

NORAC Signaling

Version 1.0 - September 2026

Introduction

During the 1980s, the railroads operating along the Northeastern United States Corridor adopted a common set of operating rules through the Northeast Operating Rules Advisory Committee (NORAC).

With respect to signaling, NORAC standardized a signaling philosophy primarily based on **Speed Signaling**. Under this system, a signal conveys the maximum authorized speed at which a train may proceed, or the speed that must be attained at the next signal. Information concerning occupancy of blocks ahead is therefore conveyed only indirectly through the required speed indication.

By contrast, many railroads operating in the central and western United States adopted the General Code of Operating Rules (GCOR), which relies primarily on **Route Signaling**. Under GCOR practice, signals convey information regarding the route lined ahead, such as a normal route or a diverging route. Authorized speeds through turnouts and along the main track are generally established by the Timetable and Special Instructions rather than by the signal indication itself.

In summary, NORAC emphasizes the communication of authorized speeds through signal aspects, whereas GCOR systems place greater emphasis on route configuration and track geometry.

Speed Classes

The following table summarizes the speed classes commonly employed under NORAC practice and adopted in the Train Director signal package.

Speed	mph	km/h	Operating Definition
Normal Speed	Maximum authorized speed	Maximum authorized speed	Maximum track speed or maximum authorized train speed.
Limited Speed	40/45	64/72	45 mph for passenger trains and 40 mph for freight trains.
Medium Speed	30	48	Proceed not exceeding 30 mph.
Slow Speed	15	24	Proceed not exceeding 15 mph.
Restricted Speed	15 or less	24 or less	Proceed prepared to stop within half the range of vision, not exceeding 15 mph.

The values shown above represent the speed conventions adopted within this Train Director signal package and correspond to modern NORAC practice.

Signal Aspect Terminology

NORAC signal aspects follow a structured naming convention consisting of one-word, two-word, or three-word aspect names.

Aspect Names

Aspect names may consist of one, two, or three words.

Within the signal package, only the following three-word aspects are implemented:

- Medium Approach Medium
- Medium Approach Slow

One-Word Aspects

A one-word aspect may be:

Aspect	Meaning
Stop	Absolute stop.
Clear	Proceed at Normal Speed.
Approach	Proceed prepared to stop at the next signal.
Advance Approach	Proceed prepared to stop at the second signal ahead.
Restricting	Proceed at Restricted Speed.

Although Advance Approach consists of two words, it operates conceptually as a standalone indication and is therefore grouped with the one-word aspects.

Two-Word Aspects

Two-word aspects govern movement through interlockings, Control Points (CPs), and diverging routes.

Line-speed restrictions not associated with signal indications are established through timetable instructions and permanent speed restrictions.

The naming convention follows three basic rules:

First word = Speed Example: Medium Clear The first word specifies the speed that applies at the current signal and through the interlocking or controlled area governed by that signal.

First word = Approach Example: Approach Medium The aspect serves as advance warning. The second word specifies the speed that will apply at the next signal.

Last word = Approach Example: Medium Approach The next signal will display Stop.

The first word specifies the speed that applies through the route governed by the current signal.

Three-Word Aspects

Three-word aspects such as: Medium Approach Medium Medium Approach Slow are normally displayed on three-head signals and are used to manage more complex signal progressions and high-density interlocking movements.

Aspect Progression

In NORAC territory, signal aspects should not be viewed as isolated indications. Each signal conveys information regarding conditions at one or more signals ahead.

A fundamental rule of NORAC signaling is that any aspect requiring a speed reduction at a signal must normally be preceded by an appropriate Approach indication.

The following examples illustrate two typical Medium-Speed diverging routes.

Example 1: Diverging Route Followed by Stop

Aspect	Interpretation
Clear	No speed reduction required.
Approach Medium	Prepare to pass the next signal at Medium Speed. The route governed by the next signal includes a Medium-Speed diverging movement.
Medium Approach	Proceed through the route governed by this signal at Medium Speed and prepare to stop at the next signal. This signal protects a Medium-Speed turnout.
Stop	Stop.

Example 2: Diverging Route Returning to Normal Speed

Aspect	Interpretation
Clear	No speed reduction required.
Approach Medium	Prepare to pass the next signal at Medium Speed. The route governed by the next signal includes a Medium-Speed diverging movement.
Medium Clear	Proceed through the block governed by this signal at Medium Speed. After clearing the controlled area, resume Normal Speed.
Clear	Proceed at Normal Speed.

These examples demonstrate how each signal provides advance information concerning conditions at the following signal, allowing the engineer sufficient distance to comply with the required speed.

NORAC Signal Rules

The following table summarizes the principal NORAC signal rules implemented in this signal package.

Rule	Aspect	Indication
281	CLEAR	Proceed, not exceeding Normal Speed.
281-A	CAB SPEED	Not simulated in Train Director. Proceed in accordance with cab signal indication. Reduce speed to not exceeding 60 mph if no speed is displayed or if cab signals are not operative.
281-B	APPROACH LIMITED	Proceed approaching the next signal at Limited Speed.
281-C	LIMITED CLEAR	Proceed at Limited Speed through all interlockings and turnouts governed by this signal, then proceed at Normal Speed.

282	APPROACH MEDIUM	Proceed approaching the next signal at Medium Speed.
282-A	ADVANCE APPROACH	Proceed prepared to stop at the second signal ahead. Reduce speed to Limited Speed.
283	MEDIUM CLEAR	Proceed at Medium Speed through the interlocking or controlled route governed by this signal, then proceed at Normal Speed.
283-A	MEDIUM APPROACH MEDIUM	Proceed at Medium Speed through the controlled route, then approach the next signal at Medium Speed.
283-B	MEDIUM APPROACH SLOW	Proceed at Medium Speed through the controlled route, then approach the next signal at Slow Speed.
284	APPROACH SLOW	Proceed approaching the next signal at Slow Speed.
285	APPROACH	Proceed prepared to stop at the next signal. Trains exceeding Medium Speed must begin reduction as soon as the signal is clearly visible.
286	MEDIUM APPROACH	Proceed at Medium Speed through the controlled route and prepare to stop at the next signal.
286-A	LIMITED APPROACH	Proceed at Limited Speed through the controlled route and prepare to stop at the next signal.
287	SLOW CLEAR	Proceed at Slow Speed through the controlled route, then proceed at Normal Speed.
288	SLOW APPROACH	Proceed at Slow Speed through the controlled route and prepare to stop at the next signal.
290	RESTRICTING	Proceed at Restricted Speed until a more favorable signal is reached.
291	STOP AND PROCEED	Not simulated in Train Director. Stop, then proceed at Restricted Speed. Normally associated with permissive automatic block signals.
292	STOP	Stop.

Speed Interpretation

The following table summarizes the practical meaning of the most common NORAC aspects.

Signal Aspect	Speed at Signal	Speed Through Interlocking / Controlled Area	Speed After Controlled Area	Speed Required at Next Signal
Stop	Stop	-	-	-
Stop and Proceed	Stop, then Restricted Speed	Restricted Speed	Restricted Speed	Governed by signal indications and conditions ahead
Restricting	Restricted Speed	Restricted Speed	Restricted Speed	Proceed prepared to stop within one-half range of vision
Clear	Normal Speed	Normal Speed	Normal Speed	Normal Speed
Limited Clear	Limited Speed	Limited Speed	Normal Speed	Normal Speed
Medium Clear	Medium Speed	Medium Speed	Normal Speed	Normal Speed
Slow Clear	Slow Speed	Slow Speed	Normal Speed	Normal Speed
Approach	Normal Speed, reducing toward Medium Speed	Normal Speed	Prepare to Stop	Stop
Medium Approach	Medium Speed	Medium Speed	Prepare to Stop	Stop
Slow Approach	Slow Speed	Slow Speed	Prepare to Stop	Stop
Advance Approach	Normal Speed, reducing toward Limited Speed	Limited Speed	Normal Speed	Approach
Approach Limited	Normal Speed	Normal Speed	Limited Speed	Limited Speed
Approach Medium	Normal Speed	Normal Speed	Medium Speed	Medium Speed
Approach Slow	Normal Speed	Normal Speed	Slow Speed	Slow Speed

Structural Classification of Signal Types

Although railroads adopting NORAC rules standardized their operating practices, they generally retained their own signal structures and hardware.

Within the Northeast Corridor (Boston, New York, Philadelphia, Washington D.C.), two principal signaling philosophies co-exist:

- **Position-based signals**, derived from semaphore practice.
- **Color-light signals**, conveying information through colored lamps.

According to construction type, signal systems may therefore be grouped as follows:

Type	Description
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Position Light (PL)	Arrays of amber lamps reproducing the positions of mechanical semaphore blades. Originally developed by the Pennsylvania Railroad.
Color Position Light (CPL)	Combines the geometry of Position Light signals with standard color indications (red, green, yellow, and lunar white).
Searchlight (SRL)	Single-lens signal employing an internal color-changing optical mechanism.
Round Cluster Light (RCL)	Circular signal heads fitted with three fixed lenses arranged in a triangular cluster.
Pedestal / Diamond	Low-mounted ground signals based on Position Light or Searchlight technology.
Dwarf	Ground-mounted signals typically used in yards, interlockings, and restricted-speed territory.

Position Signals

Position Light Signals

Position Light signals employ rows of lamps arranged to reproduce the positions formerly displayed by semaphore blades:

- Vertical
- Horizontal
- Diagonal

The lamps are normally amber in color. Lunar indications may occasionally be found on more modern installations.

Position Light signals are available in one-head and two-head configurations.

SINGLE-HEAD POSITION LIGHT SIGNALS

Single-head Position Light signals are used as automatic block signals, intermediate signals, or to protect simple routes.

The indications are straightforward:

Lamp Position	Aspect
Horizontal	Stop
Vertical	Clear
45° Diagonal Right	Approach
Flashing Diagonal	Advance Approach

TWO-HEAD POSITION LIGHT SIGNALS

The lower head is not continuously illuminated. It lights only when a speed indication is required for:

- Diverging routes
- Restricted movements
- Controlled routes through interlockings

For Clear and basic Approach indications, the lower head remains **dark**.

UPPER HEAD ONLY LIT. The following aspects may be displayed:

Upper Head	Aspect
Horizontal	Stop
Vertical	Clear
Diagonal Right	Approach
Flashing Diagonal	Advance Approach

BOTH HEADS LIT. When both heads are illuminated, the upper head generally remains in the horizontal position while the lower head displays the applicable speed indication.

Lower Head Position	Aspect
Flashing Vertical	Limited Clear
Vertical	Medium Clear
Diagonal Right	Medium Approach or Slow Clear
Diagonal Left	Restricting

It is important to note that a two-head Position Light signal may display a full **Clear** indication with only the upper head illuminated and the lower head completely dark. The lower head is primarily used to convey Limited, Medium, Slow, or Restricting indications.

Color Position Light Signals (CPL)

The arrangement of lamps and their meanings follow the same basic principles as Position Light signaling. The distinguishing feature of the Color Position Light system is that each lamp position is permanently associated with a specific color:

Lamp Position	Color	Aspect
Horizontal	Red	Stop
Vertical	Green	Clear
45° Diagonal Right	Yellow	Approach
45° Diagonal Left	Lunar White	Restricting

The term Color Position Light (CPL) originated on the Baltimore & Ohio Railroad (B&O) and remains part of NORAC practice on former B&O and CSX territory.

Unlike traditional Position Light signals, which use amber lamps exclusively, CPL signals combine lamp position and color into a single signaling code. Additional marker lamps located above or below the main head are used to indicate diverging-route speeds such as Limited, Medium, and Slow Speed.

Care should be taken not to confuse true B&O-style Color Position Lights with the modified Position Light systems later developed by Amtrak and Conrail. Although they may appear similar, they originate from different signaling philosophies.

Color-Light Signals (Searchlight and Round Cluster Light)

Most color-light signals used under NORAC rules employ two-head or three-head configurations.

Signal types may be divided into two major categories:

Searchlight Signals: Each signal head contains a single lens illuminated through an internal color-changing mechanism employing colored filters.

Round Cluster Light Signals: Each signal head contains three separate fixed lenses arranged in a circular or triangular pattern. These signals are often referred to as: Type G Signals or Tri-Light Signals depending upon the railroad and manufacturer.

Signal Colors

The following colors are used:

Color	Meaning
Red	Stop
Green	Proceed
Yellow (Amber)	Approach indication
Lunar White	Restricting indication

Unlike many European railways, where white aspects are typically restricted to shunting or subsidiary movements, NORAC practice uses Lunar White to indicate Restricting movements and certain dwarf-signal indications.

Interpretation of Multiple Heads

If all illuminated signal heads display red, the indication is: STOP. When multiple signal heads are present, red often functions as a placeholder rather than an indication in itself.

For example: Upper Head: Red, Middle Head: Green indicates: MEDIUM CLEAR

The red upper head suppresses the Normal-Speed indication while allowing the middle head to establish the governing speed. On dwarf signals, flashing red or lunar indications may modify the operating requirement and authorize movement at Restricted Speed.

SINGLE-HEAD COLOR-LIGHT SIGNALS

Single-head Searchlight or Round Cluster signals are commonly used as:

- Automatic Block Signals
- Intermediate Signals
- Simple wayside signals

The following aspects are most commonly displayed:

Color	Aspect	Meaning
Red	Stop and Proceed	Stop, then proceed at Restricted Speed
Green	Clear	Proceed at Normal Speed

Yellow	Approach	Prepare to stop at the next signal
Flashing Yellow	Advance Approach	Prepare to stop at the second signal ahead

The flashing-yellow aspect has become standard practice on most modern automatic block territories.

TWO-HEAD COLOR-LIGHT SIGNALS

When the lower head displays red, the signal effectively behaves as a single-head signal.

The second head is used to convey diverging-route speeds such as:

- Limited Speed
- Medium Speed
- Slow Speed
- Restricting

The upper head primarily conveys information concerning block occupancy and route conditions ahead, while the lower head establishes the governing speed through the controlled route.

Typical Two-Head Aspects

Upper Head	Lower Head	Aspect
Green	Red	Clear
Red	Red	Stop
Red	Flashing Green	Limited Clear
Red	Green	Medium Clear
Red	Flashing Yellow	Medium Approach
Red	Lunar	Restricting / Shunting
Flashing Yellow	Red	Advance Approach
Yellow	Red	Approach
Yellow	Flashing Green	Approach Limited
Yellow	Green	Approach Medium
Yellow	Yellow	Approach Slow

THREE-HEAD COLOR-LIGHT SIGNALS

On three-head signals, the position of the non-red indication determines the speed governing the route through the interlocking.

Signal Head	Governing Speed
Upper Head	Normal Speed
Middle Head	Medium Speed
Lower Head	Slow Speed
Lower Head (Lunar)	Restricting

A flashing green indication on the middle head is used to distinguish limited speed from medium speed which uses a steady green indication.

Typical Three-Head Aspects

Upper Head	Middle Head	Lower Head	Aspect
Red	Red	Red	Stop
Green	Red	Red	Clear
Red	Flashing Green	Red	Limited Clear
Red	Flashing Yellow	Yellow	Limited Approach
Red	Yellow	Red	Medium Approach
Red	Green	Red	Medium Clear
Red	Yellow	Green	Medium Approach Medium
Red	Yellow	Yellow	Medium Approach Slow
Red	Red	Green	Slow Clear
Red	Red	Yellow	Restricting

Red	Red	Flashing Yellow	Slow Approach
Red	Red	Lunar	Shunting
Flashing Yellow	Red	Red	Advance Approach
Yellow	Red	Red	Approach
Yellow	Flashing Green	Red	Approach Limited
Yellow	Green	Red	Approach Medium
Yellow	Red	Green	Approach Slow

READING THREE-HEAD SIGNALS

When only one non-red indication is present, the position of that indication establishes the speed governing the current route.

- Green on upper head = Clear = Normal Speed
- Green on middle head = Medium Clear = Medium Speed
- Green on lower head = Slow Clear = Slow Speed

The color then provides information about conditions beyond the current signal:

- Green generally indicates that at least two clear blocks exist ahead.
- Yellow generally indicates that the next signal will display Stop or a more restrictive indication.

When green and yellow indications are displayed simultaneously on different heads, the signal conveys both:

- The speed governing the current route.
- The speed that will apply at the next signal.

For example:

Approach Medium :

- Normal Speed at the current signal.
- Medium Speed at the next signal.

Likewise: Slow :

- Normal Speed at the current signal.
- Slow Speed at the next signal.

The introduction of Limited Speed into three-head signaling required a distinction from Medium Speed. For this reason, a flashing green indication on the middle head is used to identify Limited Speed, while a **steady green** indication indicates Medium Speed.

Signal Aspects by Signal Type

Not all signal types are capable of displaying every NORAC aspect. The accompanying table summarizes the aspects available for each signal family implemented in this package.

Aspetto	pl1	pl2	cpl1	cpl2	srl1	srl2	srl3	rcl1	rcl2	rcl3
clear	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
limited_clear	✗	✓	✗	✓	✗	✓	✓	✗	✓	✓
medium_clear	✗	✓	✗	✓	✗	✓	✓	✗	✓	✓
slow_clear	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓
approach	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
advance_approach	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
limited_approach	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓
medium_approach	✗	✓	✗	✓	✗	✓	✓	✗	✓	✓

Aspetto	pl1	pl2	cpl1	cpl2	srl1	srl2	srl3	rcl1	rcl2	rcl3
slow_approach	×	✓	×	✓	×	×	✓	×	×	✓
approach_limited	×	✓	×	✓	×	✓	✓	×	✓	✓
approach_medium	×	✓	×	✓	×	✓	✓	×	✓	✓
approach_slow	×	✓	×	✓	×	✓	✓	×	✓	✓
medium_approach_medium	×	×	×	×	×	×	✓	×	×	✓
medium_approach_slow	×	×	×	×	×	×	✓	×	×	✓
restricting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
stop	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

One aspect has intentionally been omitted: stop_and_proceed. This is a permissive automatic block signal indication requiring a train to stop before the signal and then proceed at Restricted Speed (not exceeding 15 mph), prepared to stop within one-half the range of vision. Because Train Director cannot faithfully reproduce the operating conditions required for this indication, Stop and Proceed has not been implemented.

An additional aspect called: shunting is provided within the simulated signal package. Although Shunting does not exist in NORAC terminology, it is operationally equivalent to the Restricting aspect. The designation has been retained because it exists as a native command within Train Director.

Traffic Control Systems

Centralized Traffic Control and Interlocking Areas

Signals are considered to be under centralized control whenever their indications are automatically governed by both:

- field conditions (turnouts, track circuits, route locking, etc.),
- train movements and track occupancy.

Such territory is generally operated as: CTC (Centralized Traffic Control) or as an Interlocking Area. The functions performed by North American interlocking plants are broadly similar to those found on European railways. Consequently, these installations can be reproduced effectively within Train Director using the features provided by this signal package.

AUTOMATIC BLOCK SYSTEMS

North American railroads employ two principal methods of automatic line control:

1. **ABS — Automatic Block System**
2. **APB — Automatic Permissive Block**

Historically, both systems were developed for single-track railroads where passing sidings could be separated by distances of ten miles or more.

Train meets and passes were determined primarily by the timetable and operating authority rather than by signal indications alone.

Under this operating philosophy, opposing trains could not occupy the same main track simultaneously except under highly restricted circumstances and specific operating authority.

Likewise, a train standing in a siding could not depart merely because a favorable signal was displayed. Movement authority remained subject to dispatcher instructions, train orders, timetable authority, Form D authority, or later equivalents, depending upon the territory and historical period.

ABS AC™ AUTOMATIC BLOCK SYSTEM

The Automatic Block System relies upon track circuits and signal logic directly responsive to train movements.

Whenever a train occupies a block, signals governing movements behind that train automatically display more restrictive indications in order to maintain safe train separation.

Signal indications may also be affected by turnout position. A turnout improperly aligned for the intended route will normally cause the governing signal to display its most restrictive indication.

On single-track ABS territory, or on lines with a preferred direction of operation, automatic signals provide separation between trains moving in the same direction.

Movements in the opposing direction are controlled through:

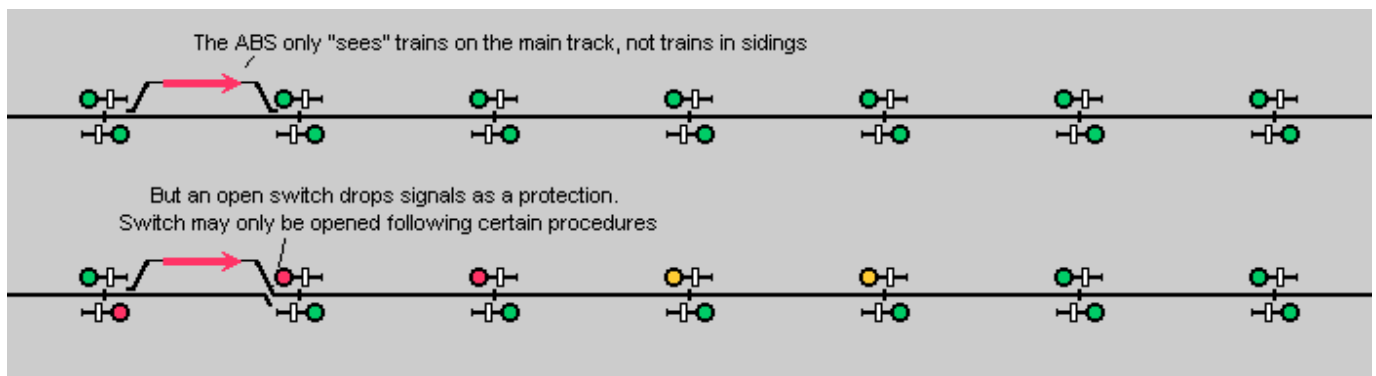
- timetable authority,
- written train orders,
- Form D authority,
- station signals,
- interlocking signals,
- other dispatcher-issued authority, depending upon the territory.

Consequently, ABS is primarily concerned with train separation and occupancy protection rather than with establishing a directional flow of traffic.

In territory where all turnouts are lined for the main route and no trains are present, it is entirely possible for signals governing movements in opposite directions to display favorable indications simultaneously.

If a turnout is lined for a diverging movement, signals protecting that route may display restrictive indications necessary to protect the movement. However, the system does not automatically establish a preferred direction of traffic for the entire line section.

This limitation ultimately led to the development of APB — Automatic Permissive Block which added directional traffic control to the fundamental principles already present in ABS.



In the upper example shown in the previous figure, all turnouts are lined for the normal route. As a result, when no trains occupy the controlled territory, favorable signal indications may be displayed simultaneously for movements in both directions. In the lower example, a turnout is lined for movement from a siding onto the main track. Signals governing movement in the direction of travel remain favorable, while signals protecting conflicting movements become more restrictive in order to protect the train entering the main track. However, this condition does not prevent a train from entering the same section of line from the opposite direction.

This operational limitation led to the development of the more advanced APB — Automatic Permissive Block system.

APB — AUTOMATIC PERMISSIVE BLOCK

The protection provided by an APB system may be broadly divided into three categories:

- Protection against opposing trains between sidings.
- Protection against opposing trains approaching a siding for a scheduled meet.
- Protection between trains operating in the same direction.

APB was therefore designed primarily to govern train movements from one siding to the next on single-track territory.

Like ABS, APB is a fully automatic signaling system. It has no knowledge of a train's destination, authority, or intended route. Instead, it establishes safe train separation solely by determining:

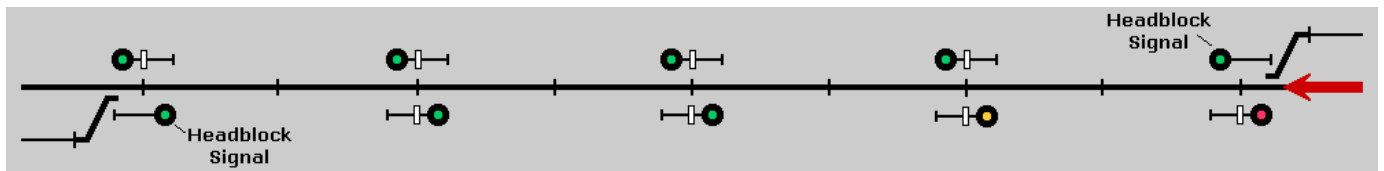
- the location of trains,
- their direction of movement,
- and the occupancy status of the blocks being protected.

The system continuously evaluates these factors and automatically establishes the safest signal indications for all trains operating within the controlled territory.

As illustrated in the preceding example, an APB installation is equipped with intermediate block signals located between sidings.

These signals serve two purposes:

- to maintain separation between trains moving in the same direction,
- to prevent conflicting movements by trains operating in opposite directions.



When a train enters the controlled territory from one direction, all signals governing opposing movements are automatically forced to their most restrictive indication. This behavior differs from a conventional ABS installation, where favorable indications may be displayed simultaneously in both directions under certain conditions.

At each end of a siding are the so-called Control Signals or Siding-End Signals. These signals determine whether it is safe to proceed toward the next section of main track.

The signals located at siding entrances and exits are absolute signals, meaning their most restrictive indication is Stop.

Signals located between sidings are generally permissive block signals, whose most restrictive indication is Stop and proceed.

The combination of absolute and permissive signals gave rise to the name: Automatic Permissive Block (APB).

Under normal operating conditions, with no trains occupying the protected territory, all signals display Clear Signal spacing must be sufficient to provide a safe stopping distance for the trains operating over the territory. Typical spacing between intermediate signals ranges from 1 to 2 miles depending on track speed, grade, curvature, and braking characteristics.

SIMULATION IN TRAIN DIRECTOR

The discussion of ABS and APB systems is included primarily to illustrate a limitation inherent in Train Director.

In a real APB installation, favorable signal indications may be displayed simultaneously in both directions when no trains occupy the controlled territory. Once a train enters the section, the system automatically establishes a traffic direction and places all opposing signals at Stop.

Train Director cannot fully reproduce this initial condition because the signaling logic tends to establish a preferred direction before traffic enters the section. As a consequence, the characteristic directional behavior of APB territory on single-track lines cannot be represented exactly.

Nevertheless, single-track territory can still be modeled satisfactorily by using signals configured as Intermediate Signals or Permissive Signals accepting that the resulting operation represents a simplified implementation of the prototype.

Historical Development of North American Signal Systems

1. Pennsylvania Railroad (PRR): Position Light or Color Light?

Throughout most of its history, the Pennsylvania Railroad employed **Position Light (PL)** signals almost exclusively.

These distinctive amber-light signals were introduced beginning in 1915 to address several operating concerns:

- color-blindness among locomotive engineers,
- poor visibility of mechanical semaphores in steam-locomotive smoke,
- visibility problems associated with electrification and overhead catenary.

The PRR did, however, employ conventional Color-Light signals in a few specific locations.

Examples include:

- the approaches to Pennsylvania Station in New York,
- the Hudson River tunnels,
- the East River tunnels.

In these locations, restricted clearances made the large circular Position Light signal heads impractical, and compact vertical Color-Light signals were used instead.

Clarification Regarding Color Position Lights

The historic Pennsylvania Railroad did **not** adopt the Baltimore & Ohio Color Position Light system as a standard signaling practice.

True **Color Position Light (CPL)** signals were developed by the B&O and combined:

- the geometric indication of Position Light signals,
- with a dedicated color code.

Traditional PRR Position Light signals relied entirely on lamp position and used amber lamps exclusively.

Many years later, Amtrak and Conrail modified a number of former PRR Position Light installations by introducing red, green, and yellow lamps. These modified Position Light signals should not be confused with genuine B&O Color Position Lights.

2. Railroads Using Position Light Signals

Position Light technology, originally developed by Union Switch & Signal, remained strongly associated with the Pennsylvania Railroad and affiliated railroads.

Major users included:

- Long Island Rail Road (LIRR), a PRR subsidiary, which adopted Position Light signaling extensively.
- Norfolk & Western (N&W), which used Position Lights on large portions of its main-line network.
- Lehigh Valley (LV), particularly in territory interconnected with the PRR.
- Reading Company (RDG), which employed Position Lights in selected areas alongside other signaling systems.

3. Railroads Using Color Position Lights

One railroad is historically identified above all others with the Color Position Light system:

Baltimore & Ohio Railroad (B&O)

Developed during the 1920s under the direction of John Patenall, the CPL combined:

- the geometric logic of semaphore-style indications,
- the advantages of color-light signaling.

Horizontal lamp arrangements indicated Stop.

Diagonal arrangements indicated Approach.

Vertical arrangements indicated Clear.

Additional marker lamps were employed to convey Limited, Medium, and Slow Speed indications.

The system remained in use through the Chessie System era and continues to survive on portions of the former B&O network now operated by CSX.

4. Railroads Using Searchlight Signals

Searchlight signals employed a single lens with an internal mechanism capable of displaying red, yellow, or green indications.

They were highly valued because of:

- exceptional long-range visibility,
- low power consumption,
- simple interpretation.

Major eastern users included:

- New York Central (NYC), which used Searchlight signals extensively on its main lines.
- Delaware & Hudson (D&H).
- Boston & Maine (B&M).
- Erie Railroad and later the Delaware, Lackawanna & Western (DL&W) before formation of the Erie Lackawanna.

Typical signal models included Hall Searchlights, US&S H-2 signals, and GRS Type SA signals.

5. Three-Lens Color-Light Signals

A separate signal type employed three fixed lenses arranged in a vertical or triangular cluster.

Unlike Searchlight signals, these installations contained no moving color mechanism.

The best-known example is the GRS Type G signal.

A notable user was New York, New Haven & Hartford Railroad (NYNH&H)

The New Haven made extensive use of Type G signals, often mounting multiple signal heads vertically in order to display the complex speed-signaling indications characteristic of northeastern railroads.

These installations became one of the most recognizable signaling features of the New England region.

References and Further Reading

NORAC Rules and Operating Manuals

- NORAC Signal Rules (Jovet)
A concise compilation of NORAC signal rules, aspects, indications, and operating requirements.
- NORAC Operating Rules (Internet Archive)
Online reference copy of the 11th Edition NORAC Operating Rules.
- SignalQuiz “NORAC Operating Rules”
Download source for the 12th Edition NORAC Operating Rules and transition guides between editions.

North American Railroad Signaling

- RailroadSignals.us
One of the most comprehensive online resources dedicated to North American railroad signaling, including historical rule books, aspect charts, hardware descriptions, and operational explanations.
- North American Railroad Signals (Wikipedia)
General introduction to North American signaling systems, including Speed Signaling, Route Signaling, and the major signaling philosophies used throughout the United States.

- NORAC Signal Aspects (pgengler.net)
Concise summary of NORAC aspects and their corresponding indications.

Position Light and Color Position Light Signaling

- American Rails â€“ PRR Position Light Signals
Historical and technical overview of Pennsylvania Railroad Position Light signaling.
- Philadelphia Chapter PRRT&HS - Position Signals
Detailed explanation of the origin, design, and operation of the PRR Position Light system.
- Pennsy & N&W Position Light Signals
Technical descriptions, photographs, drawings, and operational information covering PRR and Norfolk & Western Position Light installations.

Historical Rule Books and Signal Aspect Charts

- Railroad Signal Aspect Charts (Jovet)
Extensive collection of historical and modern aspect charts, rule books, and signaling references from numerous North American railroads.

Author's Note

The purpose of this document is to provide operational guidance for the use of the NORAC Signal Package within Train Director.

While every effort has been made to ensure technical accuracy, this document should be regarded as an educational and simulation-oriented reference. In the event of any discrepancy between the information presented here and official railroad publications, NORAC Operating Rules, employee timetables, special instructions, or railroad operating manuals, the official railroad documentation shall prevail.

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NORAC Signaling for Train Director

Version 1.0

September 2026

For additional information and technical background, readers are encouraged to consult the references listed above.