



One of a series of papers originally published as pages on RTWP and updated for RTW.

## British Signalling – What the driver sees

by

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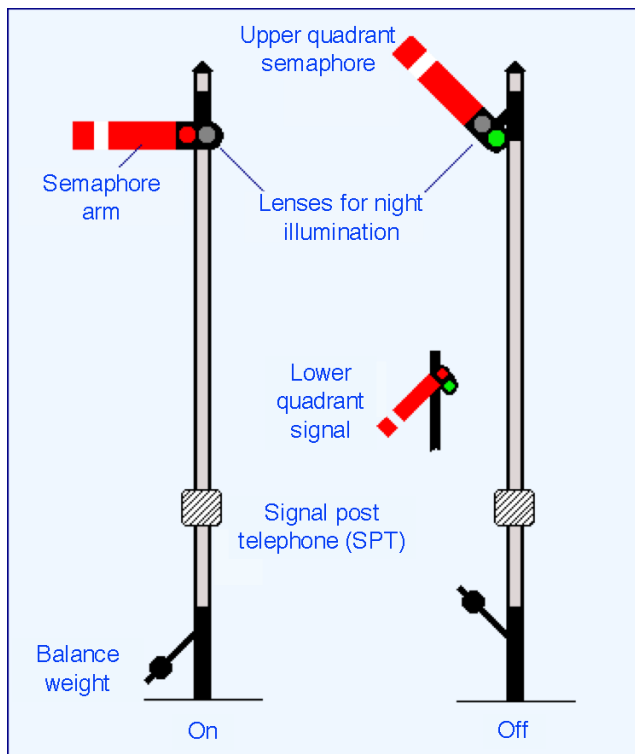
### Introduction

This page describes the types of signals seen on British railways and their meanings. Semaphore and colour light signals are included.

### Semaphore Signals

During the 19th century a system of mechanically operated semaphore signals was developed for Britain's railways. Although there were many different and independent railway companies, by the early 20th century, signals were generally standardised, but with some variations in style and appearance. Many semaphore signals have survived to this day, although they are becoming rarer. However, there are some excellent examples still to be seen on the heritage lines operated by preservation groups all over the country.

### Semaphore Signal Parts



First, a diagram (left) of a semaphore signal and its main parts. The signal is normally placed on the left side of the track with the arm directed over the offside. The standard arm is red with a white vertical band, although some older signals were plain red. To allow the signal indication to be seen at night, the arm is fitted with two lenses, duplicating the indication displayed. The lenses are illuminated from behind, originally by oil lamps, later by electric lamps.

The signal is mounted on a signal post, originally wooden but later lattice steelwork, pressed steel, old rail, and concrete appeared at various places. Some railways could be recognised from the design of their signal posts, the ones from the Victorian era having elaborate finials and other attachments.

Signal posts were often tall, so that the signal could be seen clear of engine smoke and from a distance. It was also intended that the guard could see the signal from the rear of the train as it was part of his duties to check signal indications.

<sup>1</sup> PRC Rail Consulting Ltd.

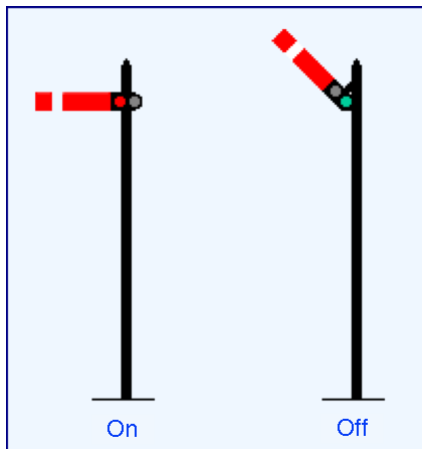
The post is normally fitted with a ladder, originally to allow access to the oil lamps and now retained for maintenance. The post is often provided with a telephone linked to the signal box. The telephone is contained in a small box with black and white diagonal stripes on the cover. The driver or other train crew can use this to alert the signaller of the presence of the train and to enquire why the signal remains "at danger", as we say in the trade.

The arm of the signal is displayed in a horizontal position to show the "stop" or "danger" indication. The red lens is illuminated. The indication to the driver is "stop" until either the signal indication gives "proceed" or he is given verbal authority by the signaller to proceed.

To give a "proceed" indication, the semaphore arm is raised to an angle of 45° as shown in the diagram. The movement of the arm causes the green lens to replace the red lens in front of the lamp. A "proceed" indication tells the driver that he may proceed at normal speed for that section of line, subject to any speed restrictions displayed and according to the speed limit of the particular type of train he is driving. Unlike many other countries, British signals do not give a speed indication to the driver.

Some signals showed "proceed" by lowering the arm instead of raising it. This type of signal is called a "lower quadrant semaphore", (shown as an inset in the diagram) as opposed to the more usual "upper quadrant" type. The lower quadrant type was much favoured by the Great Western Railway but eschewed by others following an accident caused by a stop signal showing a proceed indication because it drooped with the weight of snow resting on the arm. The GWR maintained they had never had an accident caused by this type of signal so they weren't about to change them now. Anyway, they didn't want the expense.

One final part of the signal mechanism is the balance weight. It is linked to the cable which operates the signal. The cable, of course, is connected to the lever in the signal box which operates that particular signal. The purpose of the balance weight is to pull back the signal wire when the lever is replaced in the frame by the signaller.



### Types of Semaphore Signal

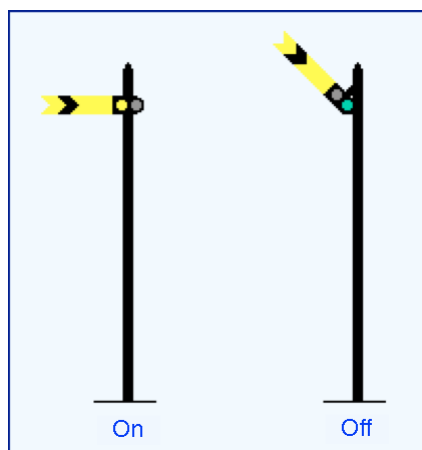
The following series of diagrams, with descriptions, shows the various types of semaphore signals seen in the UK.

A Home Signal or Starting Signal (left) is the stop signal described above. It is placed at the entrance to a block and, when showing "stop", the train is forbidden to enter the block. When a signal shows a stop or other restrictive indication, it is said to be "on". A signal showing a proceed indication is said to be "off".

Traditionally, at a station, each track would have two stop signals. One, protecting the entrance to the block, was called the Home Signal. The other, protecting the exit towards the next station or signal box, was called the Starting Signal or Starter.

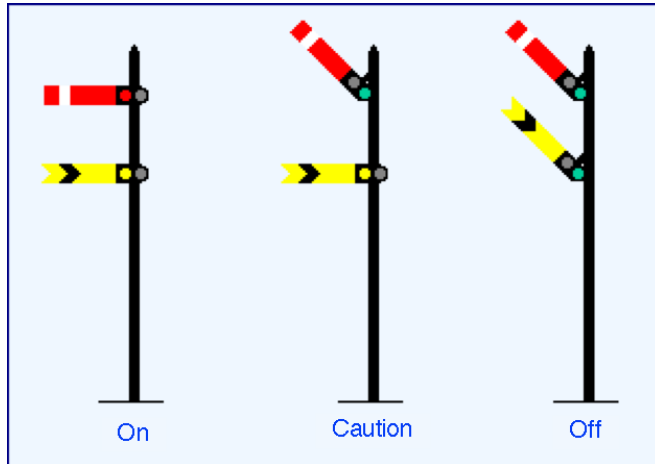
As mentioned above, this is a stop signal showing a proceed indication - it is "off". The train may enter the block at normal speed. In effect, this means the maximum speed applicable to this section of line and the type of train.

To give advanced warning of the indication of a stop signal, a "distant" signal is sometimes provided (left). This operates in the same way as the stop signal but gives either a "caution" indication (it is said to be



"on"), shown on the left, or a proceed indication, on the right. If the distant is "on", a yellow light shows at night. The distant signal showing "on" tells the driver that the next stop signal is also "on" and that he will have to stop there. The distant signal was, if possible, located  $\frac{3}{4}$  mile (1200 metres) before the stop signal. A single distant signal will often provide a warning for both home and starting signals at a station.

The distant shows a yellow (on) or green (off) light at night. Remember that the distant signal normally refers to more than one consecutive stop signal ahead. Thus, when the distant is off, the driver knows that all the relevant stop signals are off too. Each stop signal does not have its own distant signal in rear.

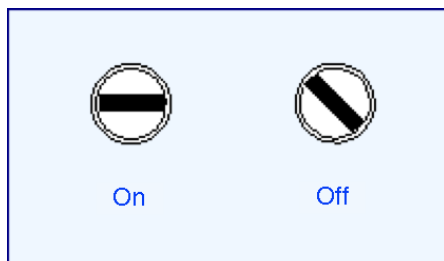


Where blocks were short or stations close together, the distant signal was often placed on the same post at the previous stop signal (diagram left). The driver now has two indications, one from the stop signal protecting the entrance to the block, the other from the distant for the next stop signal. To avoid confusion, if the stop signal is "on", the distant will also be "on", even if the next stop signal happens to be "off". This is achieved by linking the two signals mechanically - a system known as

"slotting". At night, the driver will see two lights, a red over a yellow. The red always takes precedence.

At a signal post with home and distant together, there will be occasions when the block immediately ahead is free and the train may enter but the next block may be occupied. In this case the driver will see the stop signal "off" and the distant "on" as shown here. At night, he will see green over yellow. This shows him he may proceed into the block but that the next stop signal is "on" and he must stop there.

The third indication for a stop and distant signal is where both are "off". The driver is being told both this block and the next are free and he may proceed at normal speed. At night he will see green over green.



In some very restricted locations, a repeating signal is provided, often referred to as a "banner" signal (diagram left). It is a black band on a white disc which repeats the position of the semaphore arm.

## Junction Signals

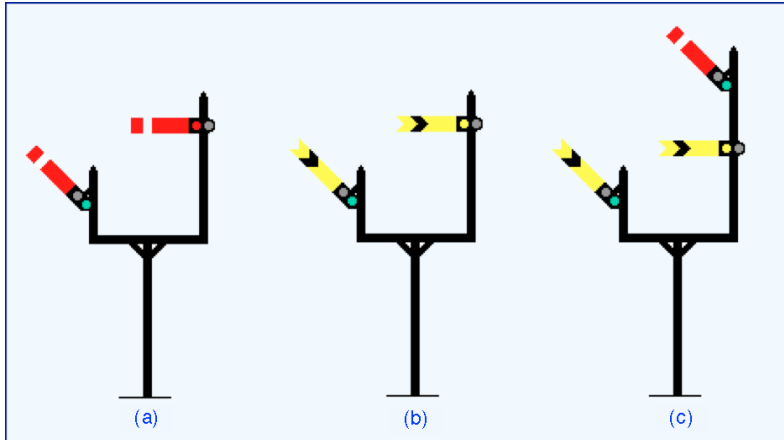
At junctions, it has always been the custom in the UK to show a driver the route set, not just to show the permitted speed as usual elsewhere. In semaphore signalling, it was normal to split the signals as shown below.

### Basic Junction Signals

See below (a). This pair of stop signals protects a pair of diverging routes. The lower signal is "off", indicating that the diverging route to the left of the two is set and locked and the train may proceed along that route. The position of the two semaphore arms was often

arranged so that one was lower than the other to indicate a slower route, usually because of a curve.

### Splitting Distant



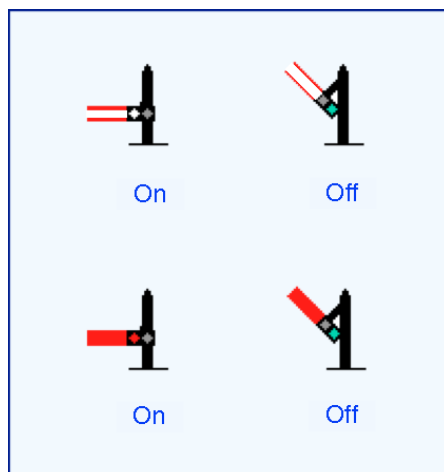
See left (b). Junction signals also have an equivalent distant set up. These are always referred to as "splitting distant". They provide advance warning of the position of the junction signals and they operate in the same way as regular distant.

There are also combined versions of the splitting

distant (c) where a stop signal is placed over the distant for the main route. Either of the distant can only show "off" if the stop signal is also "off".

The above list is basically all there is to British main line semaphore signalling. Of course, there are additional signals used for shunting and other local operations as described below.

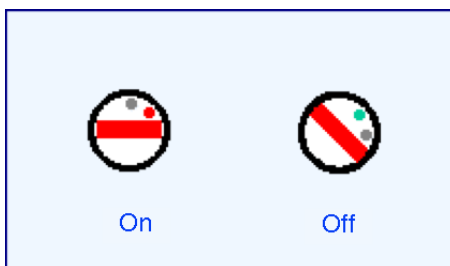
### Subsidiary Signals



The upper signal shown in this diagram (left) was a typical shunt signal, used to allow movements into and out of a siding. It was a miniature semaphore signal with red and green lamp indications. Both upper and lower quadrant varieties were common. The signal was placed on a short post at ground level or was attached to a signal post below a normal stop signal. Subsidiary signals are those used for restricted train movements. These sorts of movements take place within a single block or in and out of sidings. The proceed indication to the driver was a restricted movement saying "proceed at such a speed that you are able to stop short of any obstruction". There are a number of different types of secondary of subsidiary signals in use and, like the

main line signals, there were lots of varieties. The most common are dealt with here.

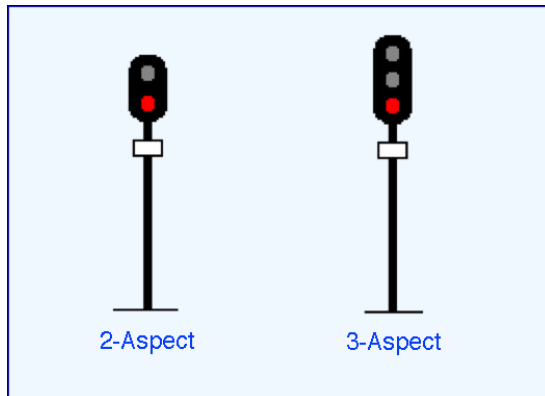
A later version of the semaphore shunt signal was this type, with a solid red arm (above left, lower), which appeared from 1925. It showed a white light, not red, when "on". It was also used for "calling on" and "warning" movements. "Calling on" refers to the advance of a train



into an occupied section and was often used at stations for coupling purposes. A "warning" signal was used to advise that the overlap beyond a stop signal is occupied. They were also used for "shunt ahead" movements - movements which have to pass the main signal for shunting purposes, normally to then 'set back' into a siding etc. The letter "S" was revealed when the arm was "off", as was the letter "C" or "W".

Many semaphore shunt signals were replaced by disc signals (above left) to improve visibility. The operation was the same and the arm was usually positioned on a white disc. Many of these can still be seen in the UK.

## Colour Light Signals

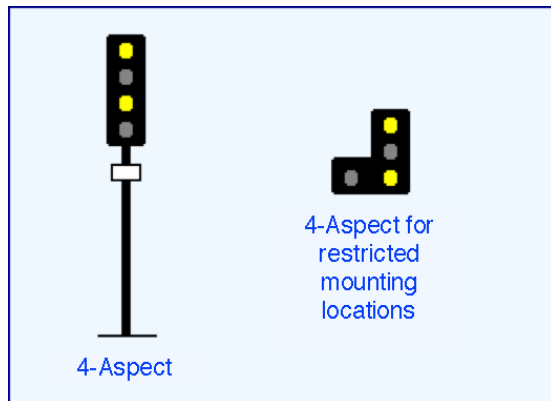


The first colour light signals appeared in the UK in the 1920s, simply as copies of semaphores. However, with the need for better track usage and higher speeds, the concept of multi-aspect signals arrived, giving the driver advance warning of the condition of several blocks ahead.

A simple 2-aspect colour light signal (left) which would act as a replacement for a semaphore stop signal. The red aspect is shown here. The other aspect is green. A 2-aspect distant signal would have yellow and

green aspects. The white plate below the signal will display an identification plate using the reference letters of the controlling signal cabin and the signal number.

The 3-aspect signal (shown above, right) was developed to allow higher speeds and shorter block sections to accommodate more trains. The three aspects are red, yellow and green. The red indicates stop, the yellow indicates that only one block section ahead is clear and the next signal will show a stop aspect. The green indicates that at least two blocks ahead are clear.

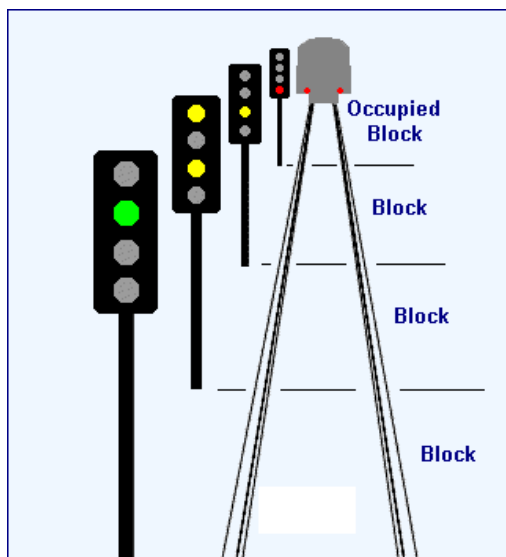


The 4-aspect signal (left) is a further development of the multi-aspect concept. In addition to the red aspect at the bottom, this signal shows a single yellow to indicate one block ahead is clear, a double yellow (one above the other as shown here) to indicate two blocks ahead are clear and green to

show at least three blocks ahead are clear.

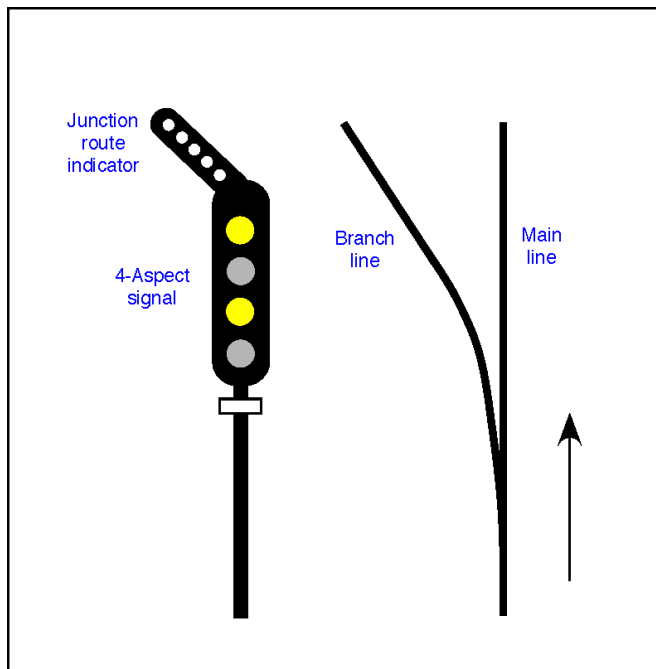
At certain location where space is limited, a 4-aspect signal can be arranged as shown above. The red aspect is placed to one side to reduce the height of the signal.

## 4-Aspect Operating Sequence



As shown in the diagram to the left, in an area where 4-aspect signalling is in use the sequence for the four signals protecting the four blocks behind a train would be red protecting the occupied block, then single yellow, double yellow and green in the following three blocks. The view here is foreshortened for the diagram. The signals in a 4-aspect installation will be about 750 to 850 yards (686 to 777 metres) apart in an intensively used area and up to 1400 yards (1280 metres) apart in a high speed area. The signals are shown without overlaps. The sequence for 3-aspect signalling (covering only three blocks) would be the same but without the double yellow aspect and its associated block.

## Route Signalling



Signalling in the UK has always used the principle of "route signalling" as opposed to the "speed signalling" philosophy adopted by many European and US railways. This means that drivers of a British train will be shown which route a train will take when it proceeds past a signal protecting a diverging junction, see diagram left. The speed of the train will be a matter for the driver observing separate rules or fixed speed limit signs along the trackside. The "speed signalling" system shows the driver what speed his train must do, regardless of the route it will take. The interlocking of the signal at the junction ensures that the speed

aspects shown are in accordance with the route set. The result of the UK's use of the "route signalling" philosophy is that signals display semaphore arms (as described above) or lights which indicate the route set as shown here.



The route is indicated by a line of five white lights which correspond to the approximate direction of the route set. The lights are known as "a feather". They will only light up when the route is set and locked and the signal is showing a proceed aspect. If the route is set for the track regarded as the main route ahead, the signal will only show a proceed aspect for this route. The "feather" will only appear to indicate a diverging route. Most examples of this signal have five white lights but three lights are used by London Underground.

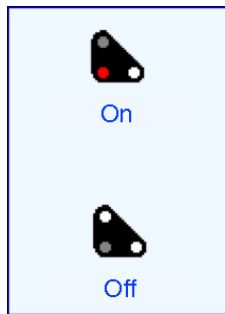
It is possible to show up to seven routes with this type of signal. The route straight ahead will just get a plain green or yellow(s) while the three routes to the right or left will get the green or yellow aspects, plus a "feather". In many areas, the diversity of routes or sighting restrictions do not allow the provision of feathers. In these cases, a number or letter(s) is shown to the driver when the signal clears. This will indicate the route set.

There are still some colour light junction signals which do not have a "feather" but repeat the semaphore "splitting distant" philosophy. At a diverging route, two signal heads, side by side, are provided. One shows the main route, the other the diverging route.

The approach to some junctions is speed controlled. The signal shows a restrictive aspect until the train has approached to within a distance which has forced the driver to reduce speed. There are several variants on how this

is put into practice. For a complete description, see the excellent web page Junction Signalling by Clive Feather.

### Modern Shunt Signal



This (left) is a typical modern shunt signal, used to allow movements into and out of a siding. It has three lights with red and white indications. The signal can be seen at ground level or attached to a signal post below a normal stop signal. When mounted below a stop signal, they do not show an "on" aspect.

The ON indication shows a red and white light side by side. The OFF indication shows two white lights at 45 degrees. The newest ones have four lenses and show two red lights side by side for ON.

### Some Photos



The following photos show some of the more modern colour light signal designs used in Britain today.

UK standard 3-Aspect Signal (left) at Sheffield (Midland). Below the red aspect is a sign which, if the signal is showing a proceed indication, illuminates "RA" (Right Away) to tell the driver station duties are complete and he can start the train. Below this is a shunt signal, which carries no red light in this case as the red is already available on the main signal. The signal carried a white identification plate and, nearer the ground, a signal post telephone. Photo: Author.



3-Aspect Signal with Theatre Type Route Indicator. Photo: Author.

**Sources:**

"Two Centuries of Railway Signalling", Kichenside and Williams, 1998, Oxford Publishing Company, UK;

"Modern Signalling Handbook", Stanley Hall, 1996, Ian Allan Ltd, Shepperton UK;

"Signalling in the Age of Steam", Michael A Vanns, 1995, Ian Allan Ltd, Shepperton UK.