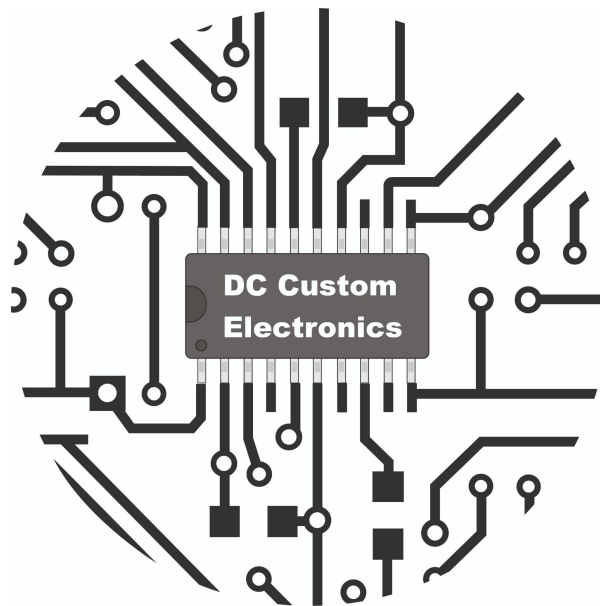


Signaling handbook

By Dc Custom Electronics



The basic guide to railroad signals and their practical usage in large scale model railroading

Disclaimer

The contents of this document are intended to advise on the PRACTICAL use of signals in large scale model railroading and may not represent the prototypical aspects or meanings used by real railroads. This document is to be treated as a guideline and is not intended as rule. Please keep this in mind when reading or referencing this document.

Table of contents

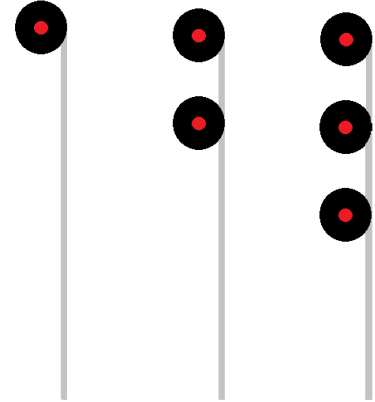
1.	Types of signals covered in this document.....	5
1.1.	Searchlight Signals.....	5
1.2.	Two Aspect Color Light.....	5
1.3.	Three Aspect Colorlight.....	5
1.4.	Specialty and Mixed.....	6
1.5.	Semaphores	6
1.6.	Color Position Light.....	7
1.7.	Position light.....	7
2.	Single head colorlight and searchlight signals.....	8
2.1.	Description.....	8
2.2.	Green.....	8
2.3.	Flashing Yellow.....	8
2.4.	Yellow	8
2.5.	Flashing Red.....	8
2.6.	Red.....	9
2.7.	Lunar.....	9
3.	Semaphore signals	10
3.1.	Green	10
3.2.	Yellow.....	11
3.3.	Red.....	11
4.	Double head colorlight signals.....	12
4.1.	Green - Red (top - bottom).....	12
4.2.	Yellow - Red.....	13
4.3.	Red - Red.....	13
4.4.	Red - Green.....	14
4.5.	Red - Yellow.....	14
4.6.	Red- Lunar.....	15
5.	Double and triple head searchlight signals.....	16
5.1.	Top Aspect.....	16
5.2.	Middle Aspect.....	17
5.3.	Bottom Aspect.....	17
5.4.	Examples.....	18
5.4.1.	Yellow-Red-Red.....	18
5.4.2.	Flashing Yellow-Red-Red.....	18
5.4.3.	Red-Green-Red.....	19
5.4.4.	Red-Red-Flashing Red.....	19

5.4.5.	Red-Red-Green.....	19
5.4.6.	Missing middle aspect.....	20
5.4.7.	Missing bottom aspect.....	20
5.4.8.	Missing both middle and bottom aspects.....	20
5.5.	Other properties of searchlight signals.....	21
6.	Computerized routing.....	22
6.1.	One track to multiple track.....	22
6.2.	Multiple track to multiple track.....	24
7.	Signal and block placement.....	25
7.1.	Signal placement.....	25
7.2.	Track block layout.....	26
7.3.		
7.4.		
7.5.		
7.6.		
8.	Signal usage examples	
8.1.	Multi head search light signals	
8.2.	Multi head color light signals	
8.3.	Lunar signals	
8.4.	Switch position	
9.	Signal systems	
9.1.	Passing sidings	
9.2.	Bidirectional track	
9.3.	Signaling a wye	
9.4.	Crossovers	
9.5.	Double track	
9.6.	Grade crossings	

1: Types of signals

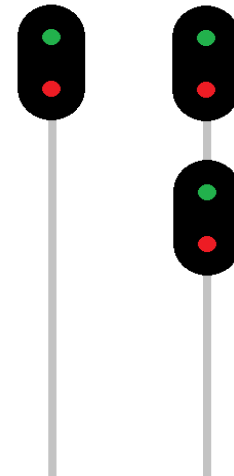
1.1. Searchlight Signals

Otherwise known as “target” signals, are three color signals in one, two, and three head versions. Each head can be either red, yellow, or green or the optional lunar can be added in place of the green.



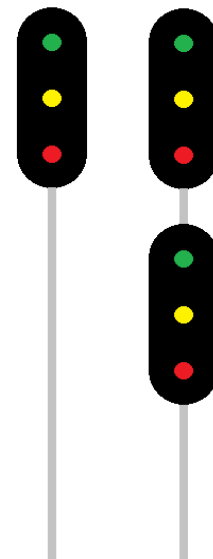
1.2. Two Aspect Color Light

Two aspect signals contain two lights or combinations of lights. Though some other signals can be two aspect signals we will stick with color light signals for this example. Each head has a red and green aspect. The green aspect can be replaced with a lunar or yellow if the situation calls for it.



1.3. Three Aspect Color Light

Three aspect signals contain three lights or combinations of lights. Though some other signals can be three aspect signals we will stick with color light signals for this example. The three aspect signals we will discuss consist of a red, yellow, and green or lunar light.



1.4. Specialty and Mixed

Specialty and mixed signals can come in all shapes and sizes. In this document we are only going to focus on a few multi head arrangements. An example of such is a three aspect over a two aspect.



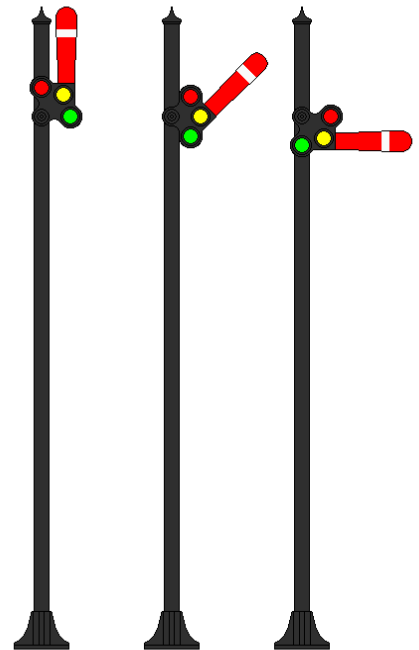
1.5. Semaphores

Semaphore signals come in upper and lower quadrant forms with four different flag types.

Flags consist of pointed, square, round, and fishtail.

Lense arrangements are generally in red-yellow-green, red-red-green, and yellow-yellow-green. (in order horizontal, diagonal, vertical). Some semaphores may have other special lense arrangements.

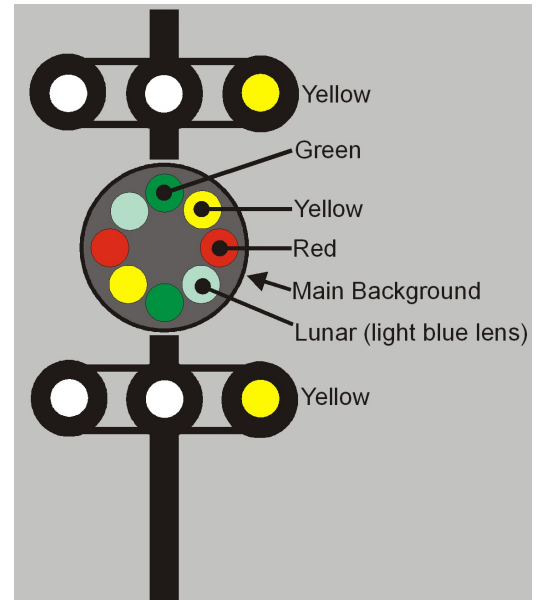
Double semaphores will not be covered in this document.



1.6. Color position signals

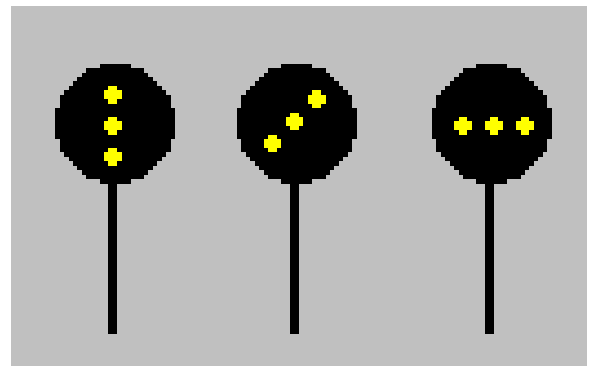
Color position signals, or CPLs, commonly known on the B&O railroad can have a variety of aspects. CPLs have 2 red, 2 yellow, and 2 green lights and can sometimes also have 2 lunar or white lights.

Additionally There may be above or below the main signal a set or individual white (lunar) and/or yellow lights. The main lights are illuminated in pairs and would mean the same thing as a colorlight signal in most cases however there is no presence of flashing red or flashing yellow. Instead they use the main signal in conjunction with the (up to) six satellite signals.



1.7. Position light signal

Position light signals are similar to color position light signals, Hence the names, In that you rely more on the position of the lights then the actual color. Position light signals are commonly found on Pennsylvania railroads. They are made up of generally seven yellow lights in a circular pattern with one in the middle. These too can have a variety of aspects. Though there are many different types and styles of position lights we will focus on the basic seven light design shown here.



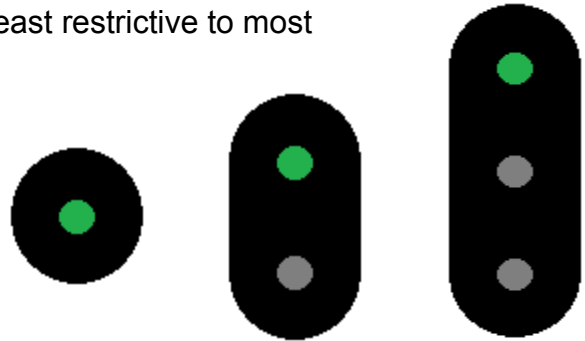
2: Single head color light signals

A single head colorlight or searchlight signal can display up to five different signal aspects. Keep in mind this guide is only how signals should be interpreted for use in model railroading. Actual meaning depends on the railroad and location of the signal. Now let's go through from least restrictive to most restrictive.

2.1. Green

"Clear"

Clear track ahead, proceed at track speed.



2.2. Flashing yellow

"Advanced Approach"

Clear track ahead but the next signal is yellow.



2.3. Yellow

"Approach"

The next signal is red be prepared to stop at the next signal.



2.4. Flashing red

"Restricting"

Stop and proceed at restricted speed.



2.5. Red

“Stop”

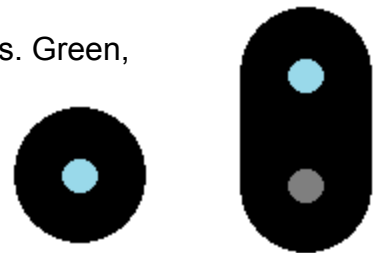
Stop and wait for a clear or call dispatch for clearance.



2.6. Lunar

“Restricting”

Two aspect signal heads generally can only display three aspects. Green, Flashing red, and red. However some heads may have a yellow or lunar in place of the green. A lunar signal in a signal head should represent proceed at restricted speed or restricting, this is the same as a flashing red however you do not have to stop. It can also mean proceed into an occupied siding or as a warning that you are entering dark territory where no other signaling will be present. Lunar signals can also appear on three aspect signals and other types of signals.



3: Semaphore signals

Semaphore signals are older mechanical signals. They can display a signal in two ways, using a light, red, yellow or green, or using an arm, either at 90, 45, or horizontal. Some semaphore signals consisted of even two or three heads and could represent almost anything that a colorlight signal can, however we will only look at a single head semaphore.

3.1. Green

With the arm in the full upright (upper quadrant) or downward (lower quadrant) position and displaying a green light the signal indicates clear to proceed at track speed.

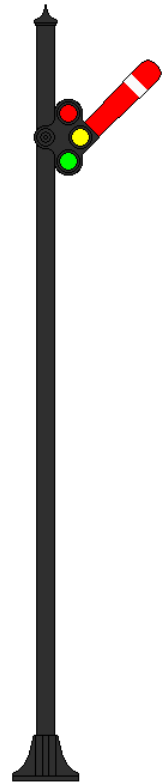
Some Semaphores may have a yellow lens in this position and a yellow “fishtail” flag. This will make the aspect act as a yellow or “caution”. This should be treated as a yellow approach signal unless otherwise specified.



3.2. Yellow

With the arm at a 45 degree angle either above or below the lamp while displaying a yellow light indicates a yellow signal, generally telling you that the next signal is red. When paired with a yellow fishtail flag this aspect means “caution”.

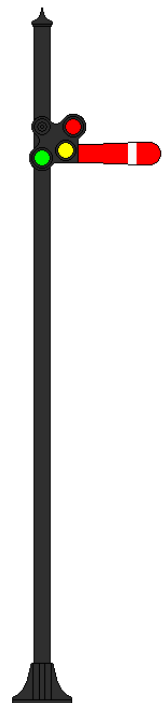
This position could also contain a red lens in place of a yellow indicating stop. This would be the semaphore equivalent of a 2 aspect signal and the red lens is there as a placeholder in the event of a signal malfunction.



3.3. Red

With the arm extended horizontally for both upper and lower quadrants and displaying a red light the signal is indicating a red STOP signal.

Some semaphores may have a yellow in this position generally paired with a yellow “fishtail” flag. This will make the aspect act as a yellow or “caution” however this can be left up to the specific railroad so be sure to check with the railroad in question.



4: Double head colorlight signals

Though there are many variations and combinations of signal heads we are going to focus on two and three aspect signals in over-under combinations. On top of this we are going to limit the logic to only switches and routing. This means that these signals should generally only represent switch position, siding occupancy, or train routes.

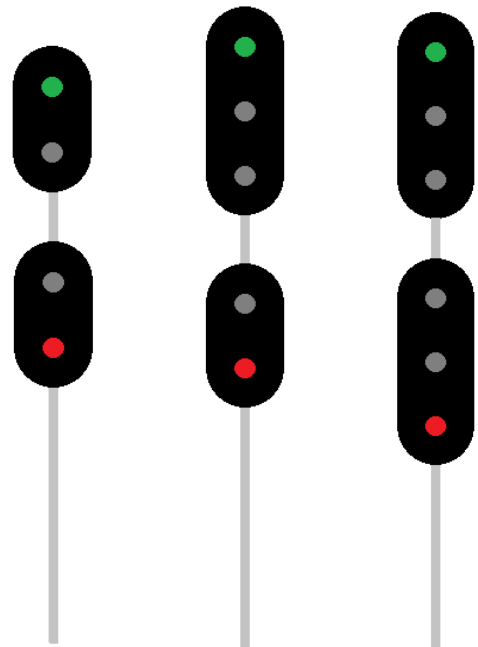
Switch direction: Generally a two headed signal at a switch will represent the direction the switch is set and possibly the track conditions for the set direction. The top signal will represent the mainline or straight direction and the bottom represents the diverging or non mainline direction.

Please reference section 2 for the meaning of each color. This will help in determining the meaning of the overall aspect.

4.1. Green Over Red

If the top signal is green then the switch is lined for the mainline(or straight) direction and the track ahead is clear.

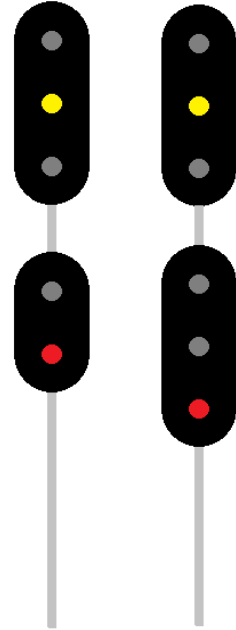
Alternatively this may also indicate simply clear track and no speed restriction.



4.2. Yellow Over Red

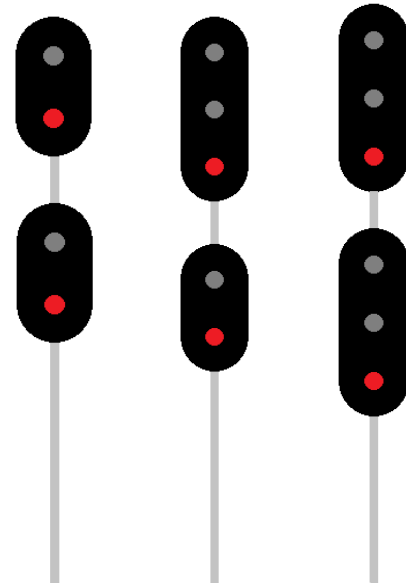
If the top signal is yellow then the switch is lined for the mainline (or straight) direction and the next signal is red. A flashing yellow would also mean the switch is set for the main line (or straight) position but in two signals ahead there will be a red. Refer to the signaling systems section for pictures and examples.

Alternatively this may also indicate clear track, medium speed restriction and an approach signal



4.3. Red Over Red

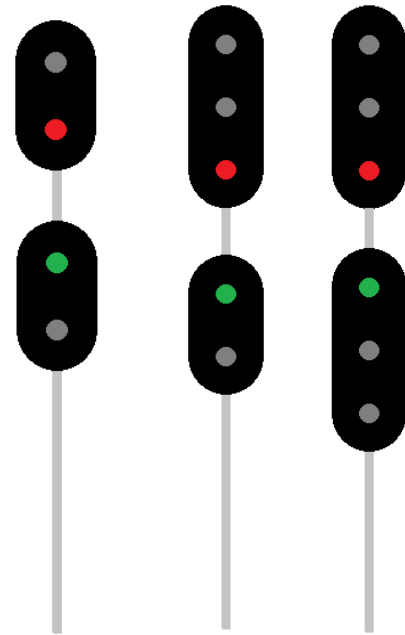
When both the top and bottom signals are red the switch may be lined but track conditions ahead warrant a red signal. There may also be a problem with the switch points or the switch may be in transition. In any case with only red signal the meaning is always STOP.



4.4. Red Over Green

When the bottom signal is green and the top signal is red the switch is set for the diverging line. This also indicates the track ahead is clear and proceed at track speed. Refer to the signaling systems section for pictures and examples.

Alternatively this may also indicate clear track and a medium speed restriction.



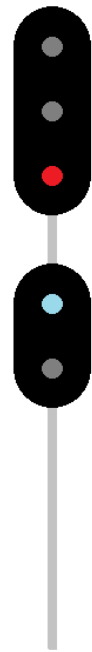
4.5. Red Over Yellow

The bottom signal may also be yellow indicating that the track ahead is clear but the next signal is red. A flashing yellow can also be in this position indicating that in two signals ahead there will be a red. Refer to the signaling systems section for pictures and examples.



4.6. Red Over Lunar

A lunar signal on the bottom can mean two things. The first, proceed into an occupied siding. This means there is a train known to be in the siding and you are to proceed in behind this train. The second meaning, clear to proceed into dark territory. Meaning there are no other signals after this one. Refer to the signaling systems section for pictures and examples.



5: Double and triple head searchlight signals

Searchlight signals can represent any of the signals that colorlight signals do and in most cases colorlight signals can also represent the same thing as searchlight signals. Let's look at a three head searchlight signal.

Any of these signals can be green, flashing yellow, yellow, flashing red, or red. A quick cheat sheet to reference later:

Green: Proceed

Flashing yellow: Advanced approach, next signal is yellow

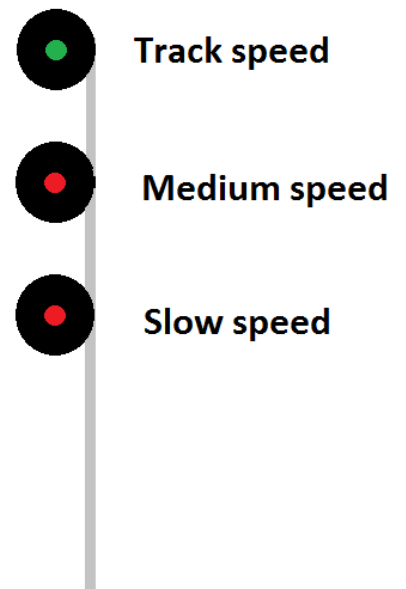
Yellow: warning for the next signal, next signal is red.

Flashing red: stop and proceed.

Red: stop

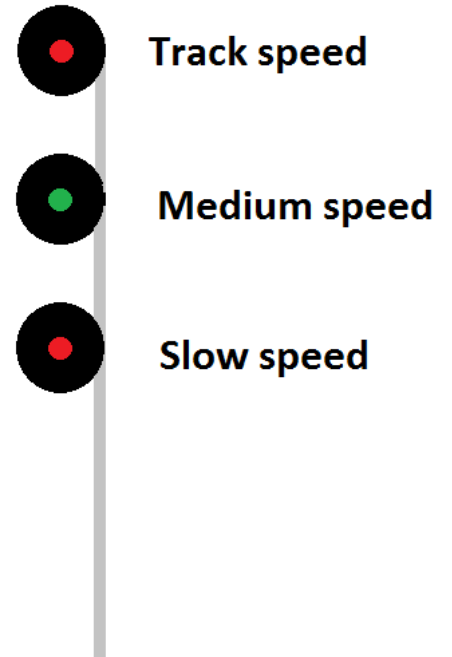
5.1. Top Aspect

The top signal when relating to track conditions represents track speed clearance. A green on the top signal indicates track conditions ahead are clear, proceed at track speed. A flashing yellow on the top signal indicates maintain track speed but in two signals you will have to stop at a red signal. A yellow signal also indicates maintain medium speed prepared to stop at the next signal. A flashing red indicates stop and then proceed at restricted speed. Finally a red means stop. Keep these aspects in mind for the following sections. If this aspect is dark or missing then it is taken to be red.



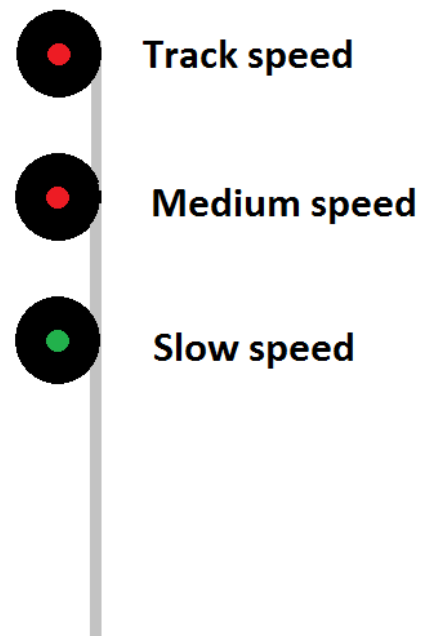
5.2. Middle aspect

The middle signal indicates the same aspects as above but at MEDIUM speed. If this aspect is dark or missing then it is taken to be red.



5.3. Bottom Aspect

The bottom signal has the same meanings but at SLOW speed. If this aspect is dark or missing then it is taken to be red.



5.4. Example

Here are a few example aspects of triple headed searchlight signals. Refer to sections 2 and 5.

5.4.1 Yellow-Red-Red

In this example the signal is indicating proceed at track speed but the next signal will be red



5.4.2 Flashing Yellow-Red-Red

This signal is on the top so this means track speed. A flashing yellow means that not the next, but the signal after next will be red. We should expect the next signal to be yellow.



5.4.3. Red-Green-Red

The clear aspect is on the middle signal. We will slow to MEDIUM speed before passing this signal. The track is clear ahead



5.4.4. Red-Red-Flashing Red

The least restrictive aspect is on the bottom this time. A flashing red is a stop and proceed therefore we will stop, make sure it is safe, and then proceed at SLOW speed because the aspect is on the bottom.



5.4.5. Red-Red-Green

At this point I'm sure you know what this signal means but just in case, this aspect means you are to reduce speed to SLOW speed before passing this signal but otherwise the track ahead is clear.



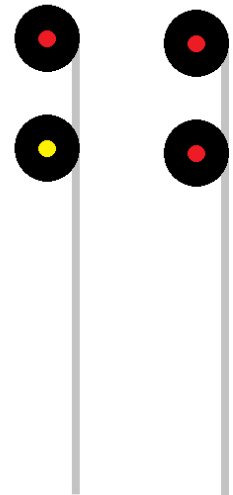
5.4.6. Missing Middle Aspect

What happens if there is a signal dark or missing? Any signal that is dark is to be treated as a red signal as well as, in this example, the missing aspect. This signal still means proceed at slow speed with clear track ahead. This is known by the extra space between heads. It simply means there is no reason for medium speed and the head was taken out or never put in service in the first place.



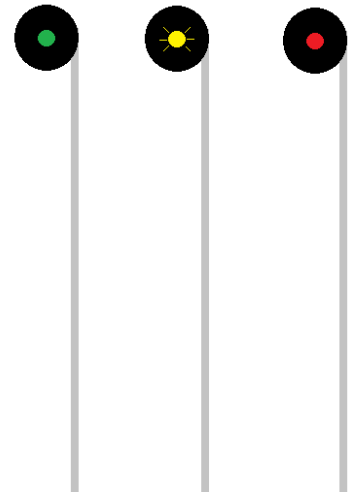
5.4.7. Missing Bottom Aspect

As stated above. Any signal dark or missing is to be treated as red. Therefore this signal would mean proceed at medium speed prepared to stop at the next signal. The one to the right with two reds would mean STOP.



5.4.8. Missing Bottom and Top Aspect

What most people are used to is a single head signal. In places where medium and slow speed were not needed the aspects were removed and the signal was left with only one head. The aspects you see here are from left to right, clear, advanced approach, and stop.

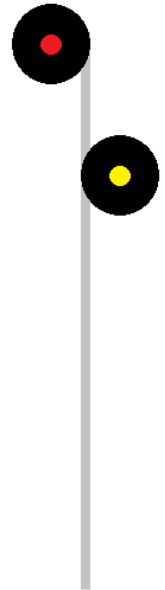


5.5. Other properties of searchlight signals

Another property of searchlight signals is the offset. If you noticed the heads in previous examples are offset from the post to the left. This indicates some kind of system control over that signal. In our case let's use it to tell us that this is a track signal and NOT a routing signal. In our case let's say that staggered signals will represent switches or routing. That would make this signal mean that you are lined to go on the diverging route and the next signal is red.

If both or all signal heads were on the left side One could assume this to be a controlled signal meaning that there is a CTC system or dispatcher in control of the signals aspects rather than just track occupancy. If the signal heads are to the right, one could assume that the signal is for an uncontrolled section of track operating only on track occupancy and no dispatch.

***Remember this is NOT a real railroad! Despite what you may wish for, this is still only a hobby for many to enjoy, therefore we want to keep things on the simpler side to allow everyone to easily understand and use signals!*



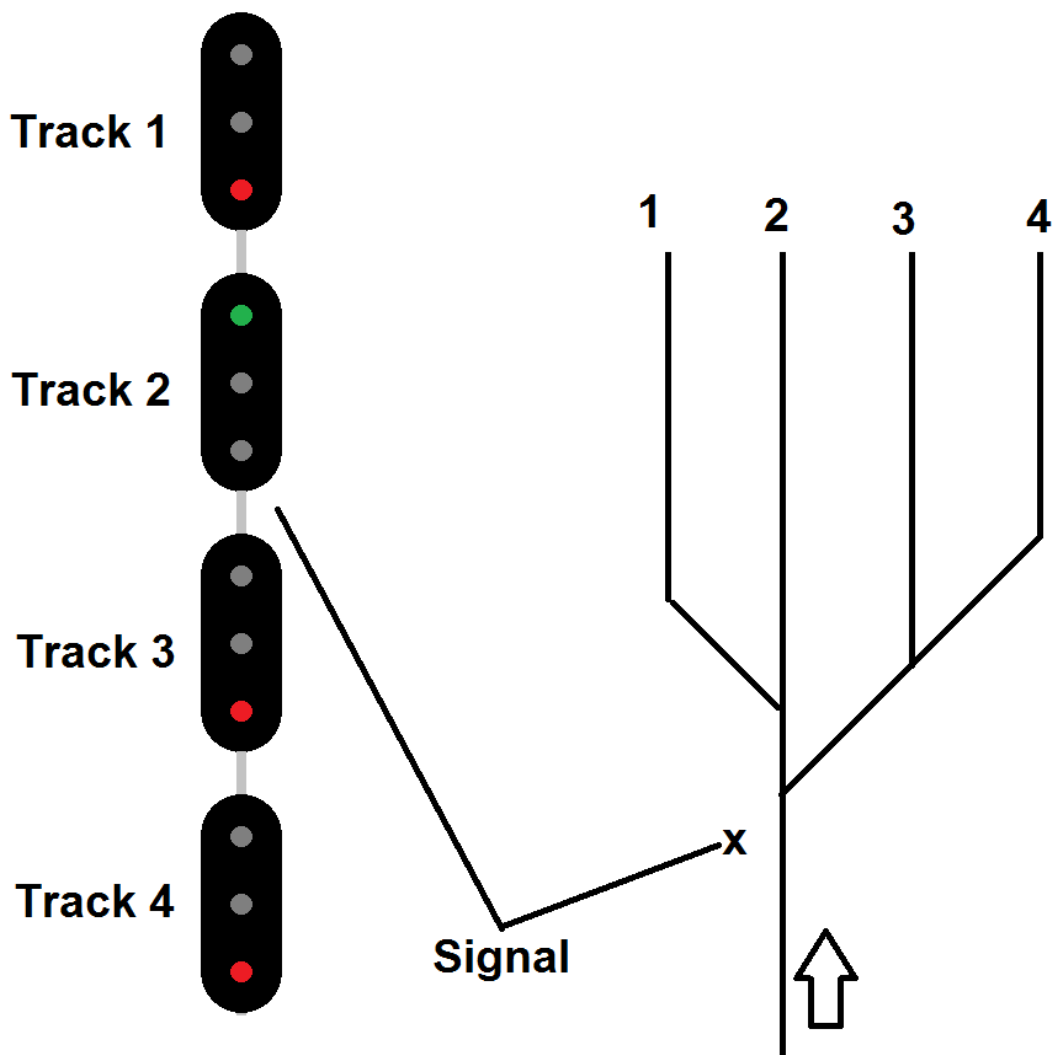
6: Computerized routing

At some point you may encounter some kind of computerized train control or dispatching. Let's go over how signals should affect this process.

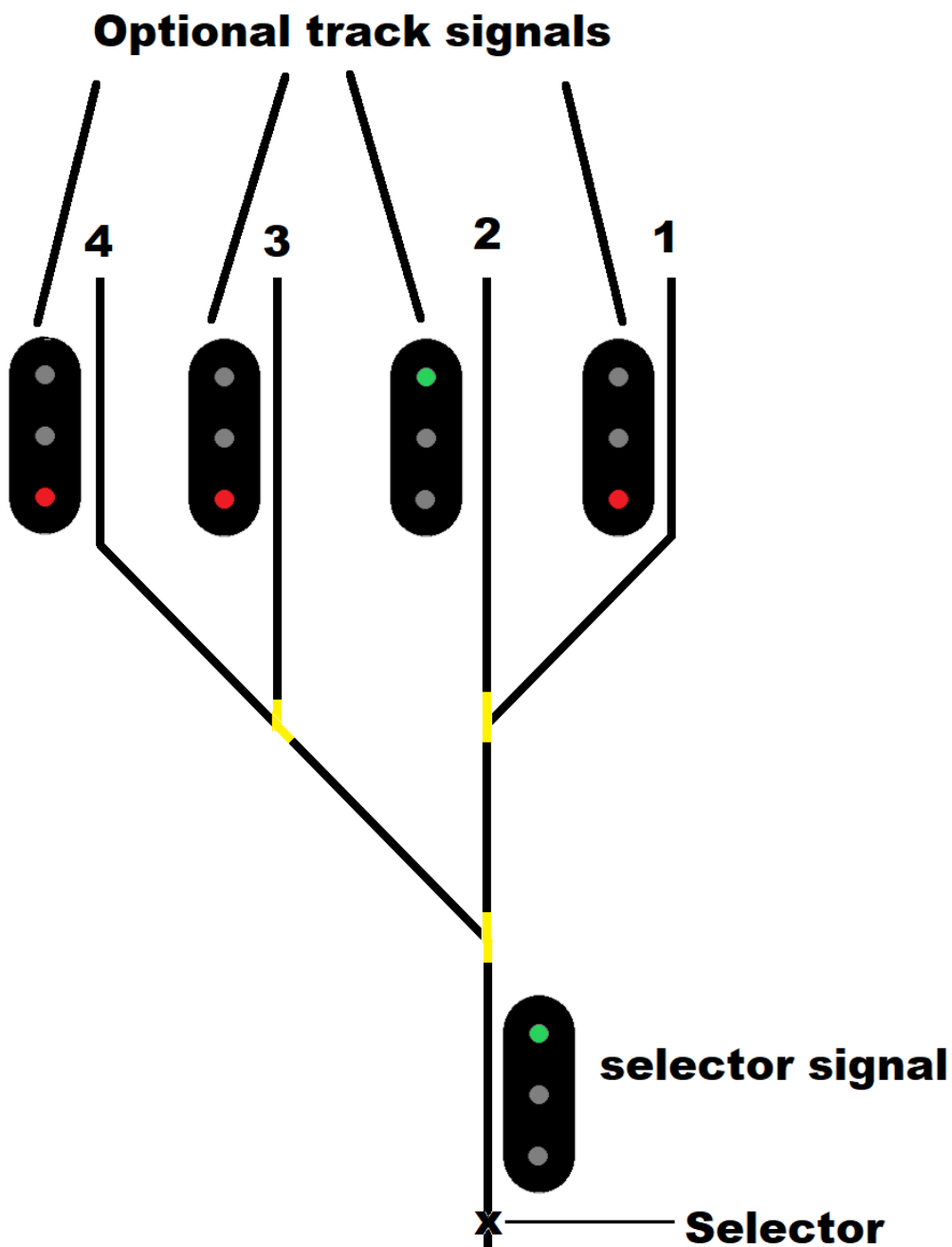
6.1. One track to multiple track

When one track branches off into multiple routes there should be a signal placed at the route selector to tell the engineer where they have selected to go and that all of the switches have lined correctly. This is when the use of more than two signal heads is really needed. The diagram below shows how multiple heads can be used to show route selection.

Train wants to go to track 2



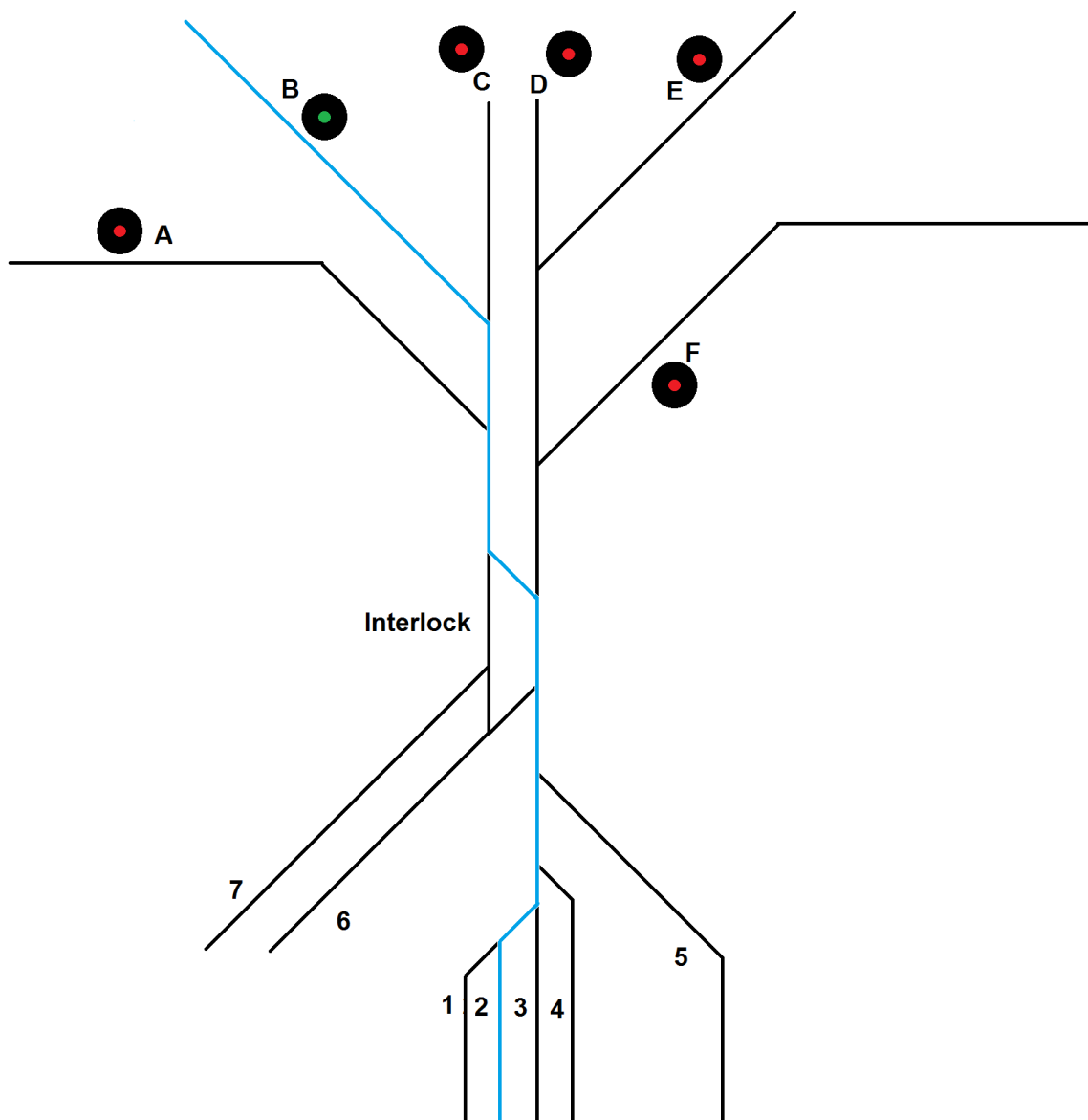
Alternatively the signal heads may be placed at each track facing the entry point or be missing altogether. In this case there should be at least a single signal head consisting of a red aspect capable of becoming a flashing red or have an additional yellow, green, or lunar aspect. When the routing process is complete this signal should give a proceed aspect of some kind and drop back to red once the train has passed the threshold of the signal (see section 7)



6.2. Multiple track to multiple track

When more than one track comes together and then separates we call it an interlock. Rather than have a signal head for every combination of routes we simply place one signal at each incoming track. This signal will either be red, yellow or green to indicate 1) stop, It's not your turn/ switches not lined, 2) proceed slowly through the interlock, and 3) clear through the interlock. Generally yellow is not used. The down side to this method is that the engineer does not get to verify where he/she is going.

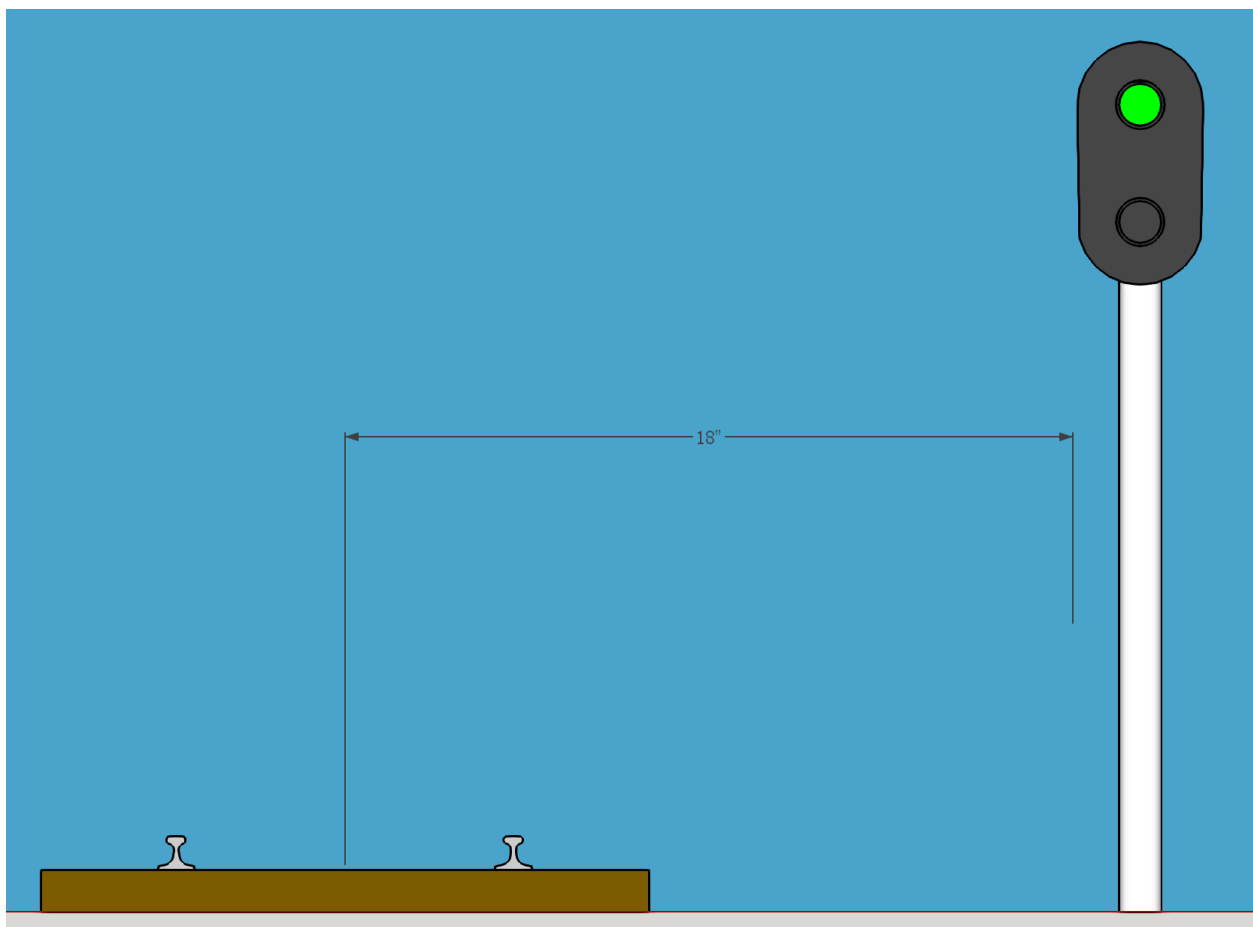
Train at signal B wants to go to track # 2



7: Signal and block placement

7.1: Signal placement

Signals should be placed clear of the largest expected car, locomotive, or load for the railroad. Make sure to keep in mind overhangs on curves for especially long cars or tight corners. The recommended MINIMUM spacing for $\frac{1}{8}$ scale 7.25 and 7.5 inch gauge is 18 inches from the centerline of the track. It is recommended to have about 24 inches or more from centerline in order to reduce riders reaching out and grabbing objects or impact from oversized railcars.



7.2: Track Block Layout

Track blocks should be logical. Too long of a block and trains will wait too long for a green signal. Too short and the logic gets messy! Additionally, how you wire your track blocks also matters! Putting an insulated joint in the wrong spot can cause many problems. Let's look at some examples of how track blocks should be wired.

