Signals for MR Layouts - Getting Started

You are considering adding signals to your layout.

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.

Setting the stage

Basic signalling information

NMRA "Railroad Signals" by Peter Watson https://www.youtube.com/watch?v=i6JRj2nkWSc&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=201&t=4s

NMRA / NERX "A Railroad Signalling Primer for Model Railroads" by Scott Gothe

1. Part 1 "More than just a pretty light" 2022 March 22 @ 13:49 https://www.youtube.com/watch?v=sWGuu7L1Npg&t=878s
2. Part 2 "The sound and the fury" 2022 April 23 @ 1:19 https://www.youtube.com/watch?v=WaG5rFgcgA0&list=WL&index=3
3. Part 3 "Route-based signalling and Interlocking" NERX virtual convention 2024March19 @ 2:45 https://www.youtube.com/watch?v=NLXGh0yS9YA&t=14190s – announced he will be doing a Part 4 and 5

Foamer's Guide to Reading Canadian Railroad Signals

Some YouTube videos to lay the groundwork for signalling on your layout

1. Part 1 https://www.youtube.com/watch?v=tJpR93kp44I&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=1&t=7s
2. Part 2 https://www.youtube.com/watch?v=16jXTDfEavA&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=2
3. Part 3 https://www.youtube.com/watch?v=b4IUiaWT8wE&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=3
4. Part 4 https://www.youtube.com/watch?v=Oqq0B0Q9exk&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=4

If you are modelling a real railroad, check out their approach to signalling.

Canadian Rail Operating Rules (CROR) book, published by Transport Canada: https://tc.canada.ca/sites/default/files/2022-05/canadian-rail-operating-rules-may-9-2022.pdf

More YouTube videos on signalling

- DCC Guy (Larry Puckett) “Easy Signals For Your Model Railroad (246)” https://www.youtube.com/watch?v=xk45o5dWR-o&t=412s
- DCC Guy “ABS Signals For Your Model Railroad (287)” https://www.youtube.com/watch?v=t4qT7-9jmcE
- DCC Guy “Building the custom ABS circuit board“ https://www.youtube.com/watch?v=FLYzQfXcjrI&list=PLvD4ru8QD3s3Osk9zA3f_ZwNHpiTHq7g4&index=114 – he answers questions from his ABS Signals video starting @ 2:05 before getting into the ABS Circuit Board which starts @ 7:00
- Paul Matthews on using an Arduino to control signals
  - “Model Railway Automatic Signal Control Using an Arduino Part 1” https://www.youtube.com/watch?v=Lvlj9YPx8yk&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=22&t=5s
  - “Model Railway Automatic Signal Control Using an Arduino Part 2” https://www.youtube.com/watch?v=FlNXe4SlxMQ&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=24
  - “Model Railway Automatic Signal Control Using an Arduino Part 3” https://www.youtube.com/watch?v=ca3osFJj4IA&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=24
  - “Model Railway Automatic Signal Control Using an Arduino Part 4” https://www.youtube.com/watch?v=oseTlKVsZdw&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=25
  - “Model Railway Automatic Signal Control Using an Arduino Part 5” https://www.youtube.com/watch?v=dlPxY7F19YM&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=26
  - “Model Railway Automatic Signal Control Using an Arduino Part 6” https://www.youtube.com/watch?v=2FRLPfaDOPE&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=27
  - “Model Railway Automatic Signal Control Using an Arduino Part 7” https://www.youtube.com/watch?v=uJxUeKJdQ0c&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=29
  - “Model Railway Automatic Signal Control Using an Arduino Part 8” https://www.youtube.com/watch?v=jHGlNZmGtaE&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=28 ; and 8B update https://www.youtube.com/watch?v=skgWH2WgRuM&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=30

  - "Model Railway Automatic Signal Control Using an Arduino Part 9" https://www.youtube.com/watch?v=VMHOoEqCbg4&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=31
  - "Model Railway Automatic Signal Control Using an Arduino Part 10" https://www.youtube.com/watch?v=WefpbGfMBx8&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=32
  - "Model Railway Automatic Signal Control Using an Arduino Part 11" https://www.youtube.com/watch?v=C55TVdM2wHE&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=33
  - "Model Railway Automatic Signal Control Using an Arduino Part 12" https://www.youtube.com/watch?v=PdMnu1T7hoI&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=34
- 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
- DIY & Digital – Grade crossing: "Arduino Crossing Signal for Model Trains" https://www.youtube.com/watch?v=-kqAZqe-W4A ; "Arduino Crossing Signal for Model Trains Part 2: Improving the code" https://www.youtube.com/watch?v=hrTbOt33vAg&t=0s ; "Arduino Model Railroad Crossing Signal With Current Sensing!" https://www.youtube.com/watch?v=j9M_1X4GgFY&list=PLvD4ru8QD3s1g5xg7DXduHwY-uNZps7V2&index=1&t=18s ; "Adding Crossing gates to the Arduino Grade Crossing Sketch" https://www.youtube.com/watch?v=UjHyxW2hHfg&list=PLvD4ru8QD3s1g5xg7DXduHwY-uNZps7V2&index=8&t=17s

An example of signalling on a MR

Some YouTube videos by NSmodeler24

1. Part 1 https://www.youtube.com/watch?v=sepWWkZvIGw&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=7
2. Part 2 https://www.youtube.com/watch?v=nt9HlG0Tb9w&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=8
3. Part 3 https://www.youtube.com/watch?v=hljf2HzaHvU&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=9

4. Part 4 https://www.youtube.com/watch?v=vc5RLh9hWHA&list=PLvD4ru8QD3s0v45NoLNlqgfZEkAjqMvvj&index=10 — using JMRI & CATS
5. Part 5 https://www.youtube.com/watch?v=3l508oTs8H0&t=10s — Programming a CTC (Centralized Traffic Control) panel with CATS

Other resources

1. Chapter 7: "Centralized Traffic Control & Railroad Signal Systems" in "A Compendium of Model Railroad Operations from Design to Implementation" by Op SIG NMRA https://opsig.org/assets/compendium.pdf
2. Model Railroader "Guide to Signals & Interlocking" by Dave Abeles — sold through the Kalmbach store (https://kalmbachhobbystore.com/)

Formulating a plan for signalling on your layout

What type of signalling are you interested in? Turnout / route-based signalling? Traffic control (e.g., ABS) signalling? Both? Grade crossing signalling?

Will you be modelling the prototype or providing guidance to operators on your layout? ← location of a train ahead that the operator can't see in ABS traffic signalling; alignment of a turnout in route-based signalling.

Will you be using commercial electronics or DIY by Arduino? ← the "Arduino" can be used to control both switch machines and signals

Traffic control and grade crossing signalling requires train detection. What type of train detectors will you use? A document has been generated on getting started in train detection.

It is a lot easier to install signals if they are planned for before building your layout. What type of detectors will you use?

Will you use current detectors? In addition to gapping for power blocks / districts, you will need to gap one side of the rails for current detection. Dropping feeders now may be a lot easier than doing so once scenary is down.

Where will you use point detection and what method of point detection? Drilling holes now may be a lot easier now than doing so once scenary is down. Installing below rails or between rails detectors may be a lot easier now than later.

You will need to provide a place for the electronic modules that will take detection input and convert that to signal outputs → a pull-out shelf is better than installing to benchwork under the layout.

Where will you place the signals? Prototypically they go on the right side of the track for viewing by the engineer inside the locomotive.

If the purpose of the signals is to help operators running trains, they may need to oriented differently from the prototype.

For route-based signalling, signals are located some distance before the fouling point of the turnout. This may not be practical on your layout.

Map out the location of detectors and signals on a diagram of your layout.

Commerical systems

- MegaPoints Controllers "AutoSignal Introduction" https://www.youtube.com/watch?v=9HaV8FUaOkk
- SignaLogic Systems https://signalogicsystems.com/ — model railroad signaling section
- Azatrax block and grade crossing controllers https://www.azatrax.com/
- Model Train Technology signal controllers, signals, grade crossings https://www.modeltraintechnology.com/
- Custom Signal Systems https://customsignalsystems.com/ — for "prototypical" signals

Markers / Flags

Blue Flag protection for an industrial spur — place Blue Flag before car on an industry spur to indicate that it is not to be moved without permission from Industrial Foreman ← the car(s) is/are being loaded and/or unloaded

Red Flag protection — (1) for a stopped train on the main track — display red flag or red flare / red fusee behind the train; and (2) as an End-of-Train Device (EOT, ETD) — options: (i) a red flag and (ii) a flashing red light ← FRED (Flashing Rear-End Device)