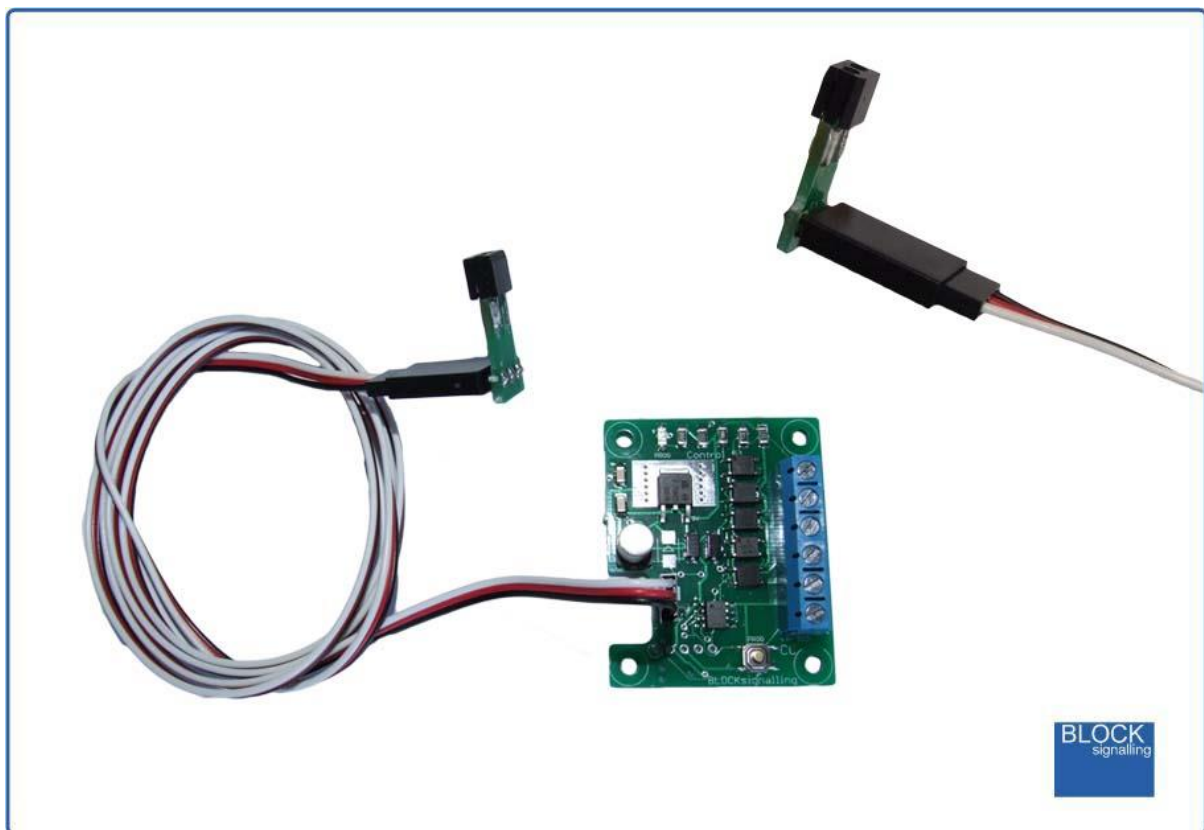


## LED SIGNAL CONTROLLER ASP1B



### Model Railway Automatic Signal Control with Wired Infra-Red Sensor

- Uses an infra-red sensor mounted below the track to detect trains passing above
- When a train is detected, the module triggers the signal to switch to red
- Signal automatically switches back to green (through yellow and double-yellow if appropriate)
- Flexible programming options to suit different signals and to allow adjustment of timings to suit
- Designed for signals which need +12V to be switched to them to light their leds (common cathode)
- Wide input voltage range (8V to 25V DC, 12V to 16V AC, or can be powered from a DCC power bus).
- Realistic fading between aspects.
- Yellow and Double-Yellow stages will change to red if another train passes.

Building on the success of our infra-red train detectors, this module boasts a wider range of input voltages, smooth fading between aspects, and the ability to be triggered from yellow or double-yellow stages back to red.

This Signal Controller detects trains by bouncing invisible Infra-Red (IR) light off the underside of the rolling stock, and detecting the light reflected back. Once triggered by the train, the module runs built-in programs to simulate the operation of 2-, 3- or 4-aspect signals.

The signal normally shows green. When the train passes the detector, the signal switches to red. Once the train has fully cleared the detector, the module switches the signal back to green (via yellow and double-yellow if appropriate).

The duration of the red, yellow and double-yellow stages can be adjusted, as can the time the sensor needs to be cleared before initiating the sequence returning to green and the sensitivity of the detection. Adjusting the time the sensor needs to be cleared can be useful to prevent incorrect detection of the train having passed due to the small gaps between the rolling stock.

This controller is designed for connection to signals which have a common-cathode (common negative) connection. This is normally the case for UK manufactured signals. European and American signals generally use a common-anode connection, which can be powered from our identically featured ASP2A.

## Features

- No calibration required – works out of the box.
- No modifications required to rolling stock.
- Not affected by light or dark, or changes in light level.
- Designed and manufactured in the UK.
- Pre-wired sensor plugged in to the main board.

## Power Supply

The module operates from AC, DC or DCC (track power bus) supplies. You can use a DC power supply between 8V and 25V DC, or any AC power supply between 8V and 16V AC. If using DCC, the feed can be between 12V and 25V, which covers all normal DCC layouts.

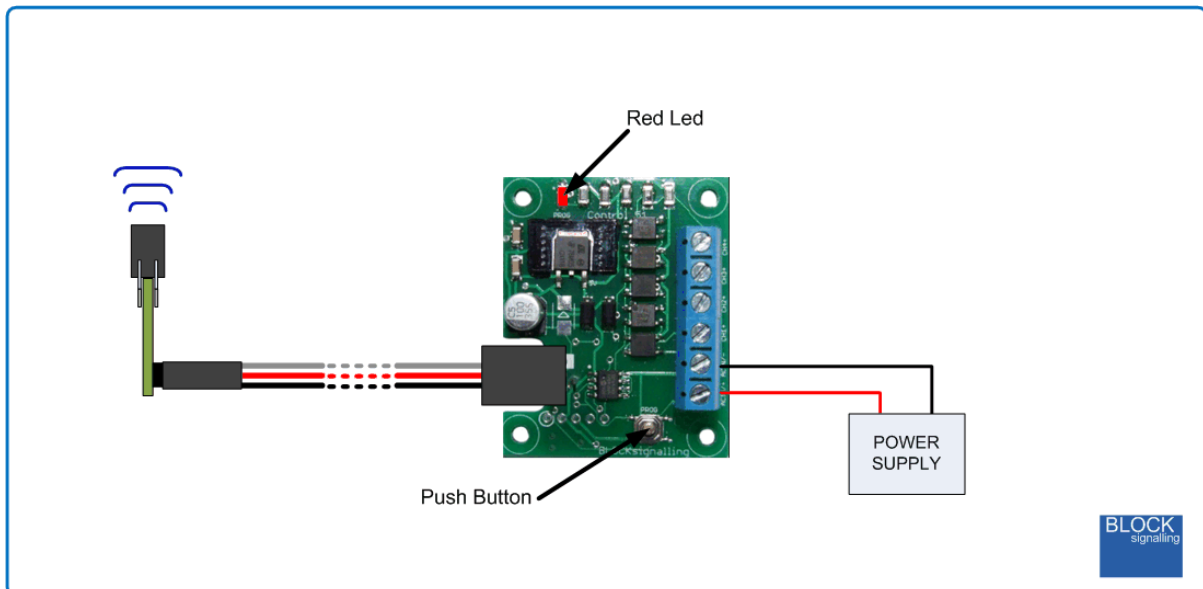
Where a choice is available, a 12V DC supply is recommended.

**Please check the wiring carefully before turning on the power to prevent damage to the module.**

## Programming

As supplied, the module is programmed for 4-aspect signals. If you are using 3- or 2-aspect signals, then it will be necessary to reprogram the module.

This is performed by **holding down the Push Button when switching on the power** (the infra-red sensor must be plugged in for the PCB led to function).



For each program there are two values to be stored (see later for details of the options available).

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 both values have been entered, the led flashes 10 times rapidly, and the module starts operating.

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

## Factory Reset

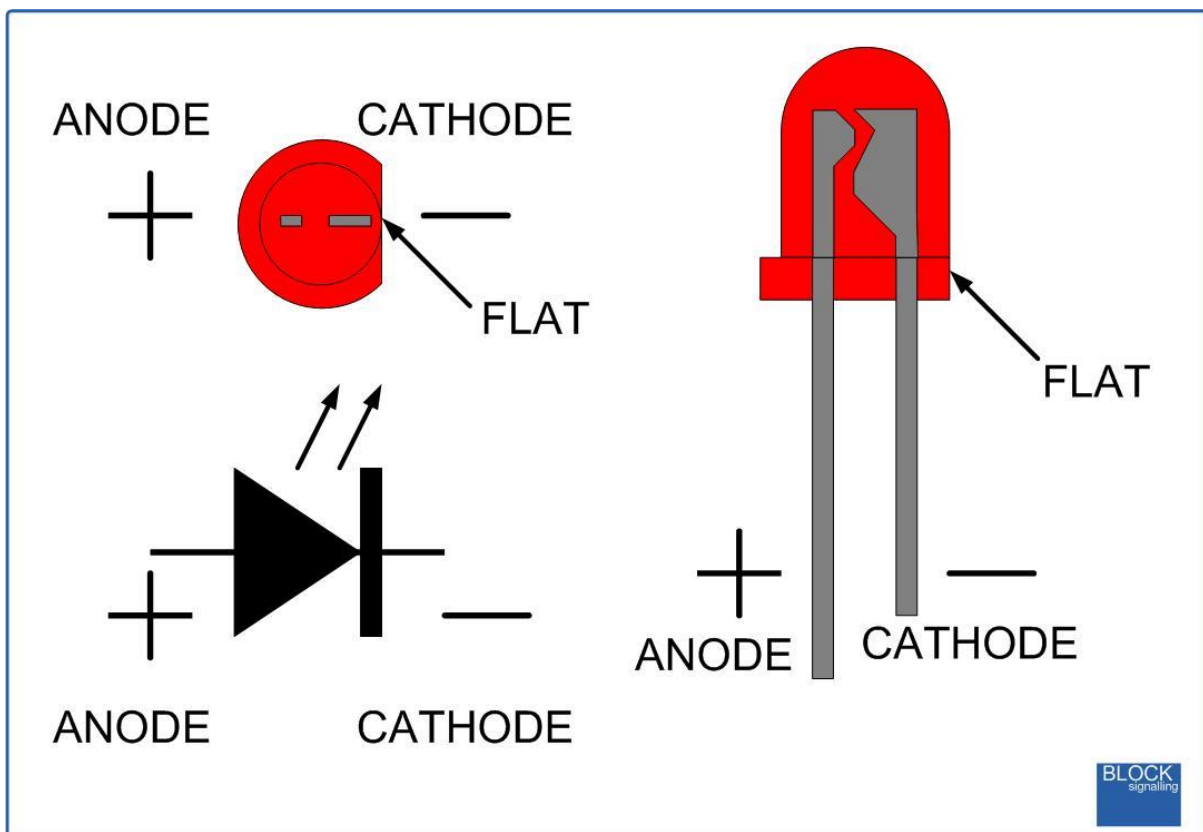
To reset the module back to factory settings, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **1 flash** of the led is seen. At this point, release the button. You will see a long flash of five seconds.

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 4-aspect signal mode. If you make a mistake programming, simply repeat the process.

## 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.





## 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					
	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
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.

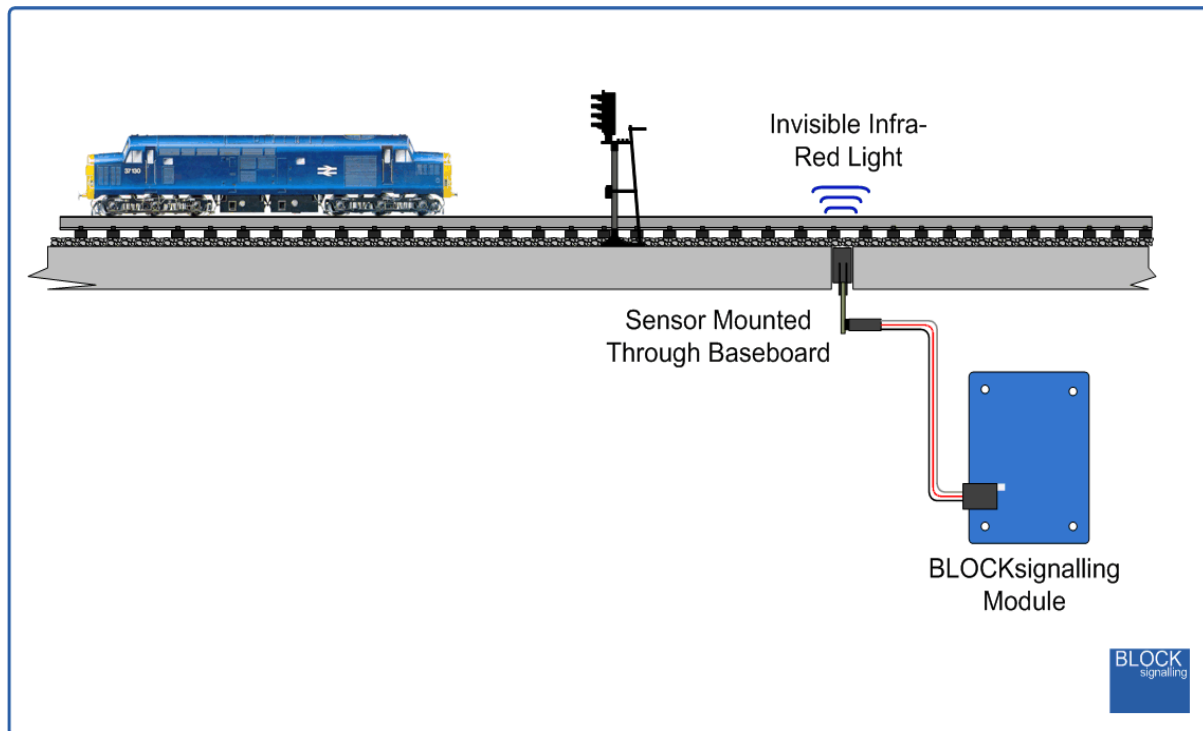
The led will begin flashing again. When you have reached the desired number of flashes to set the new sensitivity, press the button. You will see a long flash of five seconds and then 10 rapid flashes. The programming is then complete and the module will restart. If you make a mistake programming, simply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

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

## Installation

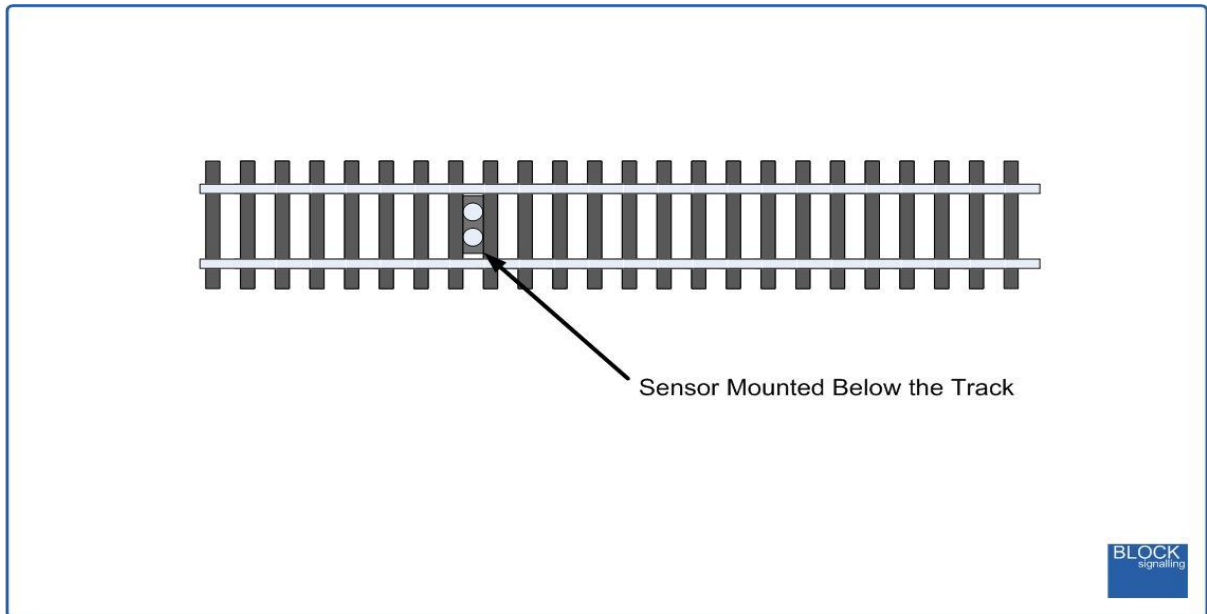
The Infra-Red sensor is normally installed below the track-bed.

The detection range of the unit is up to approximately 25mm from the face of the package when the default 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.



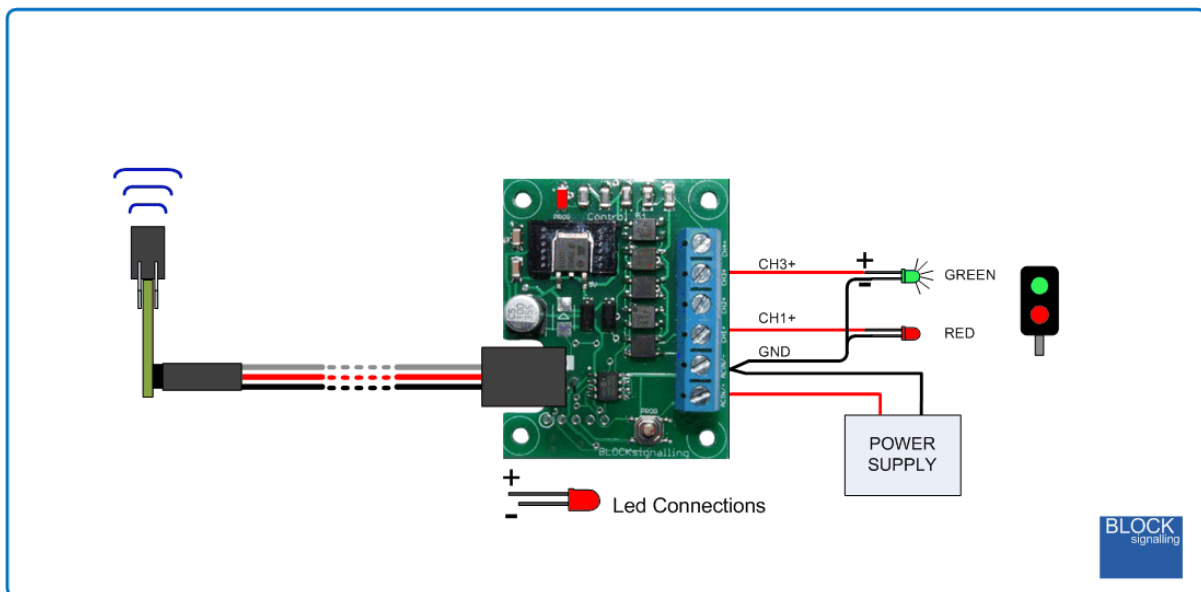
### Connecting the Outputs

Each channel has an output, which switches to a positive voltage to light the attached signal led.

There are resistors built-in to the controller, so no external resistors are required. If your signal already has resistors connected, these can remain if you wish, although the signal may appear slightly dimmer.



## Program 2 (2-Aspect Signalling)



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 in front of the sensor, the signal immediately switches to red.

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 sensor, and the release time expires, then the "red time" timer starts. When this expires, the signal turns back to green and starts looking for trains again.

The "release time" can be adjusted if slow moving trains cause the signal to prematurely switch back to green before the train has cleared the sensor.

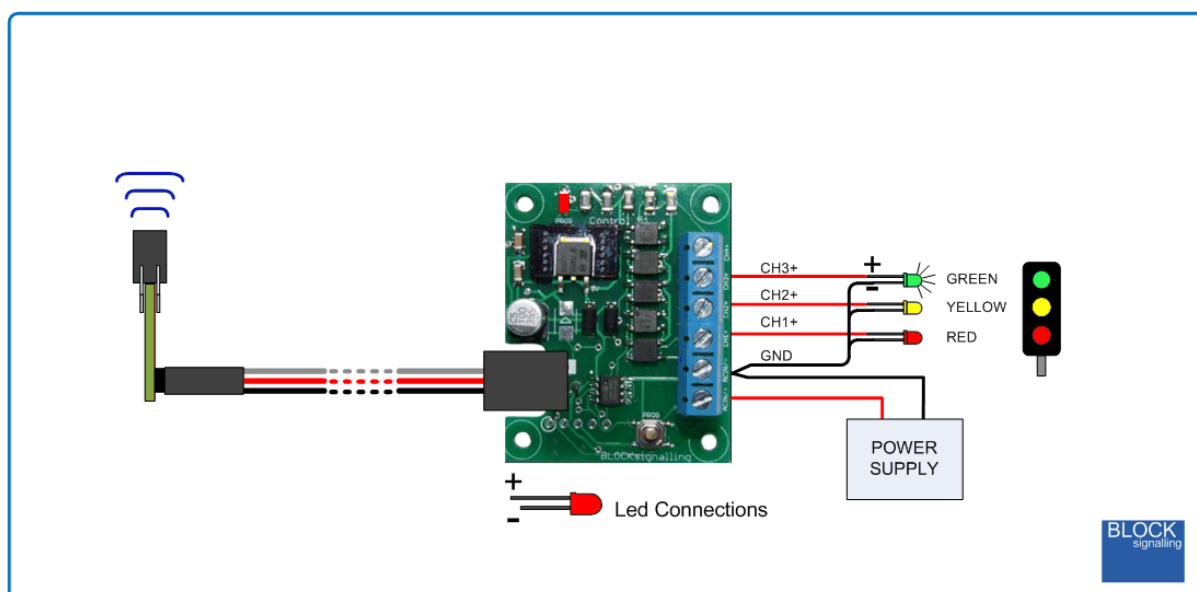
The "red time" can be adjusted to a realistic duration for a train to clear the section of track protected by the signal.

When supplied, or following a factory reset, the module will operate in 4-aspect 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)



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 in front of the sensor, the signal immediately switches to red.

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 sensor, and the release time expires, then the "red time" timer starts. When this expires, the signal switches to amber and the "yellow timer" starts.

When this expires, the signal switches back to green and starts looking for trains again.

The "release time" can be adjusted if slow moving trains cause the signal to prematurely switch back to green before the train has cleared the sensor.

The "red time" can be adjusted to a realistic duration for a train to clear the section of track protected by the signal.

The "yellow time" can be adjusted to a realistic duration for the scale.

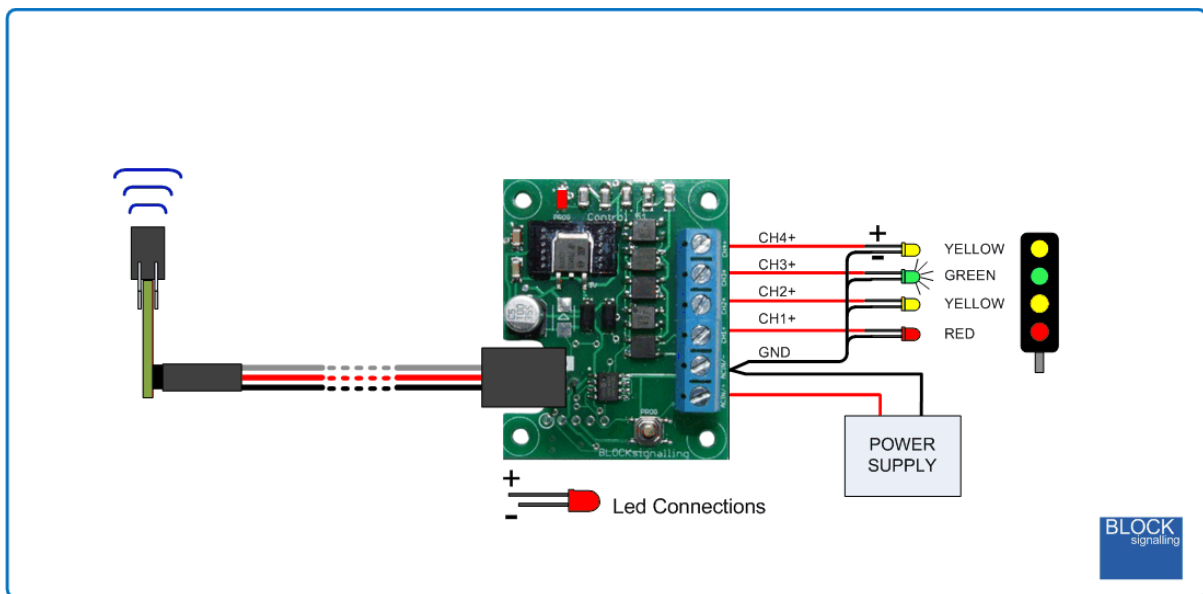
When supplied, or following a factory reset, the module will operate in 4-aspect mode. It needs to be reprogrammed as follows.

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)



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 in front of the sensor, the signal immediately switches to red.

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 sensor, and the release time expires, then the "red time" timer starts. When this expires, the signal switches to yellow and the "yellow timer" starts.

When this expires, the signal switches to double yellow and the "double yellow timer" starts. When this expires, the signal switches back to green and starts looking for trains again.

The "release time" can be adjusted if slow moving trains cause the signal to prematurely switch back to green before the train has cleared the sensor.

The "red time" can be adjusted to a realistic duration for a train to clear the section of track protected by the signal.

The "yellow time" and "double yellow time" can be adjusted to a realistic duration for the scale.

To use this mode, the module needs to be reprogrammed as follows.

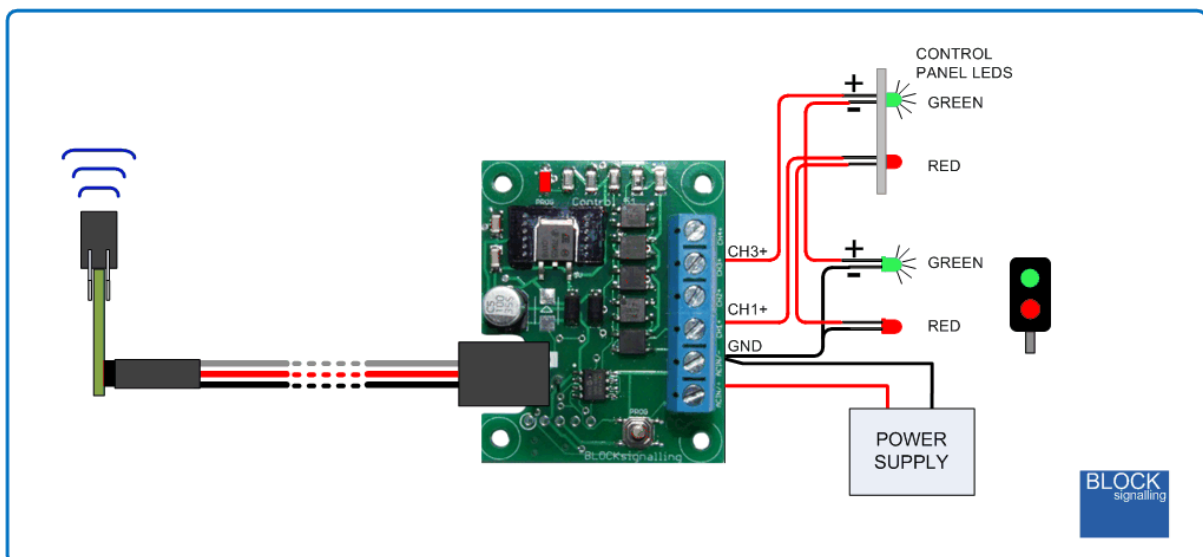
To select this program, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until **2 flashes** is seen. At this point, release the button. You will see a long flash of two seconds and then the led will begin flashing again.

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.

### Connecting Control Panel Leds

If you wish to show the status of any signal using separate leds on a control panel, then these can simply be wired in series with the signal leds.

The diagram below shows two leds on a control panel, which will show the same colour as the connected 2-aspect signal. Similar connections can be made when using 3- and 4-aspect signals.



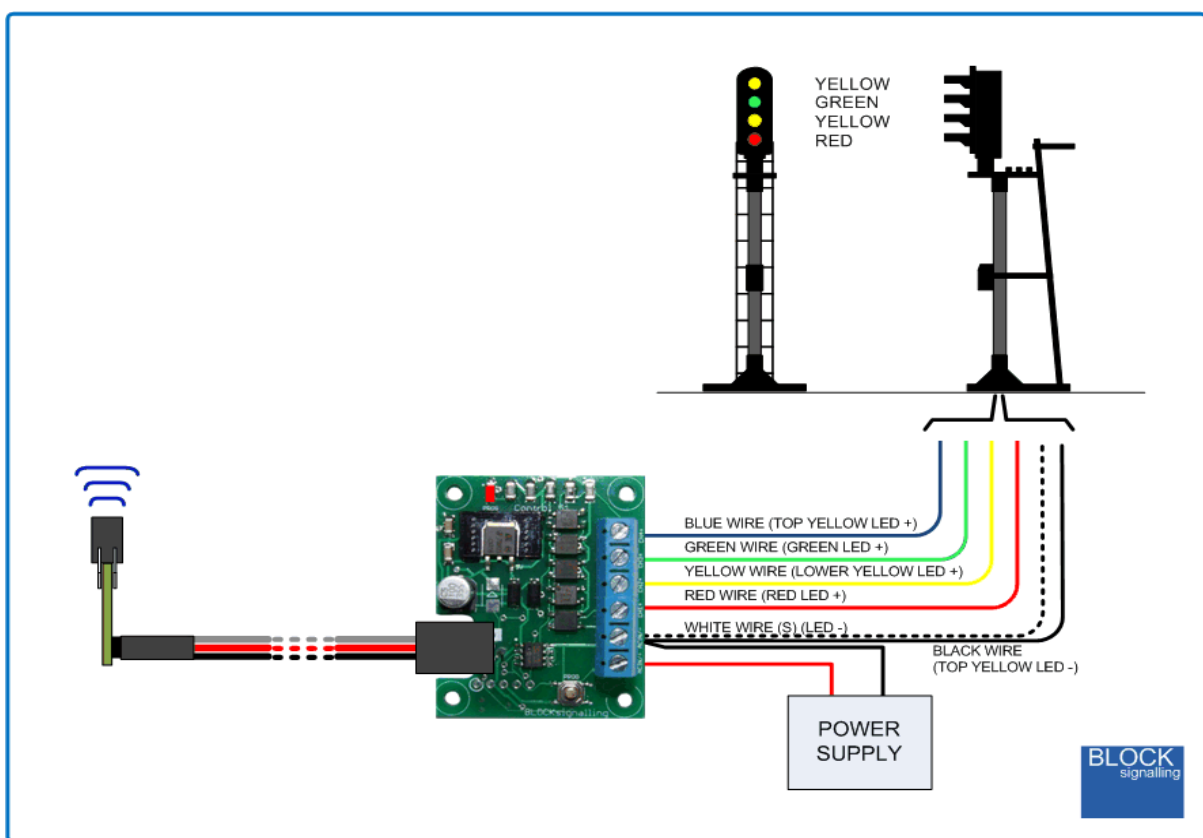
## Example Wiring to Eckon or Berko 4-aspect Signal

The positive connection from each of the leds in an Eckon or Berko signal match the led colour (red wire for the red led positive connection, etc).

Depending on the age of the signal, there will be one or more white wires. These are the negative connections to the leds.

The exception is the top yellow led of a 4-aspect signal. This has a blue positive wire and may have a black negative wire (or it may share a white negative wire with the rest of the leds).

The following wiring diagram shows the most common wiring arrangement.



## **Changing the Timing of each Phase**

The individual time for each of the phases can be adjusted to suit (the default values are shown in the programming diagram below). Once you are happy with the operation of the train detection, you will probably want to change these to more realistic values.

### **To change the Red Time:**

Switch off the power for 5 seconds. Press the push button on the PCB, and switch the power back on.

The red led on the PCB flashes at 1 second intervals. When 3 flashes have been seen, 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 (the time you want the red led to be lit, for example 10 flashes for 10 seconds).

When the button is released, the led flashes 10 times rapidly, and the module starts operating.

### **To change the Yellow Time:**

Switch off the power for 5 seconds. Press the push button on the PCB, and switch the power back on.

The red led on the PCB flashes at 1 second intervals. When 4 flashes have been seen, 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 (the time you want the yellow led to be lit, for example 10 flashes for 10 seconds).

When the button is released, the led flashes 10 times rapidly, and the module starts operating.

### **To change the Double-Yellow Time:**

Switch off the power for 5 seconds. Press the push button on the PCB, and switch the power back on.

The red led on the PCB flashes at 1 second intervals. When 5 flashes have been seen, 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 (the time you want both yellow leds to be lit, for example 10 flashes for 10 seconds).

When the button is released, the led flashes 10 times rapidly, and the module starts operating.

## **Other Programming Options**

There are a number of parameters which can be adjusted if you wish to alter the operation of the module.

### **Release Time**

This is the time that the infra-red sensor must be continuously unobstructed for the module to confirm the train has passed. This allows for gaps between the carriages or variable reflectivity of the underside of the train.

The default setting is 2 seconds. A value of between 1 and 255 seconds can be programmed.

### **Lamp Fade-Down Rate**

This is the rate that lamp (leds) dim down.

The default setting is 3 which represents the appearance of a filament lamp. If the effect of an led aspect is required, then set this to 9.

### **Lamp Fade-Up Rate**

This is the rate that lamp (leds) brighten when each is switched on.

The default setting is 4 which represents the appearance of a filament lamp. If the effect of an led aspect is required, then set this to 9.

### **Maximum Led Brightness**

The leds are normally set to operate at full brightness, with this set to 7.

This value can be reduced if the leds appear brighter than required.

### **Gap Between Phases**

This variable set the gap between each aspect switching, to represent the operation of relay interlock.

The default value is 2. This variable can be set from 1 to 9.

## **Program Flow Diagram**

The diagram below shows all the programming options.

Programming is performed by inserting a link between the A and K terminals (or by having the detector wired in place) and holding down the Push Button when switching on the power.

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.

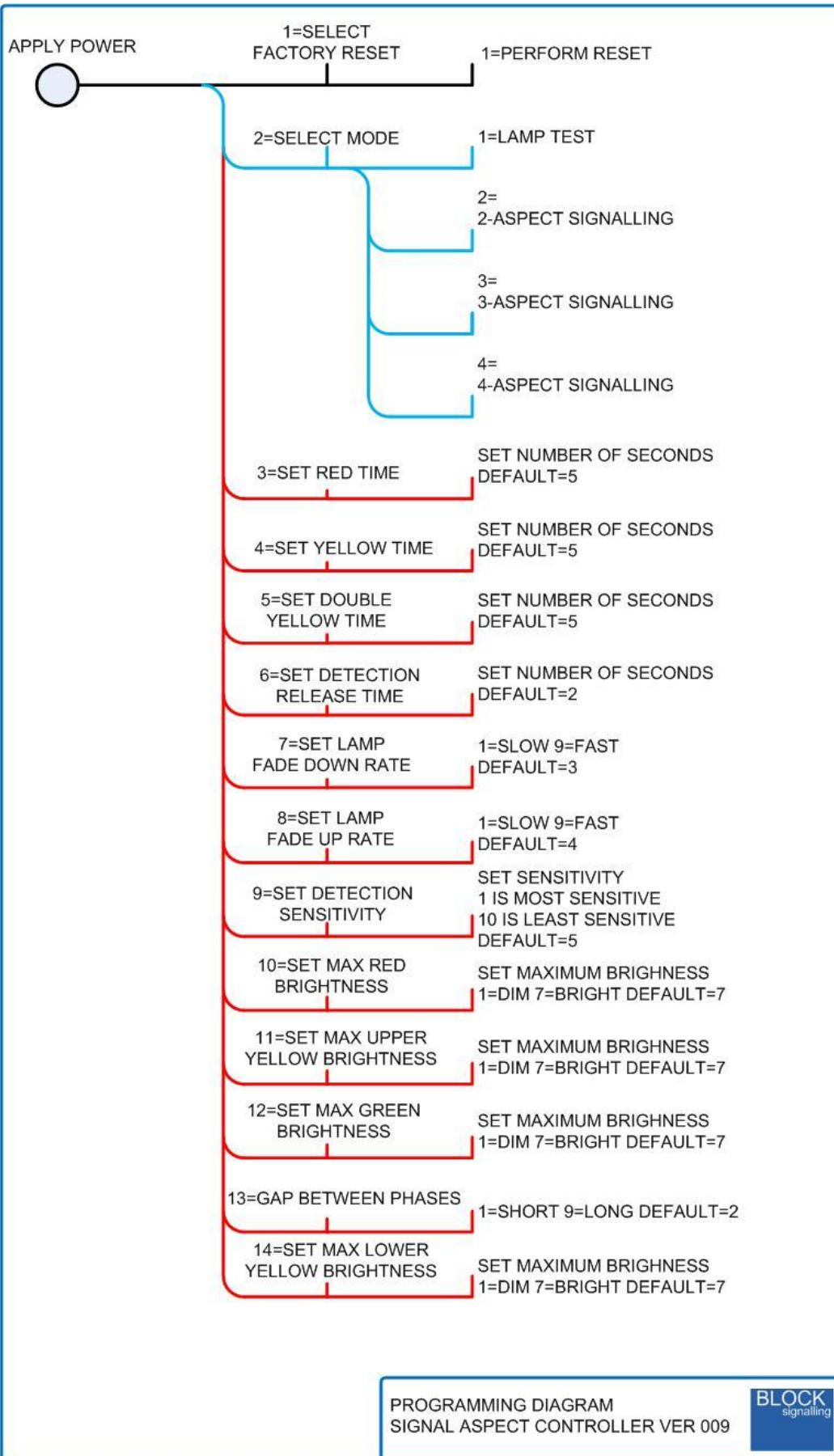
The led then starts flashing again, and this time the button needs to be pressed to store the second value.

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.





## Troubleshooting

Each module is tested individually before being packed, so you can be certain of receiving a fully functioning module to add to your layout.

In the unlikely event of encountering a problem, the following steps should allow quick diagnosis of the issue.

1. Check the sensor module is plugged in with the correct orientation.

On both the sensor PCB and the main PCB there is a white block printed near one of the three pins of the connector. This should be orientated to be next to the white strand of the sensor cable.

If the cable is plugged in incorrectly, then the red led on the PCB will not function (although the module will not be damaged).

2. Connect the power wires, making sure that the wires are connected the right way around if using a DC supply.

The negative lead should be connected to the ACIN/- terminal and the positive wire to the ACIN/+ terminal. If the connection is reversed, the module will not function (although the module will not be damaged).

If feeding the module with AC or DCC power, the lead orientation is not critical.

3. Turn on the power.

The red led on the PCB should flicker. This shows the infra-red sensor is connected correctly and that the module is looking for trains.

4. Turn off the power and connect the signal.

The module is designed for signals that have a common-cathode connection. This means the negative side of the signal leds are wired together to share a common wire.

If you connect common-anode signals, which have the negative side of the signal leds wired together to share a common wire, then the signal leds will not light.

When you power up the green signal led should light. The green signal led must be connected to the CH3 terminal.

If the red led connected to the CH1 terminal lights instead, it may be that the sensor is obstructed (or that there is a train in front of it!).

5. If the green signal led is lit, hold a sheet of paper over the sensor.

The signal should change from green to red when the paper is about 25mm / 1 inch from the sensor.

6. Remove the paper.

After a period, the flashing rate of the led on the PCB should change. The module is now confirming the train has cleared the sensor.

The red signal led should then go out.

Which signal led now lights depends on the module programming. From the factory, the module is set for 4 aspect signals, so the default is that the yellow on CH2 will light.

If you are not using 4 aspect signals, you will need to reprogram the module (see the main text above).

7. Finally the module will return to show the green signal led, and then start to look for trains again.

## **Final Notes**

Any signals show in diagrams and photos are only to illustrate connections and are not included with the module.