Signal Placement
for Model Railroads

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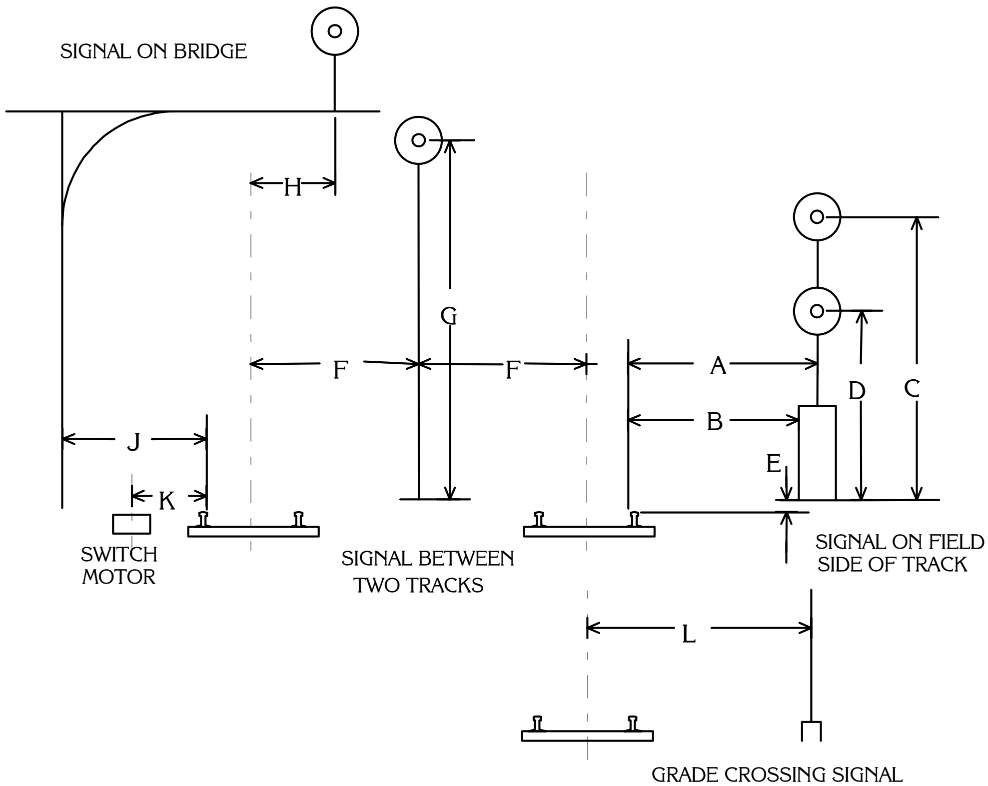
Given their traffic density, most model railroads should have signals. Modelers generally like signals, and most would like to have some on their layout, but one question is where should the signals be placed? Each layout is a separate unique case, but prototype railroads have rules for placing signals that can be applied to find suitable places to put signals on our layouts.

First the type of signals to be installed must be determined. Automatic Block Signals, or ABS are the simplest since these signals only indicate the presence (or absence) of a train in the blocks ahead and require no control by an operator. Interlocking Signals may be called for at a junction and can also be an excuse to model the always popular Interlocking Tower. Most high traffic main lines are now signaled with Centralized Traffic Control, or CTC which allows the dispatcher to control the movement of trains with Controlled Signals at Control Points, or CPs. This is a great way to dispatch trains on a model railroad too, but it will require more complicated electronics to run the signals.

Signaled territory is divided into signal blocks, with signals at the block boundaries governing entrance to the block. The exact rules vary from railroad to railroad, and ABS, CTC, and Interlockings are governed by different rules, but the placement of the block boundaries and the signals is fairly standard. The prototype signal blocks end up being very close to the electrical sections, more commonly called blocks used for control on a model railroad, and it is very convenient to let them be the same on a model railroad. If you are using DCC or another command control system you will need to establish signal blocks and they can match prototype practice.

The first step is to determine how close to the track signals should be placed. The diagram on the next page shows the standards used by three prototype railroads. This can guide you when placing a signal on your layout.

SYSTEM STANDARDS DIMENSIONS FOR THREE RAILROADS



	AT&SF	Southern Pacific	MKT
A	10'-0"	---	10'-5"
B	---	7'-0"	---
C	15'-0"	15'-0"	12'-2" Color Light; 22'-6" Semaphore
D*	10'-0"	10'-0"	---
E	8"	0"	0"
F	9'-0"	9'-6"	---
G	19'-0"	18'-0"	---
H	4'-6"	5'-6"	---
J	7'-9"	---	----
K	4'-0"	---	----
L	15' to Flasher, 12' to Gates	----	---

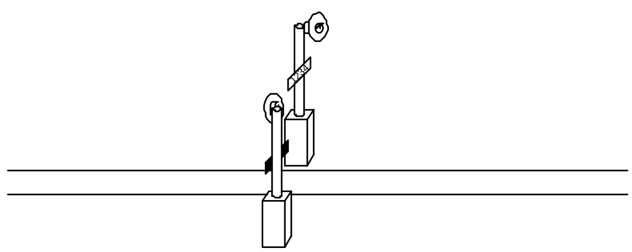
*Dimension "D"is only used for two head signals; use dimension "C" for single head signals.

NOTE: System standards are always subject to change to meet the needs of each installation; they are only a guide used by the Railroad's signal engineers when designing each installation.

INTERMEDIATE SIGNALS

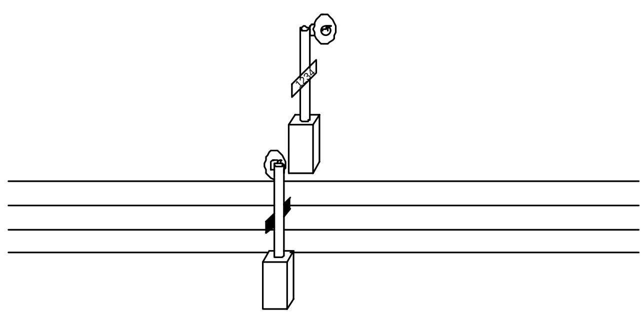
Intermediate Signals are the “normal” block signals between sidings, interlockings and control points. Most signals on prototype railroads are intermediate signals because of the long distances covered, but most model railroads could be signaled with no intermediate signals at all. Intermediate signals are usually found as a pair, one for each direction of traffic. The length of a block varies from 3000' on installations dating from the 1920s to over two miles on some modern installations. Length of a block is determined by several factors: The limit of how far a track circuit can be made reliable; the stopping distance of a train at track speed; and the geography, such as bridges, tunnels, etc. If blocks are shorter than the stopping distance of a train, then the signals must give an Advance Approach indication (some railroads use Approach Medium) to give the engineer enough distance to stop the train. Of course, the length of a block on a model railroad is determined more by the space available.

Intermediate Signals will normally have a number plate attached because they are not absolute stop signals. A train may pass an intermediate signal at stop after stopping. The number on the plate is the milepost that the signal is in plus one digit at the end. This digit will be even for Eastward signals and odd for Westward. On some railroads the last digit is the approximate tenth of a mile, and others simply number starting with 1 & 2 in each mile, but the odd/even rule holds in any case.



Intermediate Signals on Single Track

While there will normally be a signal for both directions at each block boundary, some systems, such as Overlap Block Signaling, result in the East and West Signals being separated. Such cases are rare, however.

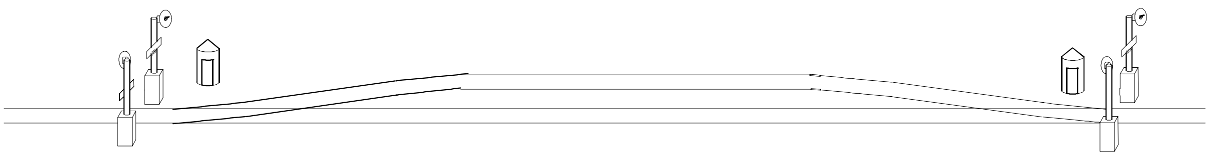


Intermediate Signals on Double Track

Double track with each track signaled for one direction of traffic will still usually have the signals for both directions opposite each other. If other conditions such as a bridge or curve location dictate that the East and West signals be at different locations this will be done, since the blocks on each track are separate, and signals do not need to be at the same location.

Automatic Block Signals at Sidings

A siding is a place named in the Timetable, and is intended for the meeting of trains. Industrial tracks that exist only to serve rail customers generally don't get special signal treatment; the intermediate block signals are simply placed where normal spacing causes them to fall. Of course there may be industrial tracks at the location of a siding. Sidings will have signals at each end, just clear of the switch, as shown below. In Automatic Block Signal territory all switches are hand thrown and signals do not directly indicate the position of switches. If a mainline switch is open, the signals facing into that block will be at stop. (This is true of any mainline switch.) If a train is to enter a siding, the engineer will stop, a member of the train crew will line the switch, which will put the signal at stop, and the engineer will then pass the signal at stop and enter the siding.



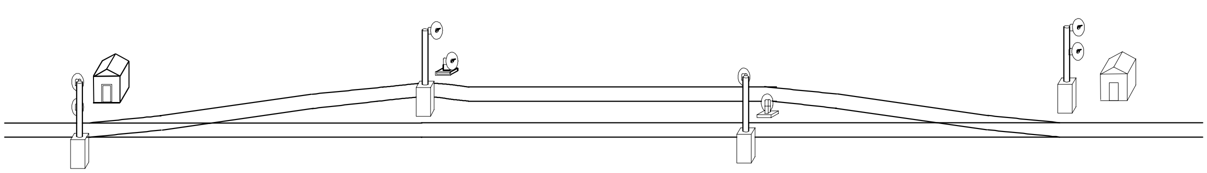
In ABS territory all signals have number boards and may be passed at restricted speed when at stop.

In Absolute/Permissive territory the signals leaving each siding do not have number boards and are Absolute signals that may only be passed with the dispatcher's permission when at stop.

In pre-radio days most sidings lacking a station had a dispatcher's phone booth located near each end so trains could contact the dispatcher if necessary. Beginning in the 1960s these were removed as radio made them unnecessary. Absolute/Permissive signaling is wired so that all opposing signals to the next siding drop to stop in front of a train. The theory is that an opposing train will thus be held at a siding. Although Absolute/Permissive signaling is common in ABS territory, most railroads do not use it as a method of dispatching trains.

CTC signals at sidings

CTC sidings have a common placement of signals at each end as shown below. The area around the switch protected by the signals is called a Control Point or CP (some railroads used to call this an OS section). None of the signals at a CP have number plates as all are Absolute signals controlled by the dispatcher. The Switches are also controlled by the dispatcher. Some railroads used to put a plate with an “A” on the signals to signify that they were Absolute, but this practice was dropped in the 1980s. There is usually a CTC shed at each CP to house equipment, and recent installations may have a radio or microwave tower for the link to the dispatcher.

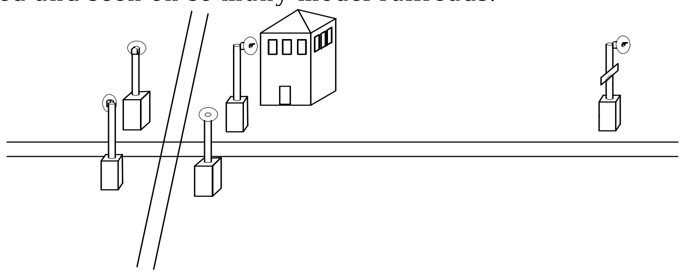


Typical CTC siding

The signals leaving the siding are placed at the clearance point so a train stopped at the signal will not foul the other track. Dwarf signals are often used for the siding, but high signals may be the standard in some territories. The signals entering the siding will usually be at the switch points, but may be located a distance down the single track for reasons of visibility by the engineer of an approaching train. Signals entering the siding will usually (but not always) be a two head signal. For simplicity, modelers can consider the top head to signal for the main and the bottom for the siding, although this is not always the way signal rules state.

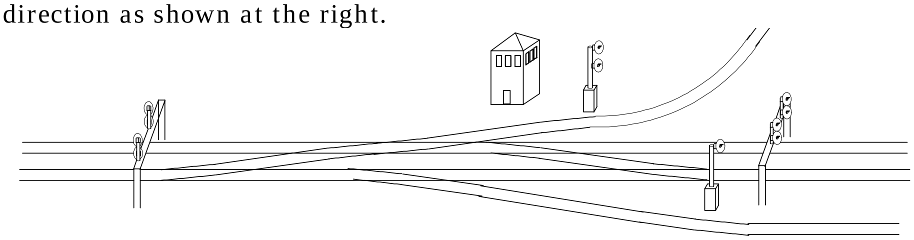
INTERLOCKINGS

An Interlocking is a section of track over which movement of trains is governed by signals which are controlled by the Interlocking Operator. Interlockings are normally located at important junctions, where railroads cross at grade, and at the approach to major passenger terminals. Some Eastern railroads used a series of Interlockings to dispatch trains on multiple track territory. Each and every track entering the interlocking limits will have an Absolute signal governing the movement of trains. The operator controlling the signals and switches at an Interlocking was usually located in a tower placed so he had good visibility of all tracks approaching his interlocking. These are the classic "Towers" so often modeled and seen on so many model railroads.



Interlocking at a Crossing

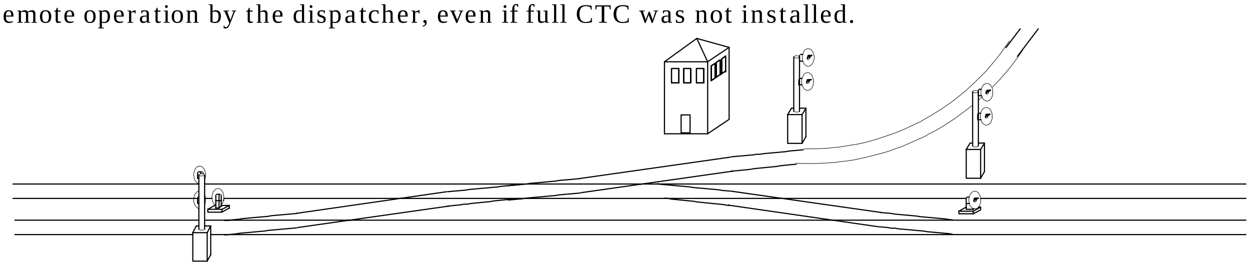
If the Interlocking is in ABS territory the next Intermediate signal will serve as an Approach signal, but if the track is unsignaled (Dark) then an Approach signal will be located about 1000' from the Home signal in each direction as shown at the right.



Signal Placement at a Junction

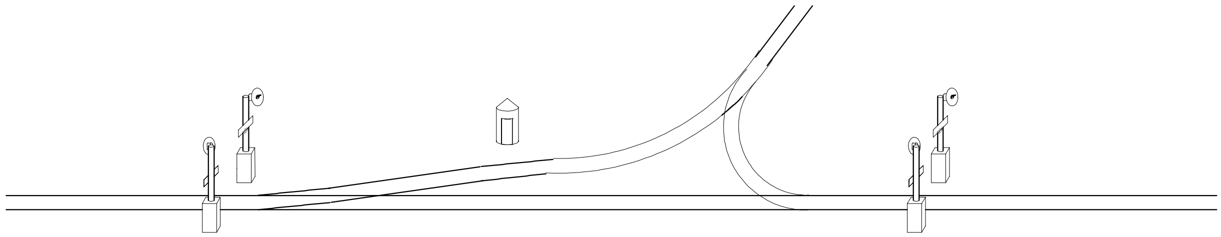
Signal placement is designed for each unique Interlocking, so this is just one example. For modeling purposes we can again assume that the top signal head governs the Main track, and the lower head governs the Diverging route, although this is a simplification and does not take into account three head signals, which were not used by all railroads. At some large complex Interlockings there may also be additional home signals located in the plant, but only advanced signal modelers need concern themselves.

In 1950 there were Interlocking Towers all over the country, but almost all are gone now. Some at RR crossings have been automated, but most were incorporated into CTC as railroads expanded the miles of track so controlled. In the last few years most remaining Towers have been converted to remote operation by the dispatcher, even if full CTC was not installed.



Double Track Showing Use of Dwarfs

In some cases Dwarf signals will be used so signal bridges are not necessary. This example is double track with each track signaled for one direction. Note that a signal is still required on every track entering the Interlocking.



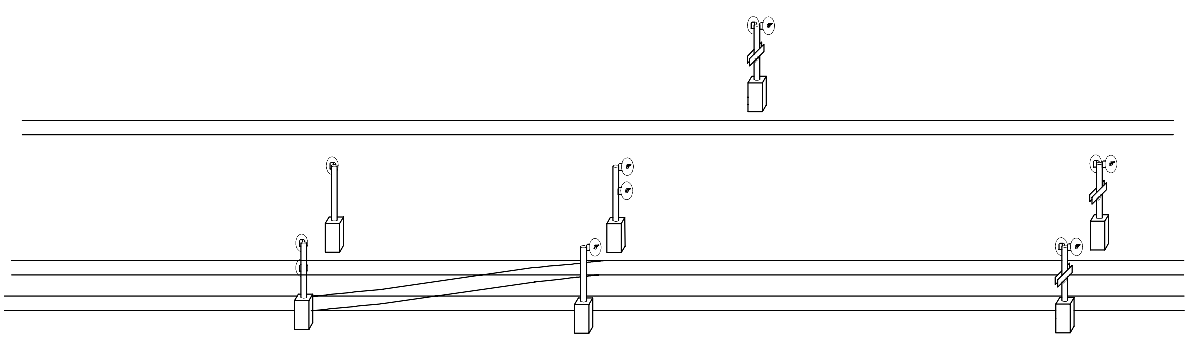
ABS Junction

While Interlockings were used at major junctions, if the railroad did not feel the expense of staffing an Interlocking Tower was justified a junction in ABS territory would be left with hand throw switches. Here the signals work much like ABS at a siding, with a simple stop indication if a switch is lined for the branch. Thus, it is not necessary to have special signaling at a junction if you wish to avoid the trouble. Please note, however, that any junction in CTC territory, no matter how minor, would have a Control Point with full controlled signaling. The signal placement would be as shown for an Interlocking, but without the tower and remotely controlled by the dispatcher.

Field Side Signals

American railroad standards called for signals to be placed on the right hand side of the track (the exception to this was the Chicago & North Western which used left hand running and signals). This was because the Engineer of a steam engine could only see the right hand side of the track. The same was true for first generation hood diesels. For single track or double track signaled for right hand running only this was easy enough, but for multiple track a signal bridge was required. When a signal bridge is used the signal for each track is 4‘ to 6’ to the right of the center line of the track it governs. On double track where signaling for left hand running or both tracks in both directions was required this meant that expensive signal bridges must be built. The Santa Fe had dozens in Arizona and New Mexico.

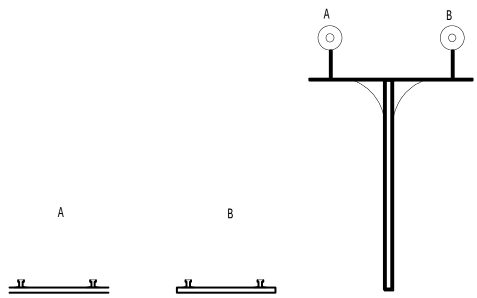
Starting in the 1980s railroads changed their rules to allow Field Side signals. This was first done on double track with the signal governing the right hand track to the right and the signal governing the left hand track to the left. If there are three or more tracks a signal bridge is still used, with each signal placed as always to the right of its track. Railroads are now applying the principle of field side signaling to single track with new installations having a single mast with signal heads facing in both directions. There is no rule regarding whether such signals are on the north or south side of the track.



Field Side Signals on Single and Double Track

Bracket Signals

Some railroads have, in the past, avoided a full signal bridge in multiple track territory by the use of bracket signals. Bracket signals are placed to one side on the track and will have a mast for each track present. If a track is not signaled the mast for that track will have what is called a Doll Signal, which is a blue light with no target. This is merely a place holder and is not to be confused with a blue flag, which would mean a track out of service.

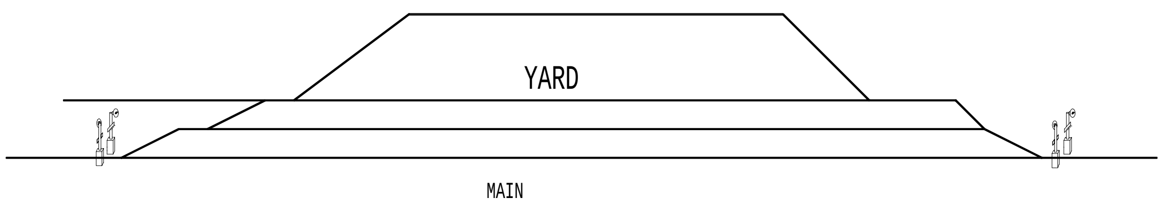


Example of Two Track Bracket Signal

Bracket signals are always on a high mast because both signals must be visible to the engineer of a train on the far track, even if a train is passing on the other track, and remember this means the engineer of a steam engine. Bracket signals were only used by a very few railroads, and then only in certain territories.

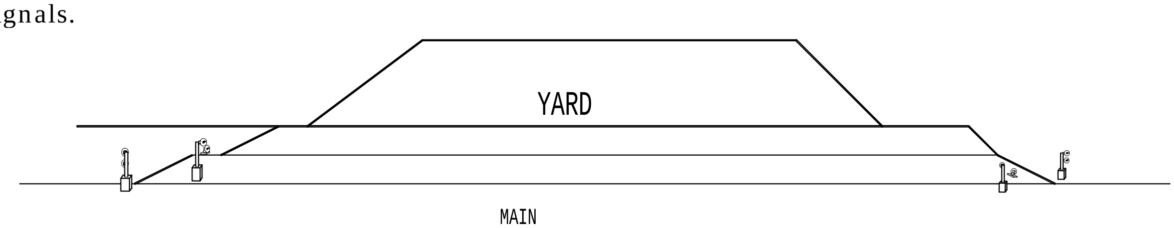
Signals at Yards

Signaling at yards does not need to be complicated. Only the largest classification yards have an interlocking plant controlling access to the yard; most yards, even division point yards, have hand throw switches connecting them to the main or a controlled siding. There are of course exceptions, but most yards have no signals in the yard itself; signals are only on the main tracks. Many yards do have switch indicators which are low signals placed right at each switch that only indicate which way the switch is thrown. These replace switch lanterns and are much smaller than a dwarf block signal.



Yard in ABS Territory

In ABS territory most yards are treated like a siding, with all switches being hand throws. There will be Yard Limits on the main, but that only affects the right to use the main track, not the placement of signals.

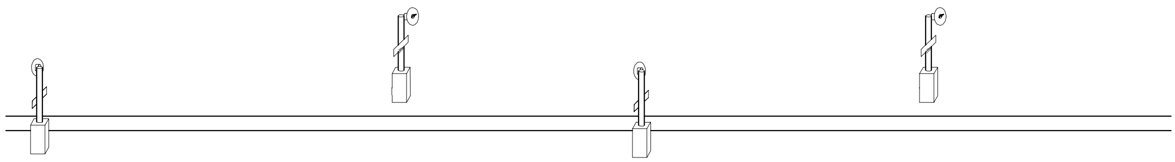


Yard in CTC Territory

A yard in CTC territory is also signaled like a siding. The “siding” track is used as an inbound/outbound lead for the yard. The timetable will state that CTC rules are not in effect on the siding, so the hand throw switches that access the yard do not need switch locks or signals.

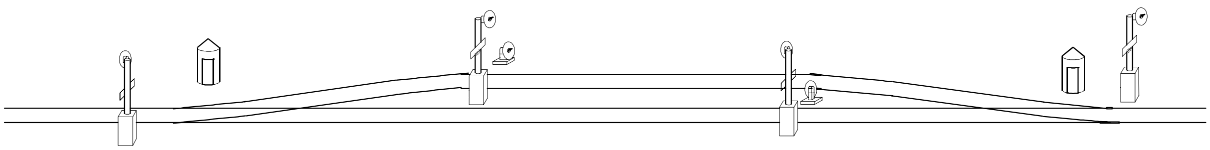
Special ABS Signals

While CTC signals are all placed pretty much the same there were some variations used in ABS signals. They don't need to be used in modeling, but you may come across them when railfanning the prototype.



Overlap Block Signaling

Overlap signaling is ABS but the signals alternate in the direction they face. This was used primarily on low density or high speed territory, and mostly to reduce to cost of installing signals.



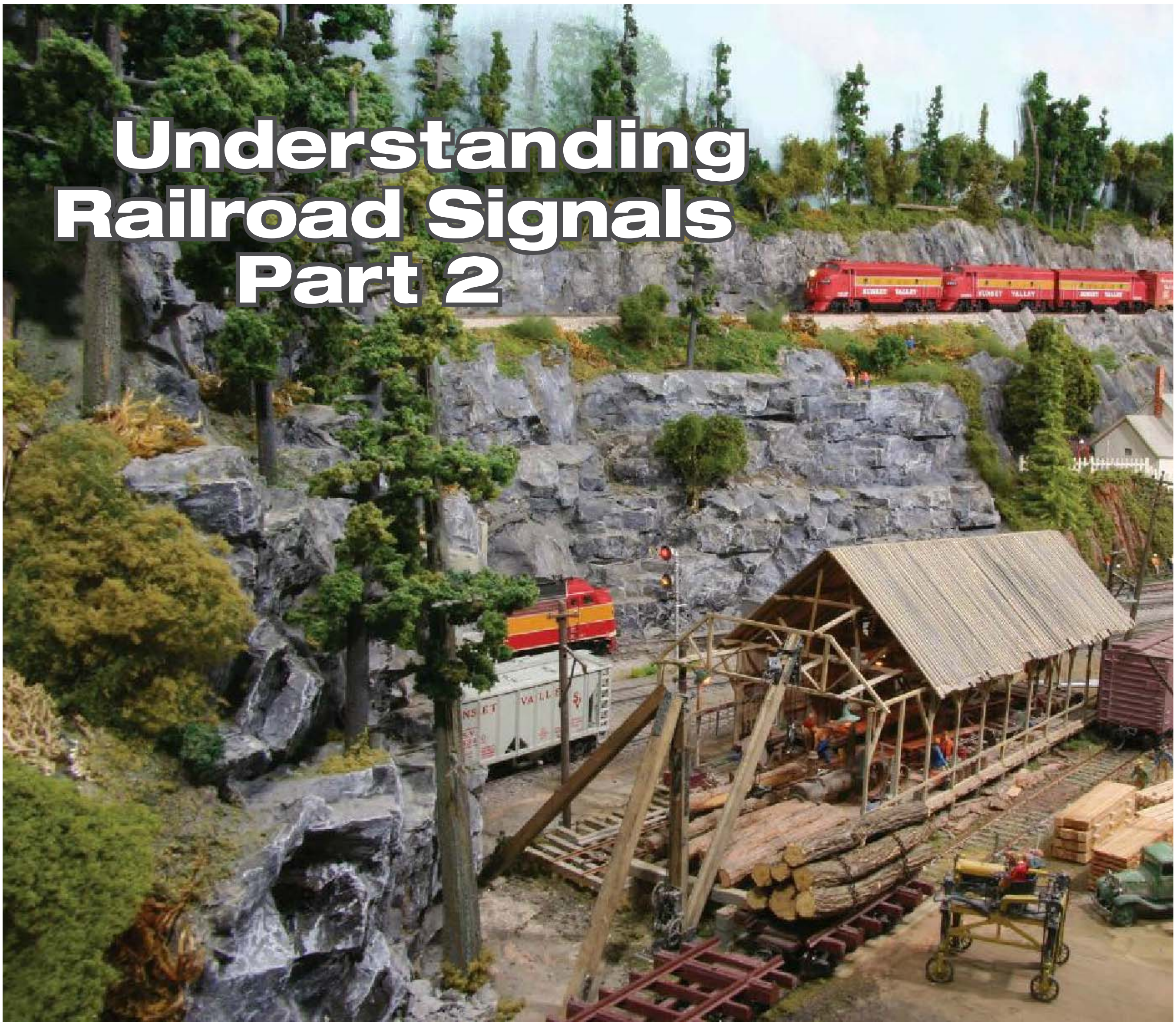
ABS Spring Switch Siding

This arrangement is very popular with prototype railroads in ABS territory. The switches at both ends of the siding are spring switches, and a train can make a trailing movement out of the siding with the switch lined for the main. This greatly speeds a meet since the inferior train doesn't need to stop to line the switch back, which is even more valuable now that cabooses are a thing of the past. At first glance the signaling looks like CTC, but the switches are spring hand throw, and the signals are not under the dispatcher's control. The figure shows ABS with number plates on all mainline signals; if the territory was Absolute-Permissive Block signals the number plates would be absent from the signals leaving the siding.

Signal Types

All of the figures show searchlight signal heads for simplicity, but any type of signal head can be used depending on the railroad being modeled and the era. I'm making no attempt to cover the kinds of signals used or the aspects and indications; the best source is photographs and the Employee Rule Book and Timetables for the line in question. Regardless of the type of signal used, the placement of the signals will normally follow the same rules.

Understanding Railroad Signals Part 2



Train 202

With a Sunset Valley freight rumbling along the Crescent City Branch on the track above, SP Train 202, a hot-shot reefer train, peeks into view with a signal displaying a red-over-yellow aspect — a diverging-approach — signifying that it is lined to take the siding at Riddle, Oregon, and must approach the next signal prepared to stop. The sawmill in the foreground, Sonke Mill, is the smallest of eight sawmills located on the SVOS.

CRAFTSMAN/*Dr. Bruce Chubb, MMR, photos by the author*

Signal Aspect, Name, and Indication

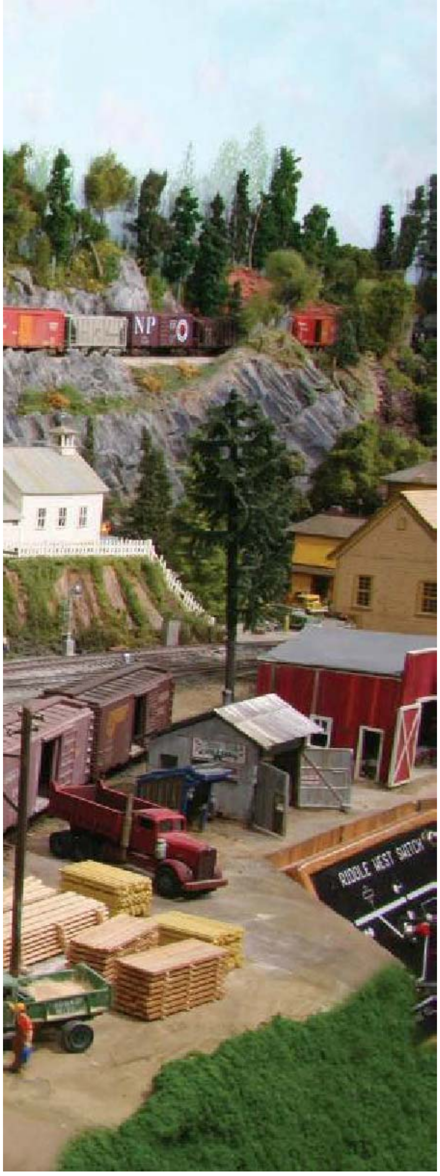
Signal fluency requires a good understanding of the terms **aspect, name, and indication:**

• **Aspect** is the color of the signal, or color and arm position when using semaphores, or position of the lights when using position light signals. Typical color aspects are red, yellow, green, and in some cases lunar white. Example aspects on multi-head signals are green-over-red; yellow-over-red; red-over-red; red-over-flashing-yellow; red-over-red-over-yellow, red-over-red-over-lunar white, and other variations.

• **Name** is the official word, or words, used in talking about the specific aspect being displayed by a signal. The most commonly applied names are: Clear; Approach; and Stop; but there are many others: Advance Approach, Approach Diverging, Approach Limited, Approach Medium, Approach Restricting, Approach Slow, Diverging Approach, Diverging Approach Diverging, Diverging Clear, Grade Restricting, Limited Clear, Limited Approach, Medium Approach, Medium Clear, Slow Approach, Slow Clear, Restricting, as well as Stop and Proceed.

• **Indication** is what the signal tells the trainmen to do. For example, a typically used indication for an approach signal is "Proceed prepared to stop at next signal."

The actual aspects used, with each corresponding name and indication, can vary from railroad to railroad, or even on different parts of the same railroad as might occur on railroad property acquired through a merger or



purchase. In all cases, any signal that does not follow a precisely defined standard for a given railroad is defined as "Signal Not In Correspondence," the details of which are listed in the Employee Timetable. Thus, to follow a specific prototype, you need to learn its practices by studying its Book of Operating Rules and Employee Timetable. However, in the remaining sections of this article, we will cover the more commonly used aspects. Fortunately, for every application you only need to make use of a relatively small subset of all those available.

ABS Single-head Block Signals

If modeling straight ABS signaling in its most simplistic form, e.g., without any interlocking plant involvement, then Figure 1 shows the only set of signal aspects, names, and indications required.

Figure 1 is very fundamental. For those interested, you could eliminate the yellow aspect. The result, however, falls far short of most prototypes, i.e., except for trolley operations where the braking distance to the next signal is not much of an issue. An interesting point noted in Figure 1 is that the most restrictive aspect obtainable with ABS signaling is "Stop and Proceed." This is because ABS signaling is set up to handle double-track applications where traffic on each track is predominantly in one direction of travel. In essence, ABS is set up to maintain the braking distance between trains traveling in the same direction to prevent rear-end collisions.

Establishing the red aspect as a "permissive stop," permits a train, after stopping, to proceed past the red signal at restricted speed, thereby preventing a circuit failure from holding up a train for hours at some remote location. Such action does not sacrifice safety, because the following train is required to operate at restricted speed, which from our previous definition means that it "permits stopping within one-half the range of vision of equipment or obstruction occupying the track, and also will prepare to stop short of a switch not properly aligned, looking out for broken rail and at no time exceeding 15 mph."

Multiple-head Block Signals

Except for the color position signal and the restricting aspect on the position light, single-head block signals are limited to the three aspects (green, yellow, and red) as listed in Figure 1. This provides protection for two blocks. In simplified terms, an engineer approaching (i.e., in the rear of) a green signal knows that the next two blocks in advance of the signal are clear. By contrast, a yellow signal (an approach) tells the engineer to prepare to stop at the next signal.

Three-aspect signaling requires that block lengths be established so that all trains traveling at maximum authorized track speed are able to stop within one block length. This requirement can be quite restrictive for many prototype applications. Sighting distance — defined as how far ahead an engineer can read a signal before reaching the signal — is not considered when spacing block signals according to braking distance. Why? Because it is

Figure 1
Basic ABS Aspects

Basic aspects, names, and indications for implementing ABS signaling.

ASPECT	NAME	INDICATION
	Clear	Proceed at authorized track speed
	Approach	Proceed prepared to stop at next signal
	Stop and Proceed	Stop and proceed at restricted speed

ASPECT	NAME	INDICATION
	Clear	Proceed
	Approach Medium	Proceed, approaching next signal at medium speed
	Approach Slow	Proceed, approaching next signal at slow speed. Trains exceeding medium speed must at once reduce to that speed.
	Approach	Proceed, preparing to stop at next signal. Trains exceeding medium speed must at once reduce to that speed. Reduction to medium speed must commence before passing signal.
	Stop and Proceed	Stop, then proceed at restricted speed.

Figure 2

Aspects, Names, and Indications for two-headed block signals. Information adapted from the Grand Trunk Operating Rules *book, dated 1962.*

assumed that due to fog, snow, or other element conditions, the engineer may be unable to see the signal until directly on top of it.

Although longer blocks have the advantage of lowering signaling cost, they result in less traffic-handling capability because trains need to be spaced out at greater intervals. In spite of the fact that we really do not need to worry about stopping distance with our models, but because of our limited space, we still tend toward having shorter blocks. Using multiple-aspect signaling can help justify our shorter blocks and add a lot of interest to the railroad. Historically, a second signal head is added to block signals as shown in Figure 2, to achieve more than three aspects.

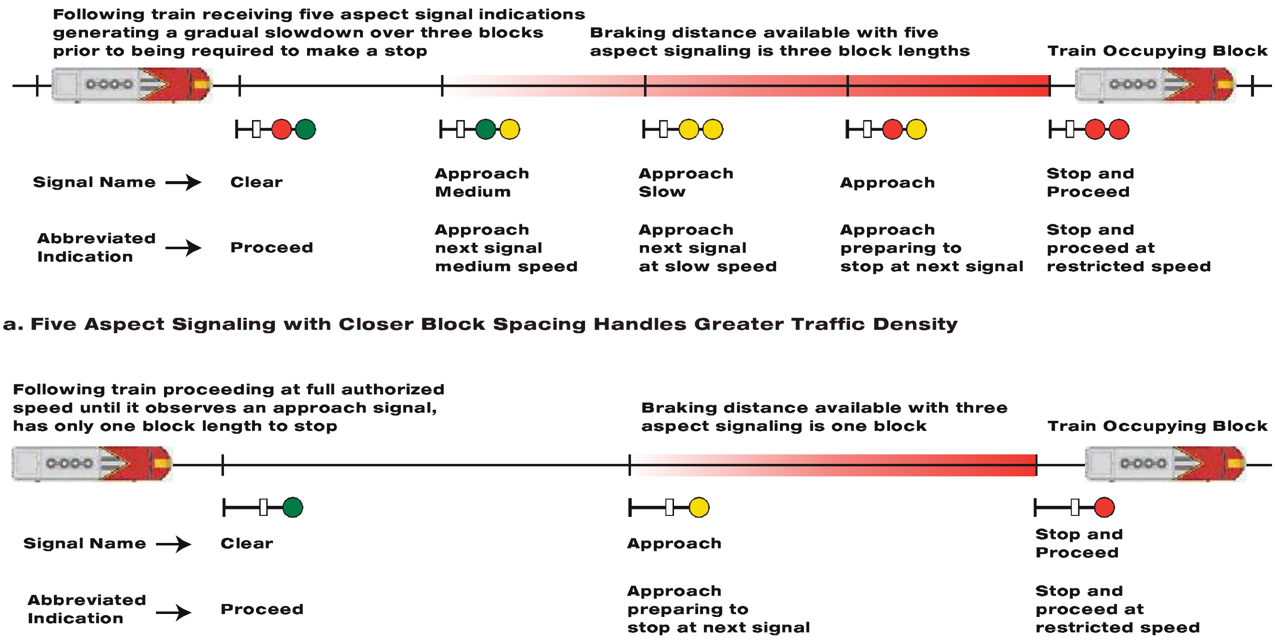
When two heads are used on a block signal, the lower head is sometimes staggered to one side to distinguish it from an interlocking signal, in which the multiple heads are always in vertical alignment. Some railroads, such as Chesapeake & Ohio, also have their multiple-head block signals vertically aligned. After all, it is the presence of the number plate that differentiates a block signal from an interlocking signal and not how the heads are aligned.

Figure 2 lists the typical aspects, names, and indications used for two-headed block signals. The five indications result in four-block protection, giving the engineer three block lengths to reach a stop.

Figure 3 compares five-indication to three-indication block signaling. With five-indication signaling, block length can be reduced to one-third braking distance. The shorter blocks allow following trains to run closer together, and this means more traffic-handling capability.

Although the prototypical cost of five-indication signaling is greater, its ability to handle heavy traffic density smoothly can more than justify the added cost in certain instances. To reduce installation cost, many prototype ap-

Figure 3



a. Five Aspect Signaling with Closer Block Spacing Handles Greater Traffic Density

b. Three Aspect Signaling with Longer Block Length Handles Less Traffic Density

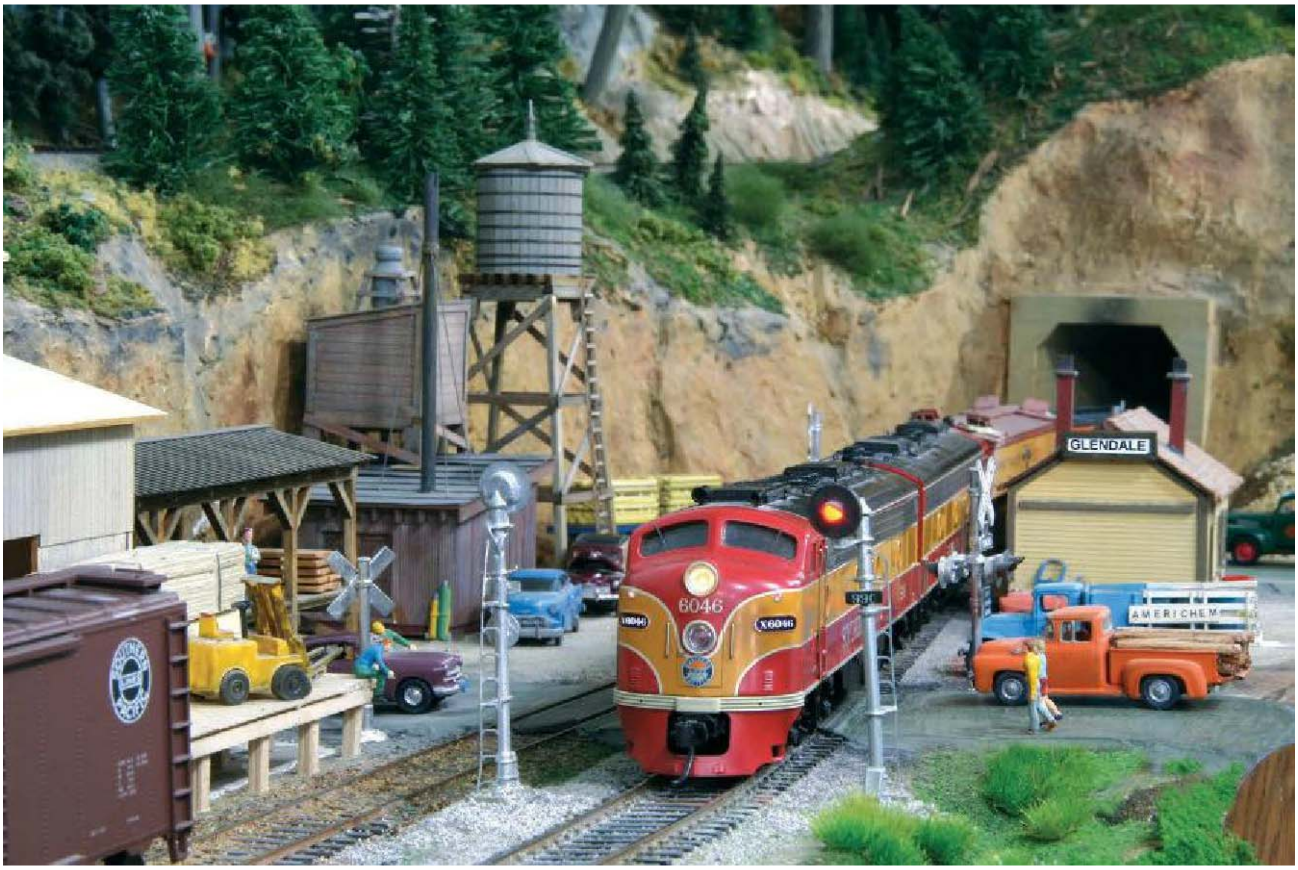
plications eliminate the Approach Slow indication. This four-indication capability simplifies circuitry with braking distance spread out over two blocks instead of three. This is still better than enforcing the one-block stopping distance required with three-aspect signaling. Although the prototype's cost for implementing added aspects is high, the only added C/MRI cost is approximately $4 for two added output lines. Software handles everything else.

Implementing Flashing Aspects

Instead of going to the expense of installing multiple-head block signals, economics frequently dictates the use of flashing aspects to achieve added indications. A prominent example with single-head block signals is using a flashing-yellow to indicate an Advance Approach, and a steady yellow for the regular Approach. This way, the train crew receives an indication to start slowing down one block in advance of receiving the actual approach. This spreads the braking distance over two blocks instead of one.

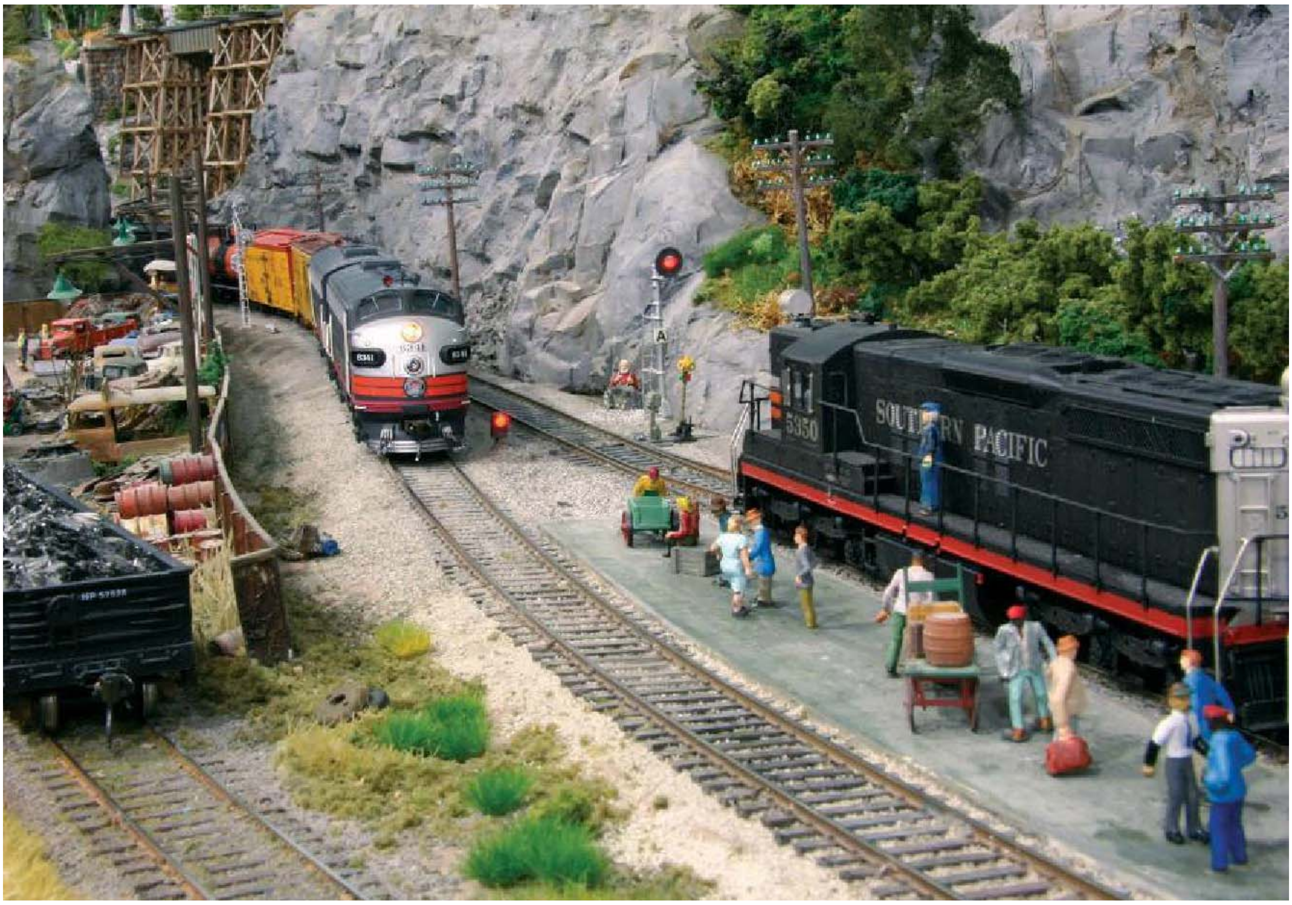
Another common application, this time for two-headed interlocking signals, is to use red-over-flashing-yellow for Diverging Approach and red-over-yellow for Restricting. Without flashing capability, it is common on some roads to add a third head so that a red-over-yellow-over-red is the Diverging Approach aspect and red-over-red-over-yellow is the Restricting aspect. As a further example, some railroads use a lower head displaying lunar white to indicate Restricting while others use a flashing-red in the lower head. The flash rate for wayside signals is defined in the American Railway Engineering and Maintenance-of-Way Association (AREMA) Signals Code of Standard Practice Manual as 50 to 65 flashes per minute.

Employing flashing aspects is a resourceful way to expand your signal system. Also, simulating this prototypical implementation can add significant interest to operations. To top it off, it is easy to add flashing aspects with the C/MRI, since all your signals are under software control. Another very big advantage is there is absolutely zero added cost for the wayside signals — typically the most expensive part of any signal system. Implementing flashing aspects with the C/MRI simply requires alternating between sending the signal command between the two desired aspects. For example, alternating between SE(35) = REDYEL for red-over-yellow and SE(35) = REDDRK for red-over-dark gives the signal at the east end of Block 35 a red-over-flashing-yellow aspect.



Train 403

the Produce Special, *with two sets of grade crossing warning flashers and grade bells operating, blasts through a pair of intermediate signals at Glendale, Oregon. Note the number plate directly below the signal head that defines this signal set as permissive signals. At the left is a corner of the Robert Dollar Mill complex at Glendale.*



Dispatcher

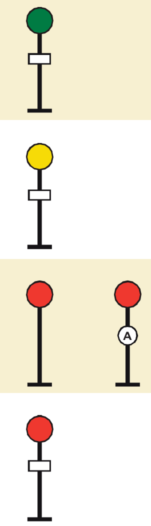
Don Baxter, having just cleared NP 425 out of Seattle Track 5, is now recording the information on his train sheet. The panel above shows the status of the 20-track lower staging. It's operated as an Entrance-Exit (N-X) interlocking plant, whereby the operator simply presses pushbuttons where train is to enter and exit each section. Up to three simultaneous movements can take place; arrival, departure, and loop-around. All required prototypical interlocking, easily accomplished via C/MRI, sets up the required track switch alignments and signal aspects.

Extra 5350

The dispatcher has Extra 5350 West, headed by three SD9s, holding on the main track at the west end of Grants Pass for Extra 6341 East to pull clear into the siding. This scene illustrates the typical triad of signals found at a large number of OS sections within CTC territory: the two-headed mast signal out by the turnout points and two signals protecting the frog end via dwarf for the siding and a mast signal for the main track. At the left is Quigley's Salvage yard, a frequent shipper on the SVOS, while the track at far upper left is a portion of the SV's Crescent City Branch.

Extra 3718 West

crossing Wall Creek Viaduct in approach to absolute signal protecting the east end of Siskiyou Siding. It's displaying a red-over-yellow aspect — a diverging approach — with indication under route signaling take the siding and be prepared to stop at the next signal, i.e., the end of the siding. Likely the dispatcher is setting up for a meet using the Siskiyou Siding. Additionally, the signaling system would have set an approach diverging — a flashing yellow — at the signal to the rear of the above signal, indicating to the train crew to approach the next signal prepared to take the diverging route.



ASPECT	NAME	INDICATION
	Clear	**Proceed at authorized track speed**
	Approach	**Proceed prepared to stop at next signal**
	Absolute Stop	**Stop and stay stopped**
	Stop and Proceed	**Stop and proceed at restricted speed**

Figure 4 APB Aspects

Aspects, Names, and Indications for implementing APB signaling.

APB Single Head Block Signals

For signaling to protect against opposing movements on the same track, as a minimum we must implement Absolute Permissive Block (APB) signaling. Figure 4 illustrates the minimal set of aspects, names, and indications required to implement APB signaling.

Comparing Figure 1 to Figure 4 confirms the significance of a signal displaying a number plate, for it is the presence of the number plate that makes the signal permissive rather than absolute. To add emphasis that a signal is absolute, some railroads place a letter plate "A" instead of the number plate.

Because prototype railroads make extensive use of permissive signals, it is nice to do so with our models wherever we can. However, for situations employing Manual Block Control (MBC) or Computer Cab Control (CCC) or Computer Block Control (CBC), where in each case cab continuity is essential across block boundaries prior to clearing a signal, it is important to treat all signals as absolute. There is no such restriction when using Command Control such as DCC.

Interlocking Signals

Even if we think we are modeling strictly ABS or APB signaling, both of which only make use of "block signals," most of our modeling applications involve at least some form of an interlocking plant, whether it is a tower operator-controlled crossover between double track, a junction with a branch line, a crossing with a foreign line, or a terminal area. For all but the simplest railroads crossing at grade, modeling each of these situations requires additional aspects of some form to account for the speed change requirements associated with the traversing through the diverging route(s).

Without getting involved with the differences between "speed signaling" and "route signaling" to be covered next month, Figure 5 introduces a second signaling head to accommodate the diverging route situation.

It should be noted that Figure 5 assumes that "route signaling" is employed. In this case, the upper head relates to the main route, while the lower head relates to the diverging route. For example, red-over-yellow, named Diverging Approach, indicates to the engineer that the movement through the plant is set up to take the diverging route, at a prescribed speed, and that he or she must be prepared to stop at the next signal. This is in contrast to yellow-over-red, named Approach, which indicates to the engineer to proceed on the main route prepared to stop at the next signal. Additionally, it is important to point out in Figure 5 that, due to its extremely safety sensitive nature, many railroads, in place of the flashing-red, prefer to use a specific and specialized color, i.e., lunar white, to display Restricting. Unlike the other three standard signal colors (red, yellow, and green), lunar white is used to display only one aspect and is seldom found used in conjunction with any color other than red. Lunar white is traditionally used in route-based signaling systems, although in today's modern railroading it is finding its way into many rulebooks for speed-signaled railroads. A lower lunar white marker leading into an interlocking plant is frequently referred to as a "Call On," indicating that "tower crew" is calling on, i.e., authorizing, the engine crew to enter the plant at restricted speed.

When aligned to take the diverging route, using the aspects shown in Figure 5, it is the engineer's responsibility to know the prescribed speed associated with each signal. If the prototype turnout is a No. 16, or in our modeling case a No. 8, the corresponding prescribed speed would be 30 mph, Medium Speed.

The aspects shown in Figures 1 through 5 may be displayed on any type of signal such as semaphore, color light, color position light, searchlight, and so forth. Additionally, the example marker and number plates shown apply to only red and red-over-red aspects, and their presence or absence has no effect on less restrictive aspects. RMC

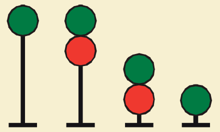
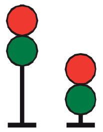
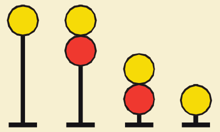
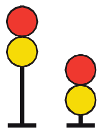
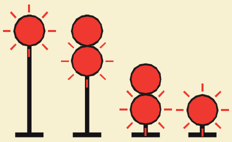
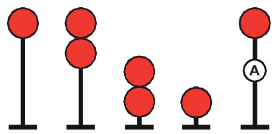
ASPECT	NAME	INDICATION
	**Clear**	**Proceed at authorized track speed**
	**Diverging Clear**	**Proceed on diverging route not exceeding prescribed speed through turnout**
	**Approach**	**Proceed prepared to stop at next signal**
	**Diverging Approach**	**Proceed on diverging route through turnout at prescribed speed preparing to stop at next signal**
	**Restricting**	**Proceed at restricting speed**
	**Absolute Stop**	**Stop and stay stopped**
	**Stop and Proceed**	**Stop and proceed at restricted speed**

Figure 5

Aspects, Names, and Indications for two-headed interlocking signals using route signaling. Adapted from the Grand Trunk Operating Rules *book, dated 1962.*

Operator

Bruce Van Huis, carrying out the role of Seattle Operator, calls the Terminal Dispatcher to clear Train 408, the NP Seattle–Portland Passenger Poll Train, out of Track 3 of 20 staging tracks representing Seattle, Spokane, or Pocatello, depending upon the train being operated. After giving the dispatcher the train's lineup, Bruce reverts to being the crew for 408 and waits for the dwarf signal on the right, i.e., engineer side of the train in front of his train, to clear. Note the train on the deck above is the Coos Bay Passenger on its journey from Eugene to Coos Bay.

Operations Bliss

The 991 (a hot intermodal train) pulls into Emporia, Kansas, as a light power move gets an approach signal at the west end of the yards. The entry crossovers to the main lines are protected by a double-headed "pot" signal that require dispatcher permission to enter the main line. All these signals are easily automated by using C/MRI. The interface can be built as kits or purchased fully assembled and tested. Nothing else you can build will transform your layout's personality, adding prototypical realism and operations.

The C/MRI acronym stands for Computer/Model Railroad Interface, a system invented by Dr. Bruce Chubb for interfacing a computer with a model railroad. Its original introduction was a 16-part series in *Model Railroader* magazine beginning with the February 1985 issue. The C/MRI system has since undergone numerous updates, making it more applicable today than the day it was invented. Bruce's system is robust, economical, and completely tested. There are thousands of systems around the world — three of them operate in my hometown of Kansas City. Bruce has published books on his system, so it is well documented. The components are available assembled and tested and in kit form (www.sliqelectronics.com) or simply as PC boards (www.jlcenterprises.net) that you can add your components to following the instructions provided in Bruce's documentation. C/MRI-compatible components are also available from www.modelrailroadcontrolsystems.com. What else could you ask for?

The basic concept is to distribute input/output nodes around your layout, whereby each of your railroad devices that you want interfaced, such as wayside signals, occupancy detectors, switch motors, panel switches, pushbuttons, turnout position, and display LEDs simply connect to input or output pins on the nearest node. Up to 128 nodes are possible, and the only connection between nodes is a single four-wire cable that daisy-chains from node to node.

We first purchased the C/MRI system from Bruce in 2002 for our Santa Fe Emporia Subdivision (*MR*, June 2004; *RMC*, June 2005), where it operated flawlessly for more than 12 years. I consider this purchase to be one of the best I have ever made regarding my model railroad. We are currently expanding our C/MRI and adapting it to our new railroad, the Santa Fe St. Louis Division — a 3,400-square-foot empire modeling a theoretical Santa Fe route between Kansas City, St. Louis, and Chicago (www.stlouisdivision.com).

We are already deep into assembling all the newly needed C/MRI components and beginning their installation. The project is fun. See the latest photos available at www.stlouisdivision.com/cmri. We will be using the C/MRI to control multiple grade crossings, (wayside) signals, interfacing to a CTC machine, and multiple yard panels and interlockings, staging, and even reverse loops. I love the programmable flash rates for the (wayside) signals.

If you are serious about adding prototypical signaling to your railroad, I heartily recommend using the C/MRI system.

Stephen M. Priest, MMR