



Train Detection for MR Layouts - Getting Started

You are considering adding train detection to your layout for:

- signalling
- one or more grade crossings
- locating a train on hidden track,
- knowing when a train has reached the end of a hidden stub track
- triggering animation when a train arrives at a certain point
 - Sounds as a train passes by
 - Speedometer for speed matching of locomotives for consistings
 - Defect detector, etc.

This document is a combination of ECD member Douglas Margison's research and experience. It was developed for people with some experience in model railroading who are considering building a new layout or want to add animation to a current layout.

Detection Types

There are two main types of detection.

1. Block occupancy detection

- Easiest approach is generally a current detector (e.g., an NCE BD20)
 - Current needs to flow through at least the last car in the train in addition to the locomotive – there is a point at which the locomotive enters Block C from Block B. Until the last car leaves Block B one wants the signal aspect at the entrance to Block B to be Red for any train approaching Block B through Block A
 - Some rolling stock manufacturers produce cabooses and other cars with lighting through track current
 - Install commercial resistance wheelsets on rolling stock – Google “model railroad resistant wheels” (e.g., <https://www.logicrailtech.com/dws.htm> ; <https://jbwheelsets.com/resistor.html>)
 - DIY (Do-It-Yourself) resistance wheelsets for rolling stock
 - DIY & Digital RR “DIY Resistor Wheelsets for Model Railroad Train Detection” <https://www.youtube.com/watch?v=AWp3heDz7Gw>
 - Little Wicket Railway <https://www.youtube.com/watch?v=22Zu2HBQTil&t=709s>
- Alternative: point detectors at the entrance and exit to a block – see “Point Detection” below
- Uses
 - To detect a train in specific areas – e.g., tunnel block; hidden staging



Train Detection for MR Layouts - Getting Started

- In Automatic Block Signalling (ABS)
- In Centralized Traffic Control (CTC) to control switches and signals
- YouTube videos: LS3Jack "Block detection and signals"
<https://www.youtube.com/watch?v=hN6R9JKQFYg> ; DCC Guy (Larry Puckett) "Block Detection For Your Model Railroad (269)" <https://www.youtube.com/watch?v=6RIQjyZcil0&t=302s> – note: Larry tends to spend some time at the beginning answering questions for a previous YouTube video → so you may have to move the slider along a bit to get to the video's topic
- If want to use current block occupancy detection, the ideal starting point is before you begin to wire your layout. Current detection requires you to gap one side of the rails. The track feeder wire from that rail loops through the current detector before connecting to the main power bus.
- How will you integrate signalling blocks into power blocks? Depending on the length of the mainline in a power block you may want to subdivide the power block into more than one track occupancy blocks. If track feeders are at 3 ft intervals, a track occupancy block may include more than one track feeder.
- Power blocks need to be gapped on both rails. Track occupancy blocks need only be gapped on one side.
 - For DC-powered layouts, you will be blocking the layout into routes for cab control.
 - For DCC-powered layouts, while you may not need to block into power districts it may be useful to do so up front.
 - If you are getting back into the hobby in your middle age and have some old DC locomotives, power route blocking for cab control / DCC districts will allow you to run DC and DCC locomotives on separate routes
 - If you are using a commercial DC throttlepack and a commercial DCC command station, DPDT centre-off switches can be used to assign a block to DC or DCC.
 - If you want to take up the challenge of fabricating a DCC-EX command station to run DCC-EX version 5 or higher software with Track Manager, as of March 2024 you can assign up to 7 blocks / districts to either DC or DCC
- Current detector / sensor: NCE BD20 – LS3Jack "Understanding the NCE BD20"
https://www.youtube.com/watch?v=Yt_HhRjIi7o&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=52 ; DCC Guy "Block Detection For Your Model Railroad (269)" <https://www.youtube.com/watch?v=6RIQjyZcil0&t=302s>
- Integrating current detection with Arduino to control signals and automation
 - DIY & Digital RR "Easy Arduino Current Sensing for Occupancy Detection"
<https://www.youtube.com/watch?>



Train Detection for MR Layouts - Getting Started

[v=Gyc1YskOeUo&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=51&t=20s](https://www.youtube.com/watch?v=Gyc1YskOeUo&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=51&t=20s)

- DIY & Digital RR; “Upgrading the Multiblock Signal System to use Current Sensing” https://www.youtube.com/watch?v=XOKfErP_ixE&list=PLhNb9AHNpkeezXepOx15ef5xktod8kWBK&index=4 – in this video, Jimmy switches from using Infra-Red detectors (see below) to current detectors
- LS3Jack “Using an Arduino to control signals” <https://www.youtube.com/watch?v=YecqNcjXzD8&list=UULFAiVmDbdwHJVEq8ZMVwGsQw&index=28>
- LS3Jack “Completing the signal project” <https://www.youtube.com/watch?v=Ky8G7CMrqI0&list=UULFAiVmDbdwHJVEq8ZMVwGsQw&index=27>
- **Note:** a separate document has been generated specifically for signals on a Model Railroad layout
- **Commercial products**
 - NCE BD20 under Automation and Detection <https://www.ncedcc.com/> – Manual: <https://www.dcccconcepts.com/manual/nce-owners-manual-bd20-block-detector/>
 - RR-CirKits DCC current occupancy detectors <http://www.rr-cirkits.com/>
 - SignalLogic Systems <https://signalogicsystems.com/>
 - Azatrax current detectors <https://www.azatrax.com/>

2. Point detection

- Locomotive or train has arrived at a specific point on the layout
- Photoelectric
 - Issues: false detection when lights are turned down to simulate nighttime → solution: infra-red or laser detector / sensor
- Infra-Red
 - DIY setup
 - Detector: 3-pin FC51 module
 - DIY & Digital – Multiblock signalling using Infra-Red obstacle detectors and Arduino signal control <https://www.youtube.com/watch?v=Pe2-wL3BeW8&list=PLhNb9AHNpkeezXepOx15ef5xktod8kWBK&index=1> ; <https://www.youtube.com/watch?v=gIEvSyArAec&list=PLhNb9AHNpkeezXepOx15ef5xktod8kWBK&index=2> ; <https://www.youtube.com/watch?v=kUyjqmrRYcU&list=PLhNb9AHNpkeezXepOx15ef5xktod8kWBK&index=3> ; <https://www.youtube.com/watch?v=rcSKkVcci4E&list=PLhNb9AHNpkeezXepOx15ef5xktod8kWBK&index=5>



Train Detection for MR Layouts - Getting Started

- DIY & Digital RR “Model Railroad Infrared Sensor Install On Existing Track”
<https://www.youtube.com/watch?v=qZ2Vrp8G71M&t=288s>
- Installation options:
 1. Below-the-layout: trigger is reflection of infra-red beam off the bottom of a rail car or locomotive
 2. Above-the-layout: trigger is a locomotive or train breaking the infra-red beam
- Issues with DIY below-the-layout obstacle detectors
 - False detection with overhead lighting or head lamp
 - Infra-Red beam is not reflected off black surfaces → generally can't detect locomotives
- Issues with DIY above-the-layout obstacle detectors
 - Need to place the transmitter (clear LED) and receiver (dark LED) on opposite side of track → takes up a lot of real estate
 - 2-track mainline or 1-track mainline + passing siding: transmitter and receiver straddle both → can't distinguish which track the train is on → solution: a laser detector with potentiometer to limit detection distance to one track
- Some commercial systems – query do their electronic modules compensate for DIY issues noted above?
 - RR-CirKits IR occupancy detectors <http://www.rr-cirkits.com/>
 - SignalLogic Systems <https://signalogicsystems.com/>
 - Azatrax IR detectors <https://www.azatrax.com/>
 - MegaPoints Controllers -- “Model Railway optical block detector hook up and demo” <https://www.youtube.com/watch?v=36PG7ViE-WY>
- Laser
 - Not affected by lighting
 - Beam reflection not affected by rolling stock colour
 - Can control detection distance
 - Model Train Technology
 - Above layout Precision Detector <https://www.youtube.com/watch?v=6yQEbzkoU3E>
 - Under the rails – Nano Precision Detector <https://www.youtube.com/watch?v=tAhe5ZTvXNk&t=417s> – product update <https://www.youtube.com/watch?v=LCTUSsTi1ss> ; and Nano Dual Direction Sensing Precision Detectors https://www.youtube.com/watch?v=MY-g_IBaeeU&t=145s



Train Detection for MR Layouts - Getting Started

More YouTube and Other Resources:

- McKinley Ry block detection <https://www.youtube.com/watch?v=dzyds8Oa9C0&t=641s>
- Little Wicket Railway: “Model Railway Sensors & Detection Part 1 - Build a Sensor Hub”
https://www.youtube.com/watch?v=yDWI4ujtuIY&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=264 ; “Model Railway Sensors & Detection Part 2 - Train Detection and Automation with IR Sensors”
https://www.youtube.com/watch?v=fTd5Z2XnP5A&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=264
- DIY & Digital “Model Railroad Infrared Sensor Install On Existing Track”
<https://www.youtube.com/watch?v=qZ2Vrp8G71M&t=282s>
- **Query Davy Dick MERG** <https://www.merg.org.uk/download/chapter/10>