaults (OFF)

SETTING THE BIGHTNESS

Setting the brightness for each output is accomplished by selecting the number of the output you want to adjust via the SELECT button. You press the select button 1, 2, 3, or 4 times to select any light 1 through 4.

Within one second of button release, all the lights will go out and the selected light will light. Use the provided screwdriver and carefully insert and turn the inside screw clockwise and counterclockwise to reach the desired brightness.

When you are happy with the setting, press the SELECT button once. This will save the setting and return the D-Controller to ready mode.

SELECTING A SIGNAL LIGHTING BEHAVIOR

The D-Controller has only two light behaviors that can be selected. They are instant change or fade change. The fade change simply fades the light from Thrown to Closed and back.

The above chart indicates that 5 presses of the SELECT button will switch the D-Controller into Fade mode. Pressing 6 times will turn Fade mode OFF.

RESETTING THE D-CONTROLLER

If you happen to get lost while configuring the ***D-Controller*** or want to get everything back to its default settings use the reset procedure. It's very simple. Press the select button 13 times. The D-Controller will flash a few times and then return to the ready state.

DCC OPERATIONS

The ***D-Controller*** can respond to DCC Accessory messages just like your turnout controllers. The ***D-Controller*** will respond to two consecutive addresses. If you set the ***D-Controller*** to address #17 (for example), the left two lights will respond to Accessory #17 for CLOSED and THROWN, and the right two lights will respond to Accessory address #18 for CLOSED and THROWN.

THEREFORE, to work with DCC in what we call mirroring, set the D-Controller to the SAME address that you set your turnouts. That's all there is to it.

The Dwarf Signal D-Controller will remember the turnout positions so when you turn the power back on the lights and the turnout will be aligned with no further action required.

Depending on your DCC system, the DCC hand control might show the last known turnout position. Or it might not. But the MTT ***D-Controller*** saves each turnout command so that when you turn OFF the power to your entire layout and then turn it back on, the ***D-Controller*** will show the lights in the correct and last position of the turnout!

To coordinate the DCC setting with your ***D-Controller***, you set the ***D-Controller*** to the SAME address as a turnout so that when you change the turnout, the ***D-Controller*** automatically changes the color of the signal. You can also configure several D-Controllers to the same switch address so that multiple but different signal lights will light according to your layout design. Since ***routes*** are a combination of turnout commands, the ***D-Controller*** can align the signal lights accordingly.

You can set the ***D-Controller*** to any valid accessory switch address between 1 and 2044. When the ***D-Controller*** receives a DCC turnout command (thrown or closed) that matches the ***D-Controller*** address, it will activate the trip function of the ***D-Controller*** and start the aspect animation. (Remember that the **D** version of the Controller reserves two (2) addresses; the primary and the primary +1.)

- Closed means that the siding is closed, and the switch aligns with the Main Line – meaning the switch should be straight.

- Thrown means that the switch is set to divert the train to the siding or wherever else it might go, but not straight.

In wired, non-interlock mode, the ***D-Controller*** uses the THROWN direction as a tripped condition.

If you find that the Thrown and Closed states are backward to the way you want to display the signal, simply reverse the fiber cable connections to the ***D-Controller.***

To operate the ***D-Controller*** with DCC you must power and connect your DCC rails A & B to the ***D-Controller***. For small and medium sized layouts this should not be a problem since the ***D-Controller*** and LED require about 30ma each to run. For larger layouts or layouts with a lot of signals connected to your DCC track we suggest you create a separate Booster zone. This way, no current will be taken away from the rails to run the engines.

If you want both outputs to follow a single input, either DCC or wired, then set the D-Controller LINK PORTS mode using option #9. Use Set Standard mode to turn this feature OFF.

SETTING THE D-CONTROLLER ADDRESS

With the D-Controller in the non-tripped state, press and hold the select button for about 10 seconds. Within 1 second of beginning to press the button, all the signal lights will go out.

<u>Continue to hold the select button until the light comes back on and then release the button immediately.</u>

The lights and the blue power light will begin to flash on and off. This indicates that the ***D-Controller*** is ready to accept a new address. Wait until the lights flash back and forth to proceed.

To set a new address, select the Accessory/Turnout number that you want to assign on your DCC hand cab. This can be a number from 1-2044. Using your DCC hand cab, enter that number and then press the appropriate command to set a CLOSED or THROWN switch event. In NON-interlink mode, either closed or thrown will work. This will be slightly different depending on the brand of DCC system that you are using.

If you have a DCC system where only an icon is selected for programming and not a number, use the same method as you would for any other turnout. Put the ***D-Controller*** into programming mode and when the lights begin to blink you can press the associated icon on your DCC system.

As soon as you select CLOSED or THROWN, the ***D-Controller*** will flash 4 times and the lights will go off. The ***D-Controller*** is now set to the new address.

To exit the address setting mode WITHOUT changing it, press the Select button once. The D-Controller will return to its ready state.

While DCC is connected and active, DCC commands will override the input signal. In other words, you can use detectors OR DCC to trigger the *D-Controller* but not at the same time.

INTERLOCKING & THREE-WAY SWITCHES

YouTube Videos:

https://youtu.be/Dk7eP6yPSQg
https://youtu.be/a3hHoweTQF0
https://youtu.be/ILXS3EbvSjA

Interlocking, as used here, is the process of connecting the output of one D-Controller/turnout to the Input of a following D-Controller/turnout.

When turnout #1 is closed, turnout#2 is effectively cut off from the mainline and thus both of its sides of turnout #2 should show a RED indication. However, when turnout #1 is Thrown in the direction of turnout #2, then turnout #2's direction, either thrown or closed should be indicated. That is how the D-Controller works.

Likewise, if in turn turnout #2 is controlling access to turnout #3 and it's closed (not thrown to turnout #3), then turnout #3 should also show both red signals. Then, when any combination of turnout positions allows a clear path for a train to the exit, all the turnouts in that path will show green.

If you simply connect the D-Controller to each of the turnouts separately (not interlinked), then each will show the position of the turnout irrespective of the turnout ahead. Thus, one side will show green when in fact that direction may be unavailable because of the position of the connected turnout. This is a perfectly fine implementation and would be a non-interlinked configuration.

However, with interlocking you can cascade your D-Controllers and signals through the entire yard, both entrances and exits. If you are using DCC you do not have to wire anything – just connect the A/B rail power to the D-controller, set it's address and configure it accordingly.

If you are connecting the D-Controller via one of the wired methods, the process is almost as easy. You feed the signal switch wire of input #1 of the D-Controller #1 to interlock of the #2 input of the D-Controller following it. The first D-Controller connected to the turnout that provides access to the main line will usually run in Standard mode.

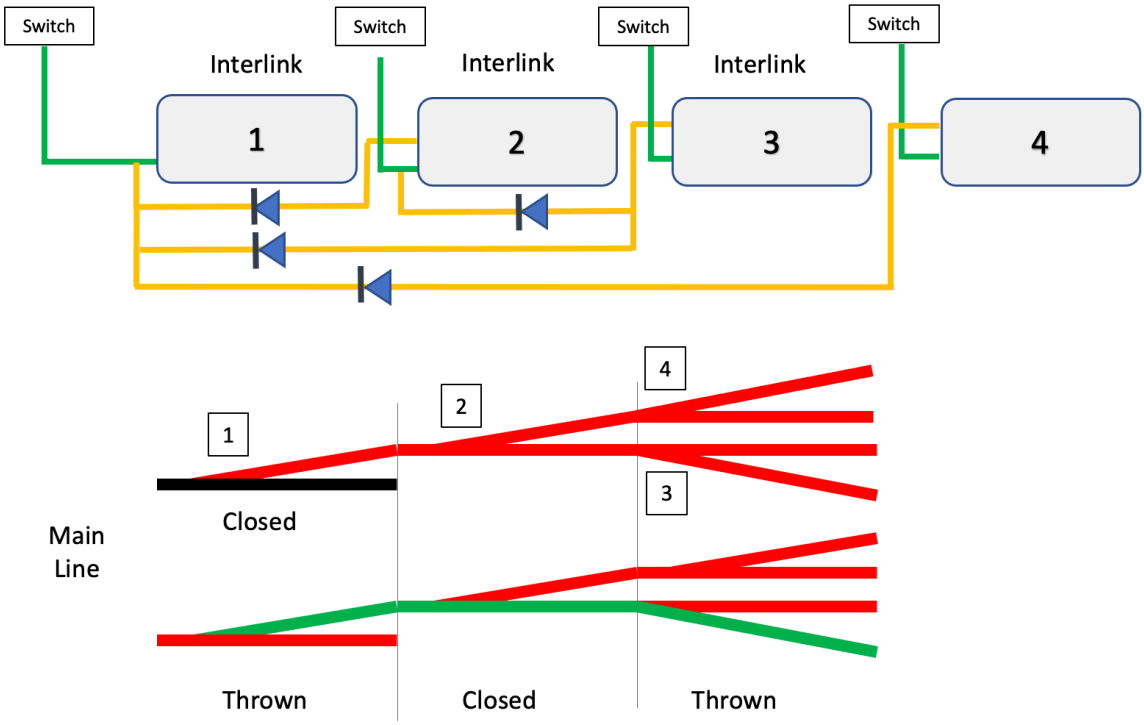
A three-way switch is simply a combination of a primary turnout and a secondary merged into one device. To operate a 3-way switch you need two switch motors/coils. Therefore, you will also need two D-Controllers. You set the first D-Controller to Standard mode and the Second one to Interlocking. You then load the interlocking decoder addressed of the first D-Controller into the interlocking address of the second D-Controller. To accomplish this, you will use a version of the address setting mode.

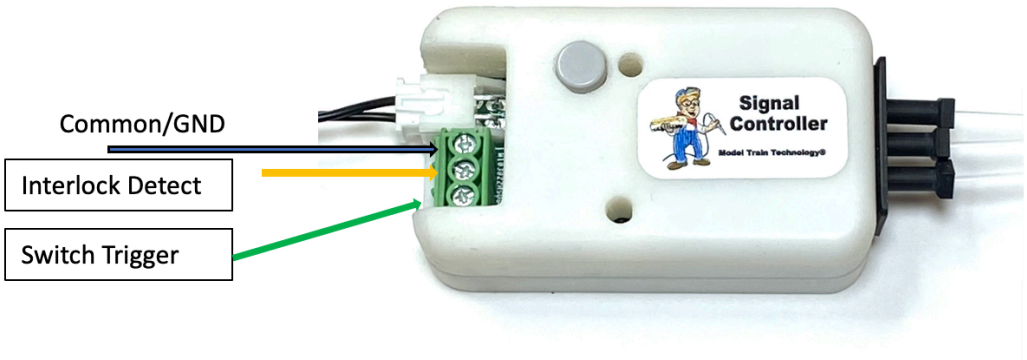
MUTIPLE CASCADING TURNOUTS

In the case where you have cascading turnouts and are using DCC, the first D-Controller in the "tree" can be set to either Standard mode or Interlocking. The second and subsequent D-Controller should all be set to Interlocking.

If you are using wired mode, you connect the #1 input of the following D-Controller to the Input #2 of the D-Controller following it. This is very similar to latching mode used for multiple connected blocks out on the

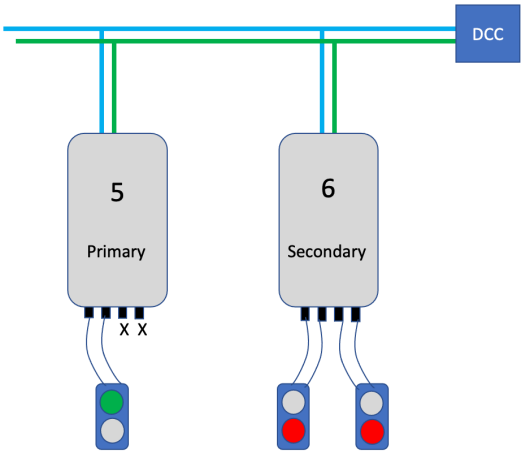
mainline. To establish a multi-tier or cascading branch of turnouts, use a simple switching diode on the input side of the D-Controller so that each branch of the tree can separately trigger the interlocking. The figure below shows this configuration.

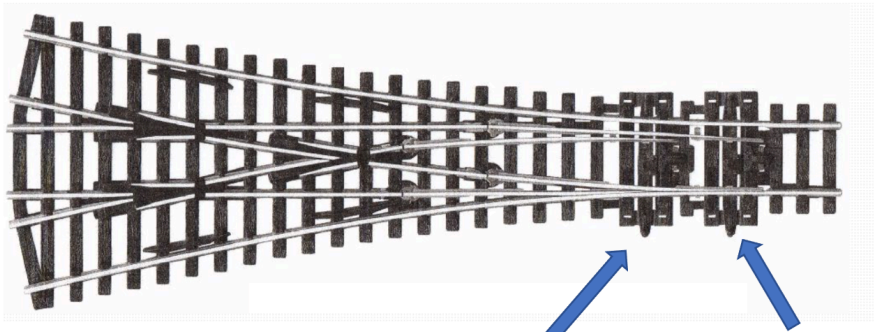




THREE WAY SWITCHES

The D-Controller can synchronize with all three-way switches. Since a three-way switch requires two turnout machines, likewise you will need two ***D-Controllers*** to make this work. Here is the basic layout of three-way signaling. Note that only one of the light outputs of D-Controller ***Primary*** is needed.





This is the Secondary Turnout. Set the D-Controller mode to Interlocking and load the DCC address of turnout #1 along with whether Thrown or Closed provides the path to exit through turnout #1

This is the Primary Turnout. Set the D-Controller Address to the same as the turnout machine.

** Example PECO Switch

DCC CASCADING INTERLOCKING

While at first this might seem daunting, the architecture is very simple and easy to implement. In short,

1. For each turnout on your layout, assign a D-Controller and give it the same address that you use to switch the turnout. We call this mirroring.

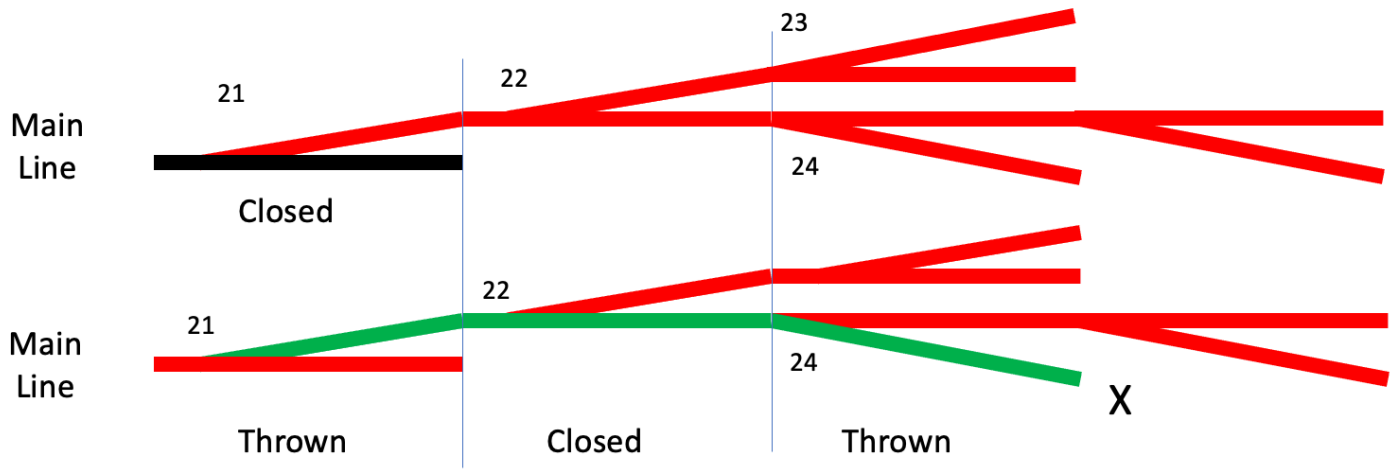
2. Then, for each D-Controller, except the one at the top (beginning) of the tree, load the DCC address of all the turnouts that proceed it.

3. When loading each address, note which direction – Thrown or Closed would give the switch a Clear-to-Proceed path. This will depend on which way you installed the turnouts. Sometimes people get the wiring for a switch backward (Thrown to Closed or vise vera). As long as you select the option that gives the Clear-to-Proceed path for the turnout you are configuring for, it will work.

Note: With Icon based systems you may have to first set the turnout in the OPOSITE direction of how you want to align throw and closed because pressing the icon toggle/switches the direction. Thus, it is the switched direction that the D-Controller will read and assign.

Now, when you switch a turnout that proceeds the one you are installing, and that switch cuts off the route to the exit, both of its signal lights will turn red – regardless of the direction of the physical switch. When you then switch the switch ahead that gives a clear path, the D-Controller will change the lights back to match the physical turnout.

Decoder Number	21	22	23	24
D-Controller Setting	Standard	Interlink	Interlink	Interlink
InterLink Permission	none	21T	21,T 22,T	21,T 22,C
D-Signal Controllers:	1	2	3	4
DCC	21	22	23	24



HOW TO LOAD INTERLOCKING DCC ADDRESSES.

You should have already practiced setting the D-Controller's own DCC address. The process for loading the interlocking address is similar.

1. Using the included table, mark down the address numbers of each interlocking turnout AND, mark down which way you chose for the clear path to the exit, either Thrown or Closed. In some cases, like NCE this is #1 or #2.

2. Set the D-Controller into address setting mode by holding the Select button. The lights will go out. Continue to hold until the lights come back on – then release the Select button. The lights, including the blue LED, will begin to flash. Wait until this begins.

3. While the lights are flashing, press the Select button Twice. (press, press)

4. The lights will flash twice but then continue to flash on and off.

5. Select the DCC address of the first interlocking turnout on your DCC controller. Then press either Thrown or Closed as you marked on the table.

6. The light will go off, the blue LED will flash 4 times and then the D-Controller will resume its alternate flashing. The flashing blue LED indicates that the address and throw direction are saved.

7. You are still in the mode to load additional interlocking address and directions. Add the addition addresses as needed.

8. To finish and EXIT this mode, press the Select button once.

9. The D-Controller will return to ready mode.

It's not possible to edit an individual address or setting. The only way to fix an error is to clear the interlocking address and start again. I have a test layout that has 6 switches. After some experimentation the whole process to load all the D-controllers took about 20 minutes.

Each D-Controller has room for 20 interlocked turnouts. That should be enough for even the very largest layout.

LINKING PORTS

In Standard Mode the D-Controller listens to two sequential DCC addresses or two separate wired inputs. If you like, you can ***Link*** the ports so that both light outputs operate in tandem with the first wired input or primary DCC address. This is useful when you want to extend fibers to your CTC panel to show the turn out positions in sync with the layout.

BLUE LIGHT TIMEOUT

If set, the BLUE indicator light will go out after 30 seconds of startup or if the Select button is not pushed. Each time you press the Select button, the light will come back on and start its 30 second timeout clock.

ELECTRONICS AND STATIC ELECTRICITY

The ***MTT PRECISION DETECTOR™ - Trackside*** circuit board and components are exposed when the cover is off. Electricity can be dangerous. Static electricity can cause component failure. Scuffing along a carpet and then touching one of the component connectors can cause a static spark. These components are fairly rugged – some designed for the automotive industry. Just be mindful of the risk. The current on the board will not harm you if the board is powered and operated as per the instructions.

ONE YEAR MANUFACTURER WARRANTY: We warrant this product to be free from defects in workmanship and materials, under normal residential use and conditions, for a period of one (1) year for the original invoice date. Shipping and handling fees are to be paid for by the customer.

LIMITATION OF LIABILITY

UNDER NO CIRCUMSTANCE SHALL COMPANY OR ITS AFFILIATES, PARTNERS, SUPPLIERS OR LICENSORS BE LIABLE FOR ANY INDIRECT, INCIDENTAL, CONSEQUENCIAL, SPECIAL OR EXEMPLARY DAMAGES ARRISING OUT OF OR IN CONNECTION WITH YOUR USE, OR INABILITY TO USE THE PRODUCT, WHETHER OR NOT THE DAMAGES WERE FORESEEABLE AND WHETHER OR NOT COMPANY WAS ADVISED OF THE POSSIBLITY OF SUCH DAMAGES. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, COMPANY'S AGGREGATE LIABILITY TO YOU SHALL NOT EXCEED THE AMOUNT OF THE PRODUCT. THE FOREGOING LIMITATION WILL APPLY EVEN IF THE ABOVE STATED REMEDY FAILS OF ITS ESSENTIAL PURPOSE.

Model Train Technology LLC

10524 Moss park Rd. Ste. 204-256

Orlando, Florida 32832

407-242-5436

www.ModelTrainTechnology.com

support@modeltraintechnology.com

Version 2.0a