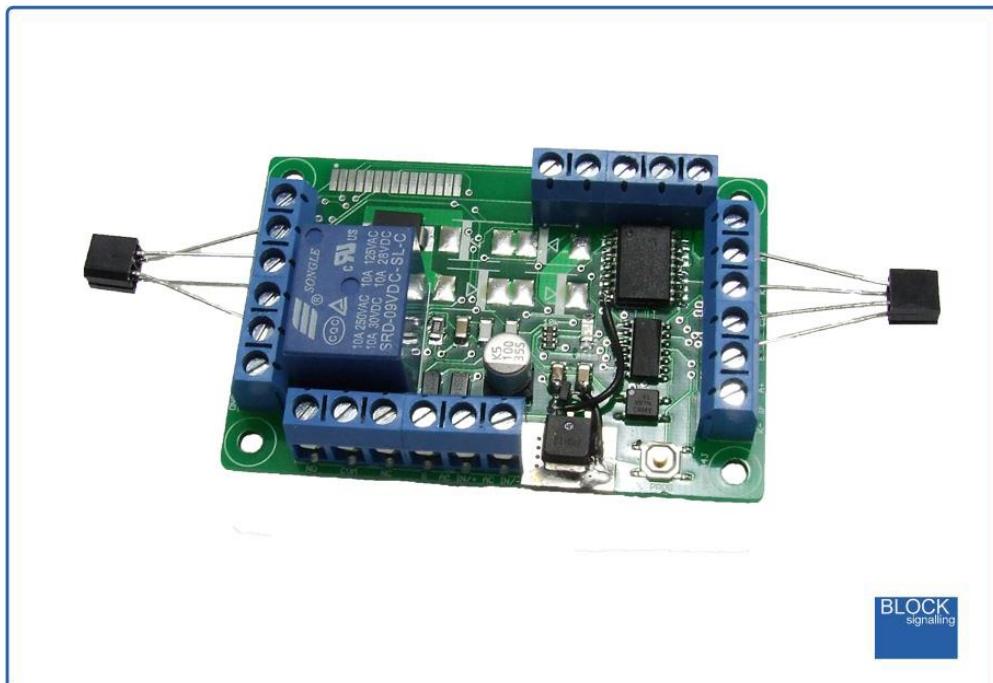


# BLOCKsignalling

[www.blocksignalling.co.uk](http://www.blocksignalling.co.uk)

## SECTION CONTROLLERS SEC1A-DCC & SEC1B-DC



- Monitors trains entering and leaving a section of track
- Automatically sets the signal at the start of the section to danger (red)
- Isolates a section of track to stop trains at the signal
- Communicates to previous sections to ensure they show yellow (and double yellow) aspects when 3- and 4-aspect signals are used
- Last section can simulate returning back to clear using timers to provide realistic operation when 3- and 4-aspect signals are used
- Points which are not set in the trains favour can force the signal to danger and switch the isolating section to DC
- Signal can be forced to danger by an external input (useful for starter signals)
- Suitable for 2-, 3-, and 4-aspect led signals (SEC1A-DC for common-cathode and SEC1B-DC for common-anode).
- Bidirectional running with 2-aspect signalling at each end of the line
- Remembers whether the section is occupied after the power is removed and automatically restores the signals after power returns.
- Simple to setup, but also fully configurable to provide the most realistic operation

## **Introduction**

The BLOCKsignalling Block Controller Module is designed to protect a section of track to prevent more than one train entering that section at one time.

At the entrance to the section there is a signal and a short isolated piece of track which can be energised and de-energised by a relay built-in to the module. There is also an infra-red sensor which is located below the track which is able to detect trains passing overhead.

The isolated section of track is normally energised by the relay and the signal normally shows a green aspect.

The infra-red sensor is continuously looking for a train passing, and as soon as it detects one, it turns the signal to red and isolates the track section, preventing another train from entering the section.

The module then uses a second infra-red sensor located at the exit from the section of track to detect when the train has completely left the section.

When this is confirmed, the signal at the entrance to the block is switched from danger back to green (if a 2-aspect signal is used). If 3- or 4-aspect signals are connected, then information from the following blocks is used to switch the signals to show yellow or double yellow. This is discussed in further detail below.

The isolated track section at the entrance is then re-energised.

## **Bidirectional Running**

There are two programs for bi-directional running with 2-aspect signals.

The first uses both sensors to detect trains entering the section. When a train enters, the signal outputs are set to red. The sensors are checked alternately.

When the train has completely entered, the module then begins checking both sensors to see if a train leaves the section.

The sensors are checked alternately, and if a train is detected, the module waits until the train has cleared that sensor before setting the signals to green.

The second mode for bi-directional running uses both sensors to detect trains entering the section. When a train enters, the signal outputs are set to red. The sensors are checked alternately.

The module remembers the entry sensor and then begins checking the other sensor to see if a train leaves the section.

If a train is detected leaving via the exit sensor, the module waits until the train has cleared that sensor before setting the signals to green.

In these two modes, the isolated track sections are not used.

## **Power-Off Memory**

There is a new setting to record whether there was a train in the section at the time the power is turned off. When the power is turned on again, the information will be reloaded from memory and so the correct status will be indicated on the signals and relayed to any interconnected modules.

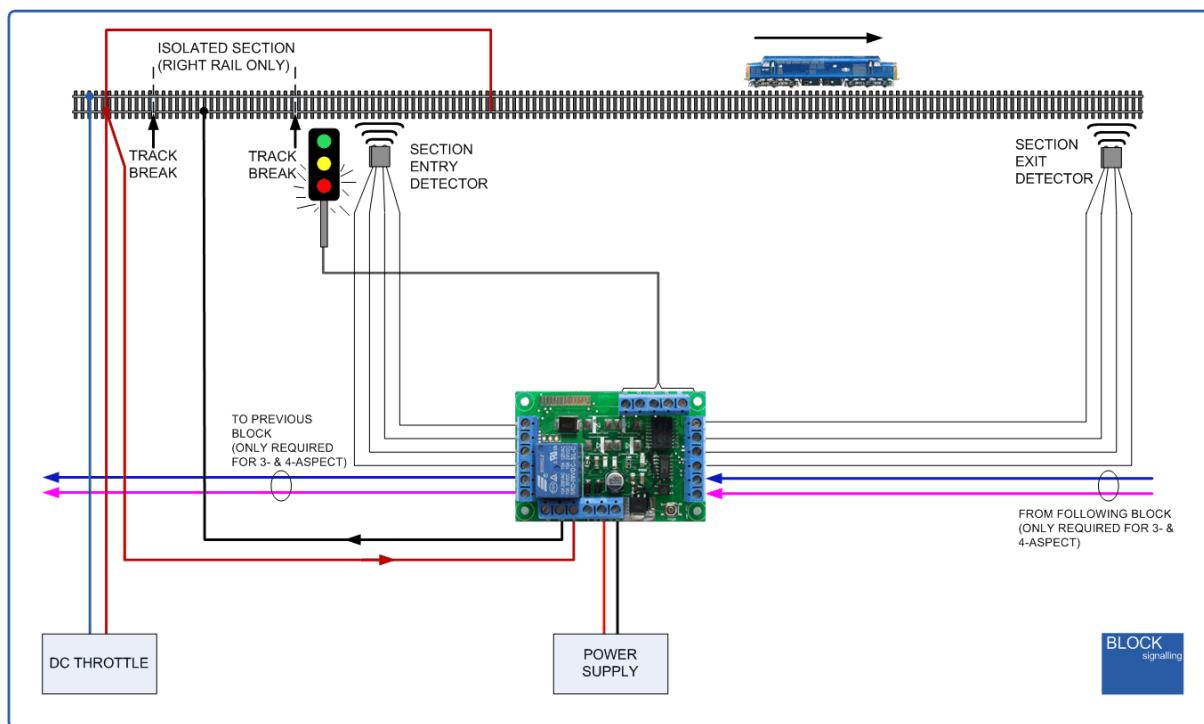
This feature is also used to remember the directional train are running when the bidirectional mode is used.

This feature is disabled by default.

## Connection for a Single Block

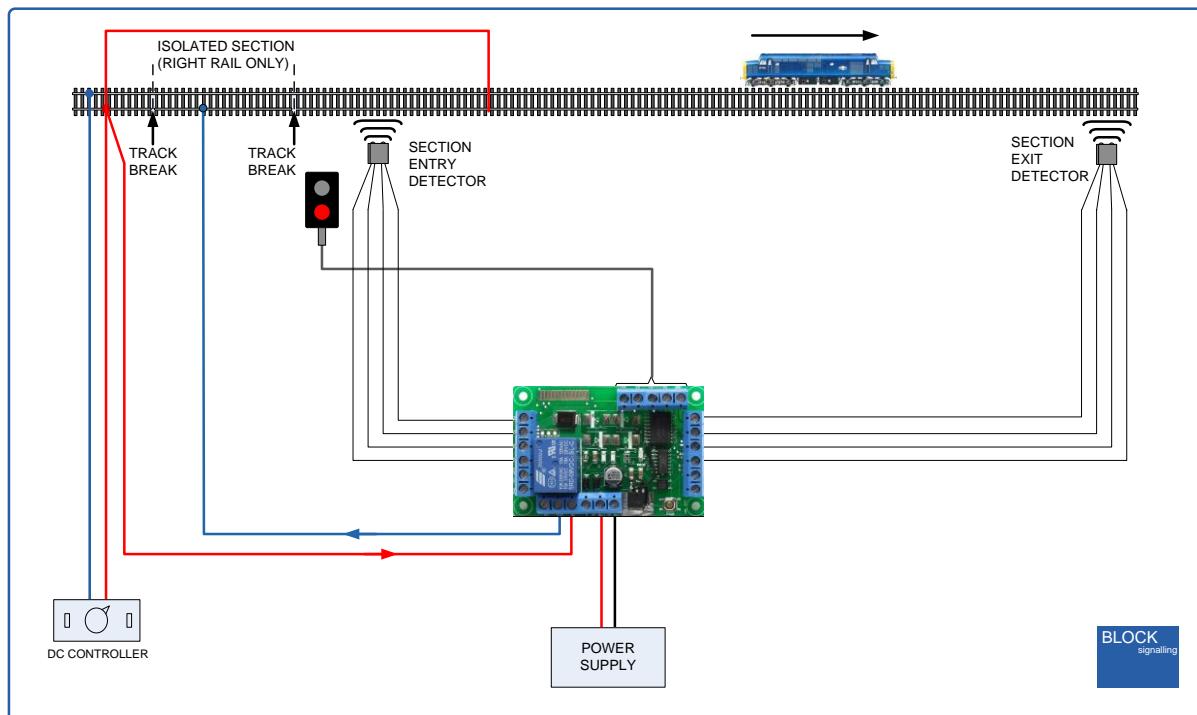
The control of one block section consists of the following parts:

1. An entry sensor, to detect a train entering the section (Sensor 1).
2. An exit sensor, to detect a train leaving the section (sensor 2).
3. A section of isolated track preceding the signal (there are track breaks in only the right-hand rail), which is controlled by a relay on the block controller stop a train at the signal when the signal is at danger (this is not used with bidirectional running).
4. Connections to and from adjacent sections to communicate information about which blocks are occupied (not required when 2-aspect signals are used).



## 2-Aspect signals (Unidirectional Running)

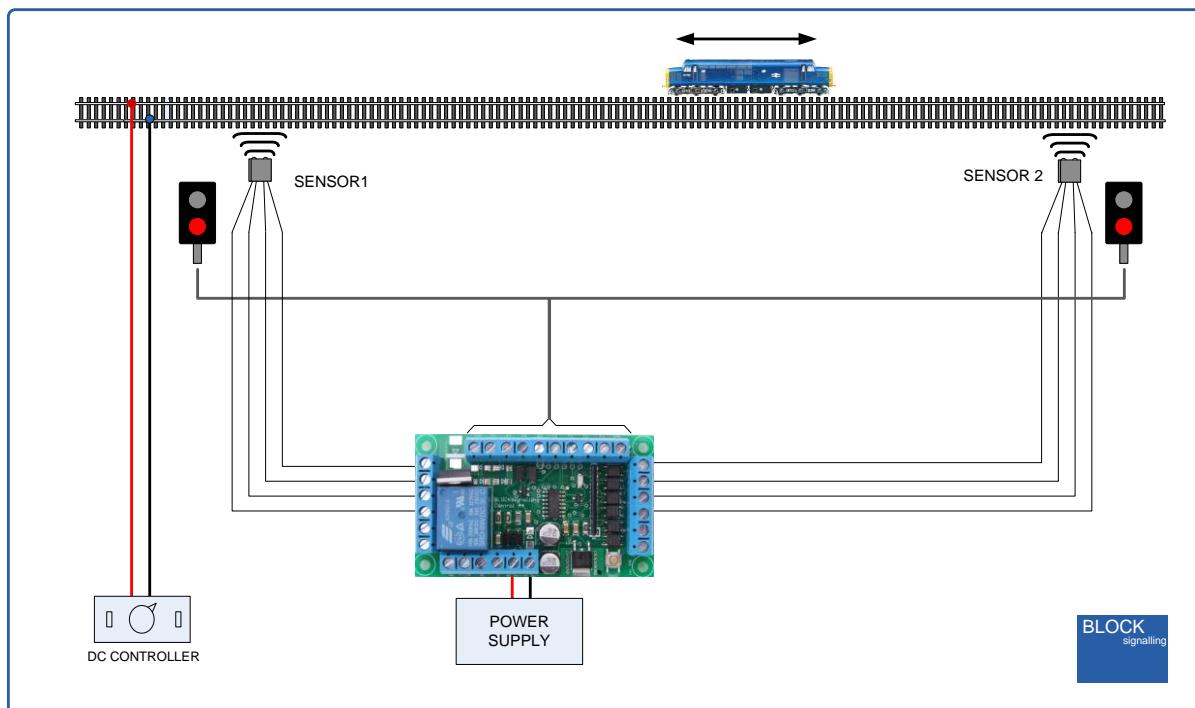
If trains only run in one direction on the line, an isolated section can be placed preceding the signals. When a train is detected entering the section, the module will operate the signal and isolate the track section to stop any following trains entering the same section.



## 2-Aspect signals (Bi-directional Running)

If bidirectional running is being used with 2-aspect signals, then both the signals are controlled by one module.

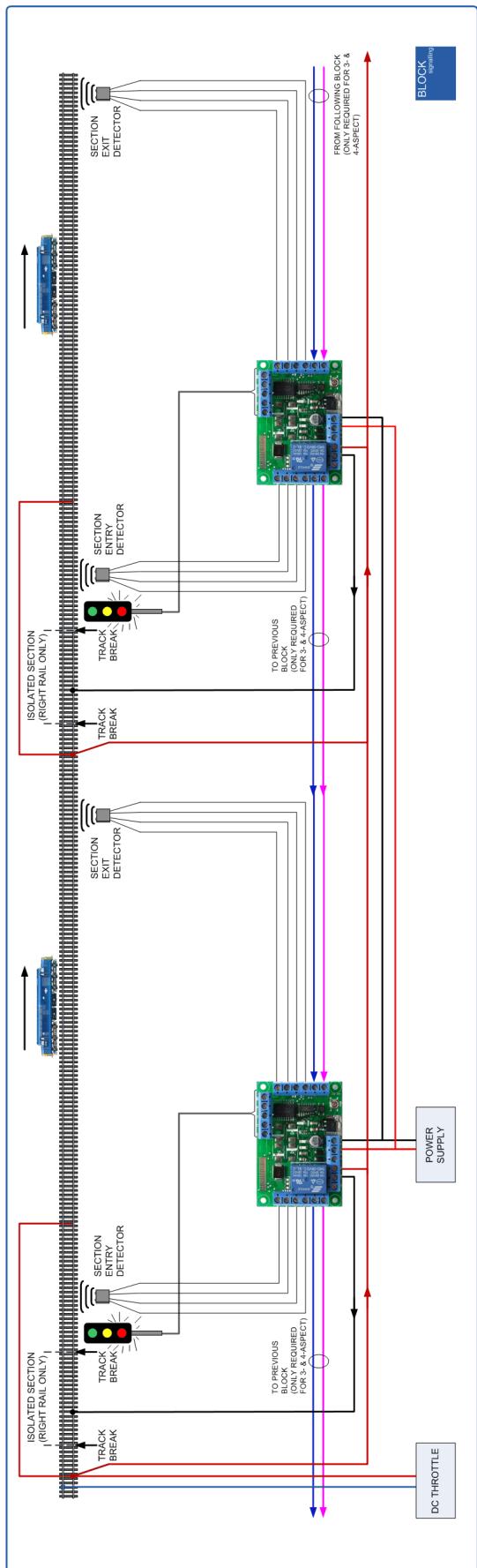
An isolated track section is not used.



## **Connection Multiple Simple Blocks**

If 3- or 4-aspect signals are used, additional connections are required between the modules to communicate which sections in front of the train are occupied.

To connect blocks together, the Train in Section (TIS) wiring is linked from one block to the next.

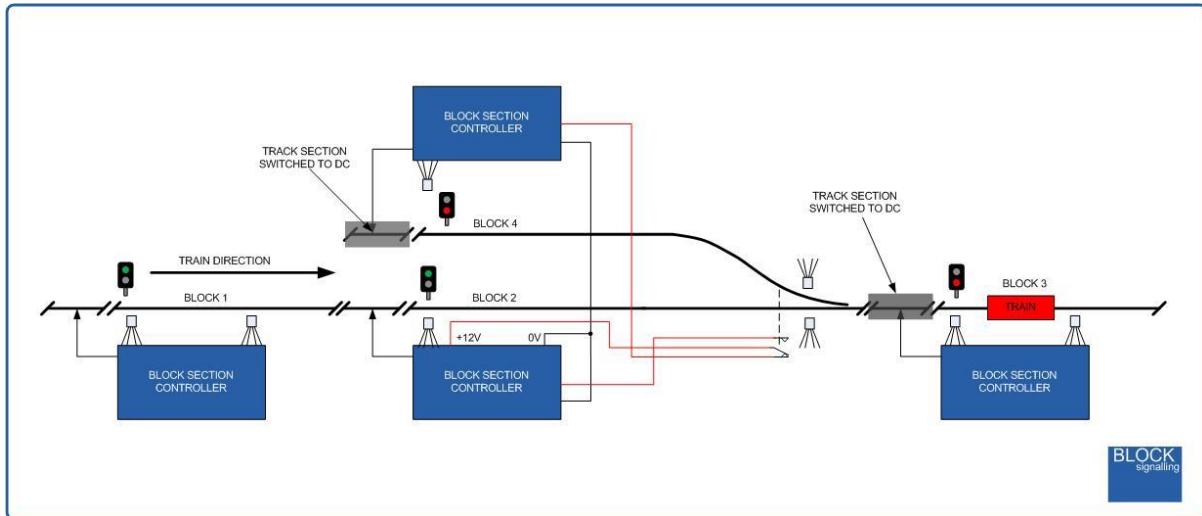


## 2 Aspect Light Signal Example

In the following example, 2 aspect light signals are used. The train has driven from the left to the right, and is currently in Block 3.

The block section controller for Block 3 has detected the train enter the section, and has set the signal to danger (red) and isolated the track section to prevent any other trains entering.

The auxiliary contacts on the points indicate to the controller of Block 4 that a route is not available (12V appears on the inputs to the block 4 controller via the points motor auxiliary contacts), and so it indicates danger and isolates its track section.



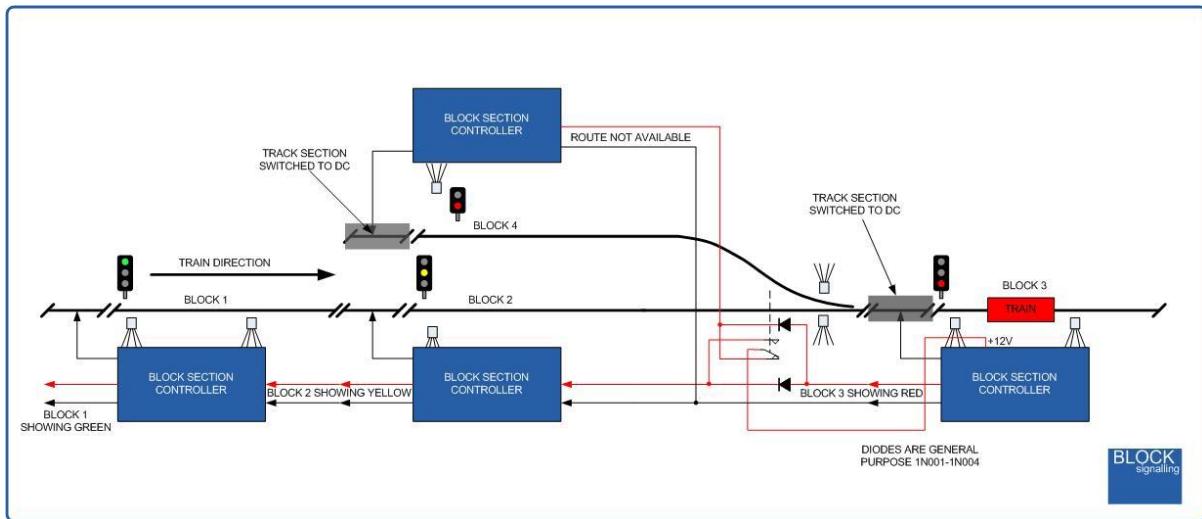
### 3 Aspect Light Signal Example

In the following example, 3 aspect light signals are used. The train has driven from the left to the right, and is currently in Block 3.

The block section controller for Block 3 has detected the train enter the section, and has set the signal to danger (red) and isolated the track section to prevent any other trains entering.

The Block 3 controller signals to the preceding Block 2 controller that it is at danger (red) and so the Block 2 controller indicates caution (yellow).

The auxiliary contacts on the points indicate to the controller of Block 4 that a route is not available, and so it indicates danger and isolates its track section.



## 4 Aspect Light Signal Example

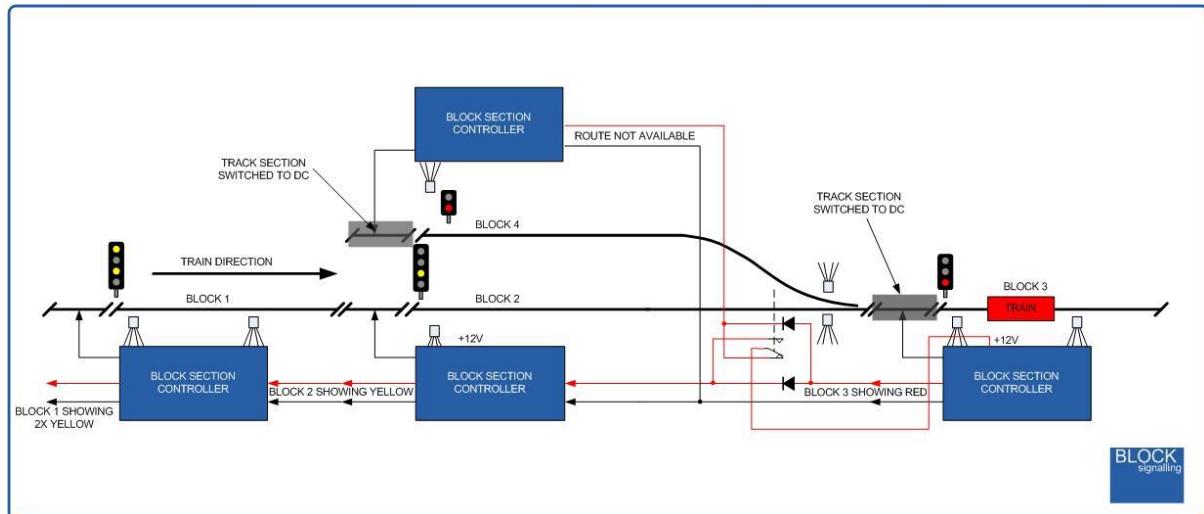
In the following example, 4 aspect light signals are used. The train has driven from the left to the right, and is currently in Block 3.

The block section controller for Block 3 has detected the train enter the section, and has set the signal to danger (red) and isolates the track section to prevent any other trains entering.

The Block 3 controller signals to the preceding Block 2 controller that it is at danger (red) and so the Block 2 controller indicates caution (yellow).

The Block 2 controller signals to the preceding Block 1 controller that it is at caution (yellow) and so the Block 1 controller indicates caution (double yellow).

The auxiliary contacts on the points indicate to the controller of Block 4 that a route is not available, and so it indicates danger and isolates its track section.



## **Configuration for Ends of Track and Points**

At the start of a section of track, there are no preceding sections which are signalled, so the connections of the module do not need to be connected to any preceding blocks.

At the end of a section of track there are no following sections which are signalled, so the connections of the module do not need to be connected to any following blocks. These final blocks can be set to revert from red to green (via yellow and double yellow if appropriate) by setting timers. For instance, a train can disappear into a tunnel, and after a time, the signal will switch back to green automatically to give the most realistic operation.

Using auxiliary contacts from points motors, a 12V DC feed can be connected to the inputs of a module. A constant +12V DC will force the module to show a danger signal and isolate the track section, protecting points which are not set in a train's favour.

## **Power Supply**

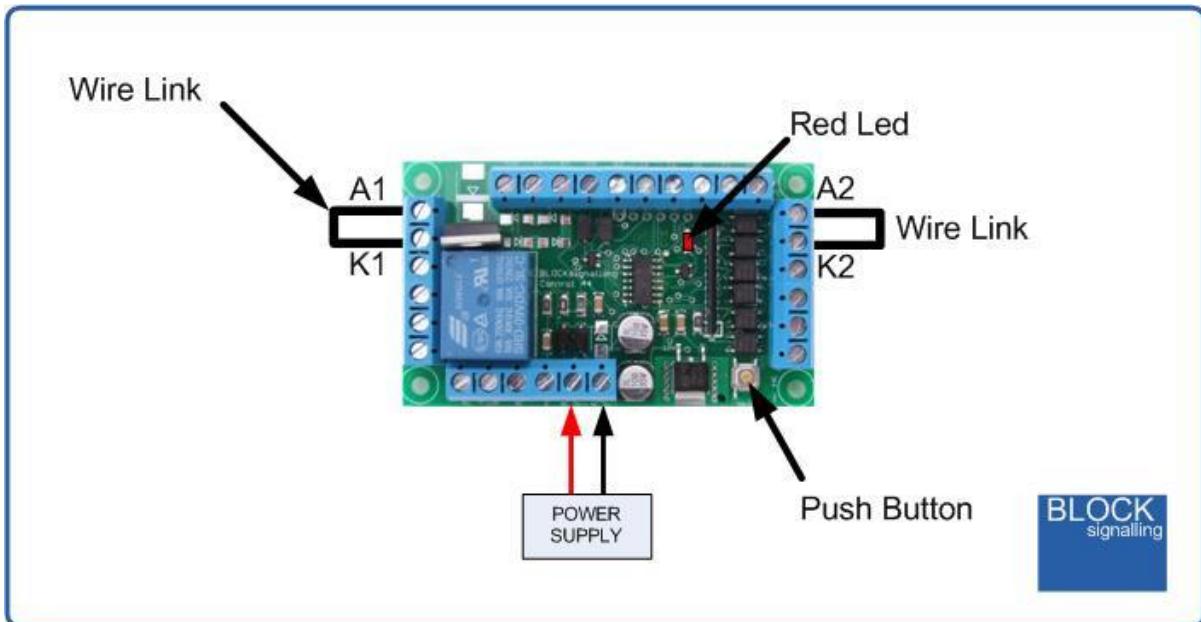
The module is designed for use with a DC power supply of between 12V and 25V, or an AC power supply of between 12V and 16V, or to be fed with a DCC derived power feed.

Where there is a choice, the recommended power supply is 12V DC.

**Please double check all wiring before applying power, as incorrect wiring can instantly cause damage to the unit.**

## Programming Procedure

Programming is performed by inserting a link between the A and K terminals and holding down the Push Button when switching on the power (this link will be removed shortly and the infra-red sensor connected).



When programming, there are two values to be entered.

The red led on the PCB flashes at 1 second intervals. When the required number of flashes is seen (see later for the list of possible choices) the button is released to store the first value. At this point the led comes on for five seconds to confirm the first value is stored.

The led then starts flashing again, and this time the button needs to be pressed to store the second value.

Now the two values to be stored have been entered, the led flashes 10 times rapidly, and the module starts operating.

Each value entered can range between 1 and 255. If more flashes are seen, or the programming is aborted by switching off, then the programming must be repeated.

## Testing Wiring

The module has a test sequence which can be selected (program mode 1).

The module will start with the led on the PCB flashing at a slow rate. If a finger is brought close to infra-red sensor 1, the flashing rate will increase.

Once the led has flashed 20 times, the led will light solidly for 1 second, then the second sensor will be tested in the same way. Following this, a lamp test sequence will begin.

First all outputs are switched on, then they all go off except ch1. Then ch1 is switched off and ch2 comes on. This sequence continues until ch4 is on and then all the outputs are switched off and the sequence is repeated. Each step takes 1 second. The led on the PCB switches on and off with each step (providing A and K are linked).

## Factory Reset

Resetting back to factory settings will allow the module to restart with known settings and is useful if there may have been a mistake made in programming.

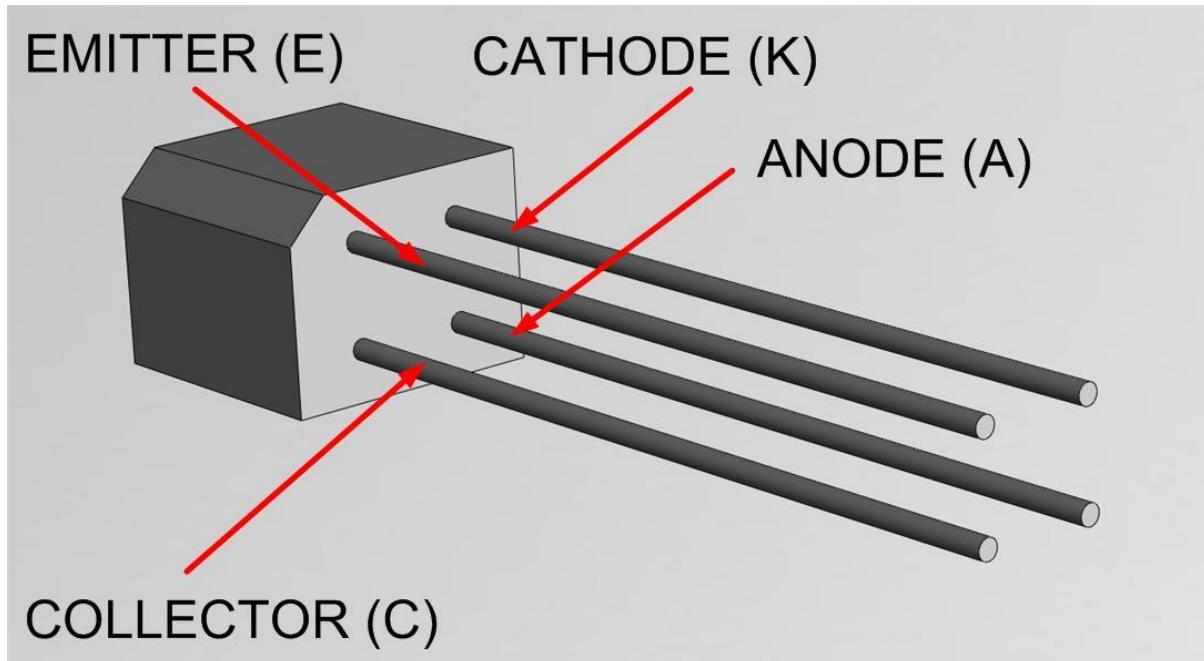
To reset the module back to factory settings, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **1 flash** of the led is seen. At this point, release the button. You will see a long flash of five seconds.

The led will begin flashing again. When you have seen **1 flash** press the button. You will see a long flash of five seconds and then 10 rapid flashes. The reset procedure is then complete and the module will restart with factory settings, and run the lamp test mode. If you make a mistake programming, simply repeat the process.

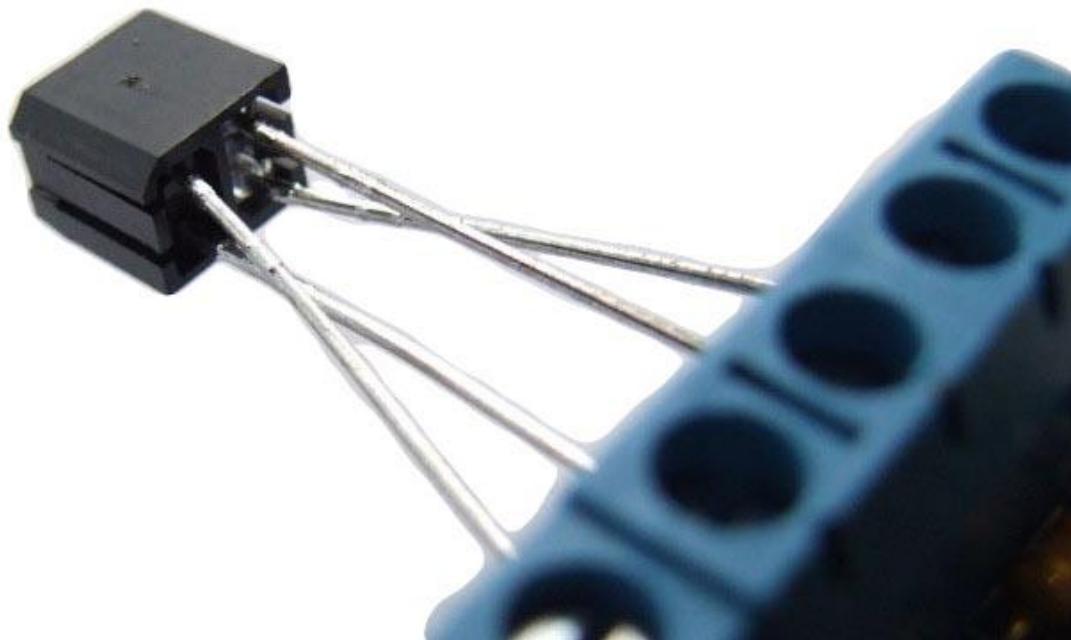
The module is reset and will run in the test mode (see above).

## Testing the Infra-red Detection

An Infra-Red source and Infra-Red detector are moulded into a single 5mm x 6.5mm package that can be located below the track bed to reflect light off rolling stock.



Identify the leads from the diagram and connect to the terminals marked A, K, C and E on the PCB.



The wires can be extended using small chocolate block and extra lengths of cable if required (not supplied).

## Sensitivity Setting

The module is supplied with the sensitivity pre-set to suit most installations and should not need adjustment.

In locations such as tunnels, or when the module is not being used under the track bed, then it may be desirable to adjust the detection threshold.

The sensitivity is factory set to 5, and can be adjusted from 1 to 10 (with 1 being the most sensitive and 10 being the least sensitive).

	Trigger Threshold					
	2	3	4	5	6	7
Aluminium Foil (shiny side)	170mm	125mm	100mm	95mm	90mm	85mm
A4 White Paper	100mm	65mm	50mm	45mm	40mm	35mm
Matt Black Card	55mm	35mm	30mm	25mm	20mm	15mm
Shiny Black Plastic	45mm	30mm	25mm	20mm	18mm	15mm

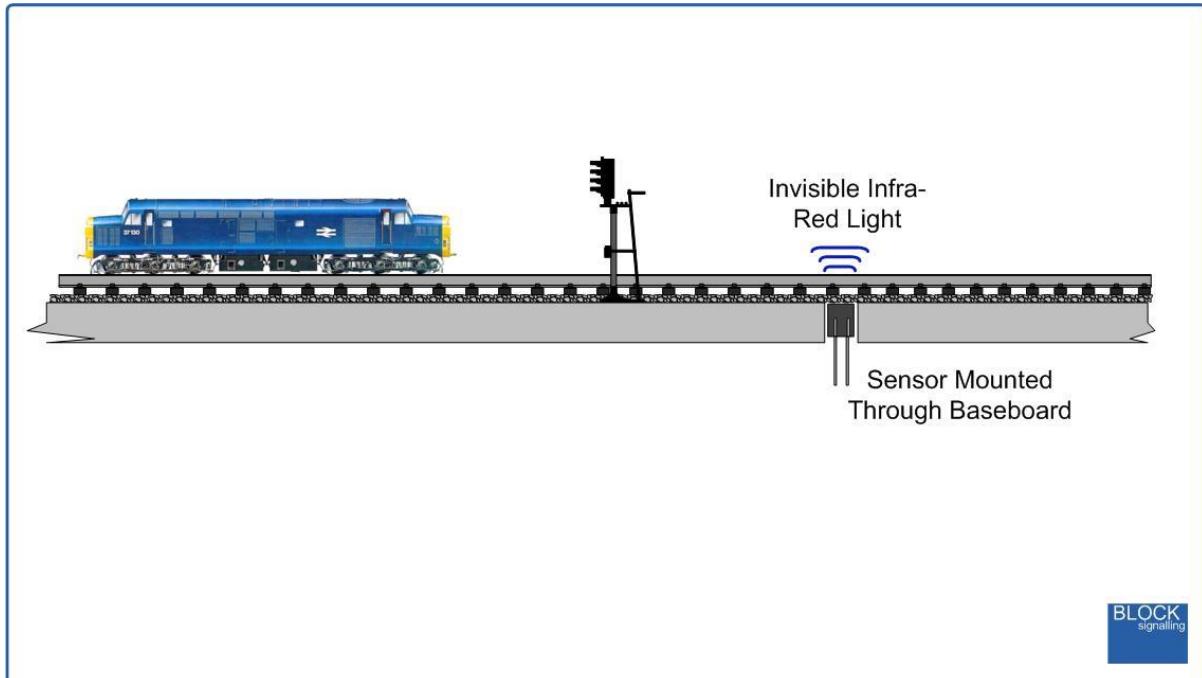
To change the sensitivity, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the Push Button until **9 flashes** of the led are seen. At this point, release the button. You will see a long flash of five seconds.

The led will begin flashing again. When you have reached the desired number of flashes to set the new sensitivity, press the button. You will see a long flash of five seconds and then 10 rapid flashes. The programming is then complete and the module will restart. If you make a mistake programming, simply repeat the process.

Performing a factory reset will reset the sensitivity setting back to 5.

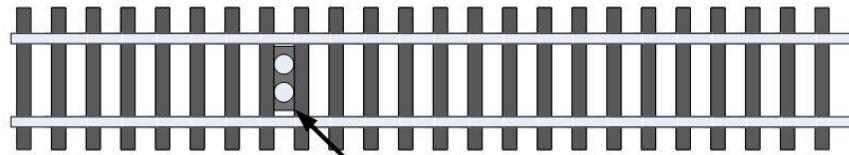
## Installation

The Infra-Red sensor is normally installed below the track-bed. The detection range of the unit is up to approximately 25mm from the face of the package when normal sensitivity is set (for dark surfaces with low levels of reflectivity).



The detector can be mounted in an 8mm hole drilled through the track baseboard. If required, the detector can be held in place using a small amount of blutack, expanded polystyrene or similar.

The led diameter is 2.2mm, so on smaller scales the leds can still have a clear view between the sleepers.



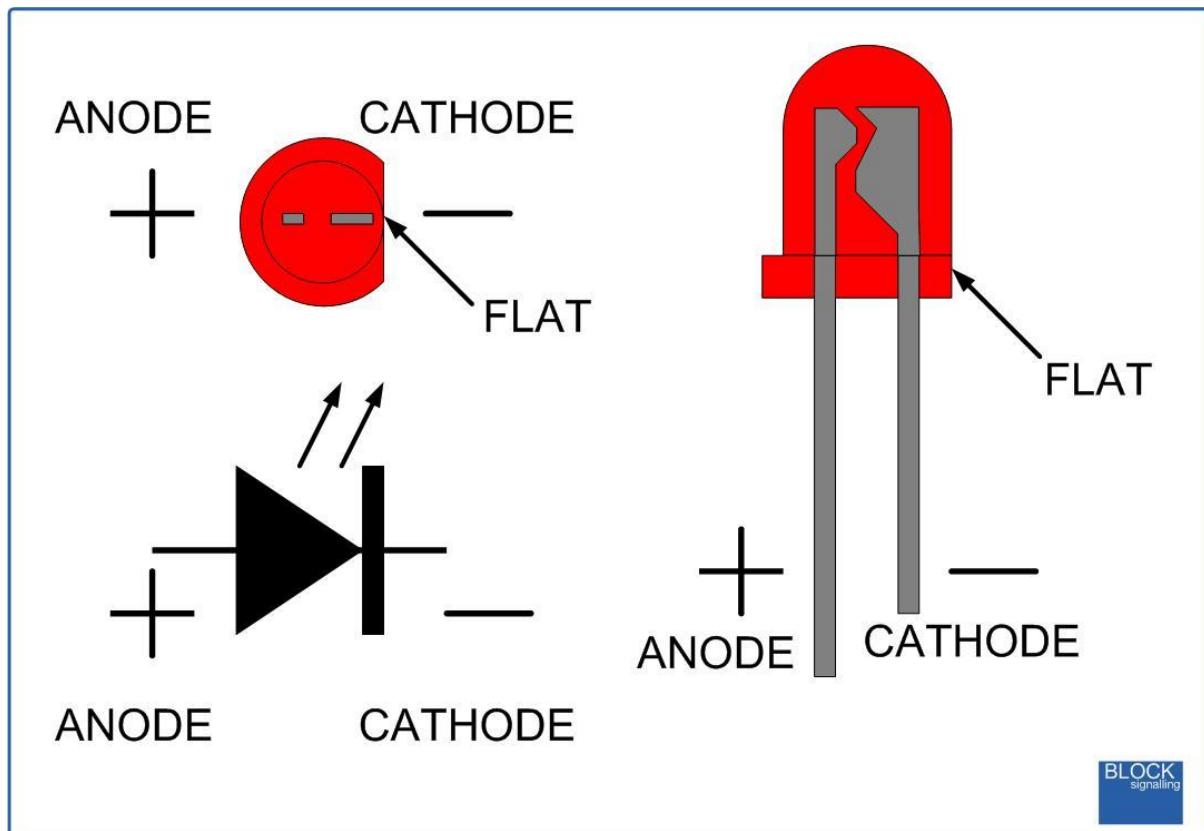
Sensor Mounted Below the Track

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## Led Connection

When using leds it is important to connect them the right way around.

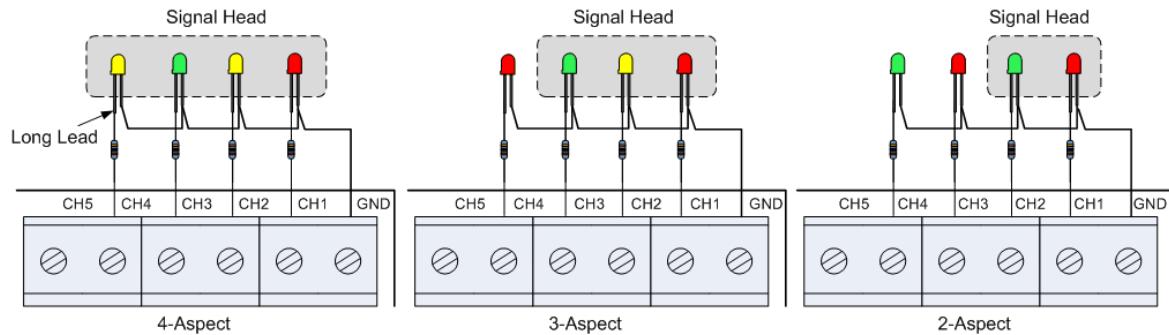
The negative lead (cathode) is identified by a flat on the side of the led body, and by having a shorter lead.



This section controller comes in both a common-cathode (SEC1A-DC) and a common-anode version (SEC1B-DC).

The following diagram shows the signal wiring for the two versions.

### Common-Cathode Wiring



#### Notes:

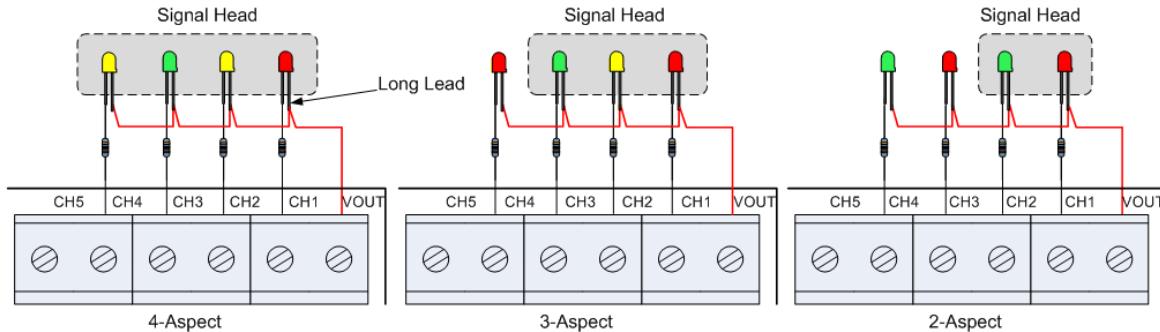
1. When in 3-aspect mode, channel 4 follows channel 1
2. When in 2-aspect mode, channels 4 & 3 follow channels 2 & 1
3. Resistors are 1000 ohms



Led Connections



### Common-Anode Wiring



#### Notes:

1. When in 3-aspect mode, channel 4 follows channel 1
2. When in 2-aspect mode, channels 4 & 3 follow channels 2 & 1
3. Resistors are 1000 ohms

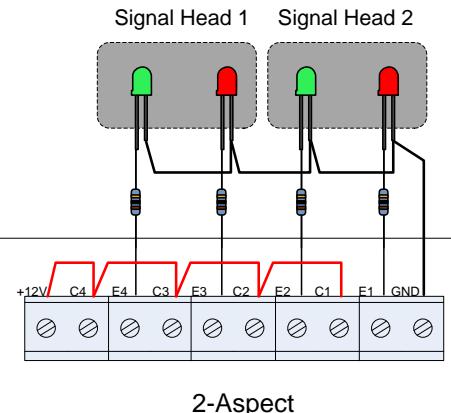


Led Connections

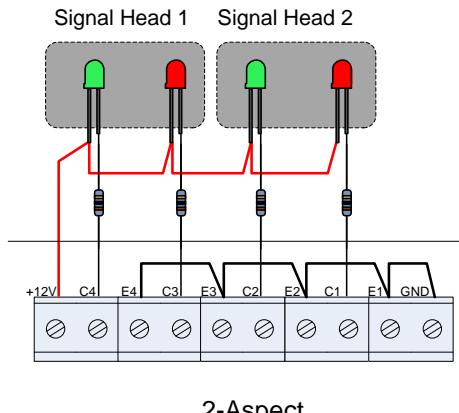


If using the bidirectional running mode, the signals are wired as follows:

### Common-Cathode Wiring



### Common-Anode Wiring



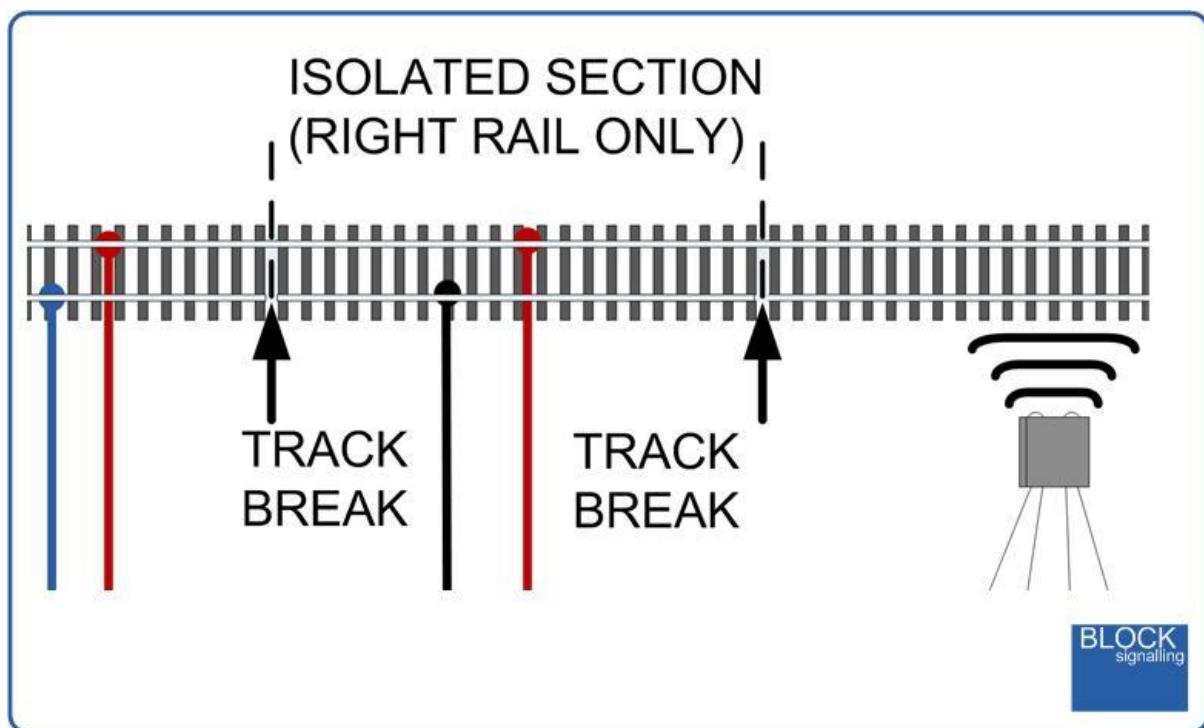
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## Track Break

The track breaks are made only in the right-hand rail.

The drawing below shows a close up of the isolated section of track.

No modifications are made to the left-hand rail.



## Program 2 - 2-Aspect Signalling Unidirectional Running

This program simulates the operation of a two aspect signal, which is normally showing green. The module searches for a train, and if one is detected above the first sensor, the signal immediately switches to red. At the same time the relay energises to isolate the track section.

Whilst the sensor is covered, the signal stays at red. As the train passes over the sensor, any gaps between the rolling stock which are shorter than the release time programmed are ignored.

Once the train has cleared the first sensor, the module swaps to searching for the train using the second sensor.

When one is detected, and then clears the sensor, the signal switches back to green and the relay is de-energised restoring power to the track.

When supplied, or following a factory reset, the module will operate in lamp test mode. It needs to be reprogrammed as follows.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

When **2 flashes** have been seen press and hold the button. You will see a long flash of five seconds and then 10 rapid flashes. The button can now be released and the programming is complete. The module will start running the program. If you make a mistake programming, simply repeat the process.

### Program 3 3-Aspect Signalling Unidirectional Running

This program simulates the operation of a three aspect signal, which is normally showing green. The module searches for a train, and if one is detected above the first sensor, the signal immediately switches to red. At the same time the relay energises to isolate the track section.

Whilst the sensor is covered, the signal stays at red. As the train passes over the sensor, any gaps between the rolling stock which are shorter than the release time programmed are ignored.

Once the train has cleared the first sensor, the module swaps to searching for the train using the second sensor.

When one is detected at the second sensor, and then clears the sensor, the signal switches back to green and the relay is de-energised restoring power to the track (unless an indication is received from the following section that it is at danger, in which case the signal shows yellow instead).

The signal will continue to show yellow until the following section shows a clear signal.

When supplied, or following a factory reset, the module will operate in lamp test mode. It needs to be reprogrammed as follows.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

When **3 flashes** have been seen press and hold the button. You will see a long flash of five seconds and then 10 rapid flashes. The button can now be released and the programming is complete. The module will start running the program. If you make a mistake programming, simply repeat the process.

## **Program 4 4-Aspect Signalling Unidirectional Running**

This program simulates the operation of a four aspect signal, which is normally showing green. The module searches for a train, and if one is detected above the first sensor, the signal immediately switches to red. At the same time the relay energises isolate the track section.

Whilst the sensor is covered, the signal stays at red. As the train passes over the sensor, any gaps between the rolling stock which are shorter than the release time programmed are ignored.

Once the train has cleared the first sensor, the module swaps to searching for the train using the second sensor.

When one is detected, and then clears the sensor, the signal switches back to green and the relay is de-energised to restore power to the track, unless an indication is received from the following section that it is at danger (showing red) or showing caution (yellow), in which case the signal shows caution or double caution (two yellows).

The signal will continue to show yellow if the following section is showing danger, or continue to show double yellow if the following section is showing caution.

When supplied, or following a factory reset, the module will operate in lamp test mode. It needs to be reprogrammed as follows.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

When **4 flashes** have been seen press and hold the button. You will see a long flash of five seconds and then 10 rapid flashes. The button can now be released and the programming is complete. The module will start running the program. If you make a mistake programming, simply repeat the process.

## **Program 5 - 2-Aspect Signalling with Bidirectional Running**

This program simulates the operation of a 2-aspect signal at each end of a section, which normally show green. The module searches for a train at either sensor, and if one is detected, the signals immediately switch to red. An isolated track section cannot be used, otherwise the train could not leave the block.

Whilst the sensor is covered, the signals stay at red. As the train passes over the sensor, any gaps between the rolling stock which are shorter than the release time programmed are ignored.

Once the train has cleared the first sensor, the module swaps to searching for the departing train, checking both sensors alternately.

When one is detected, and then clears the sensor, the signals switch back to green.

When supplied, or following a factory reset, the module will operate in lamp test mode. It needs to be reprogrammed as follows.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **5 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

## **Program 6 - 2-Aspect Signalling with Bidirectional Running and Direction Memory**

This program simulates the operation of a 2-aspect signal at each end of a section, which normally show green. The module searches for a train at either sensor, and if one is detected, the signals immediately switch to red. An isolated track section cannot be used, otherwise the train could not leave the block.

Once the train has cleared the first sensor, the module swaps to searching for the departing train only at the other sensor.

When one is detected, and then clears the sensor, the signals switch back to green.

When supplied, or following a factory reset, the module will operate in lamp test mode. It needs to be reprogrammed as follows.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **6 flashes** are seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

## **Power-Off Memory**

This setting records whether there was a train in the section at the time the power is turned off. It also records the train's direction of travel.

When the power is turned on again, the information will be reloaded from memory and so the correct status will be indicated on the signals and relayed to any interconnected modules. This feature is disabled by default and needs to be enabled using setting 7 if required.

## **Final Block**

The final block does not receive any information from following blocks to inform it whether to show yellow (or double yellow for 4-aspect signals).

To get over this the module can be programmed to operate the yellow and double yellow aspects using timers.

First program the module to act as the final module (program 3, followed by 2).

The default duration to show yellow is 3 seconds, the double yellow for 6 seconds (for 4-aspect signals).

These can be adjusted to suit in the same way as other settings.

## **Programming Options**

Programming is performed by holding down the Push Button when switching on the power (the infra-red sensors or the link wires must be in place).

The red led on the PCB flashes at 1 second intervals. When the required number of flashes is seen (see later for the list of possible choices) the button is released to store the first value. At this point the led comes on for five seconds to confirm the value is stored.

The led then starts flashing again, and this time the button needs to be pressed to store the second value.

Once the two values to be stored are entered, the led flashes 10 times rapidly, and the module starts operating.

Most values entered can range between 1 and 255 (see below for limits). If more are seen, or the programming is aborted by switching off, then the programming must be repeated.

Following the diagram is a detailed explanation of all the settings.

