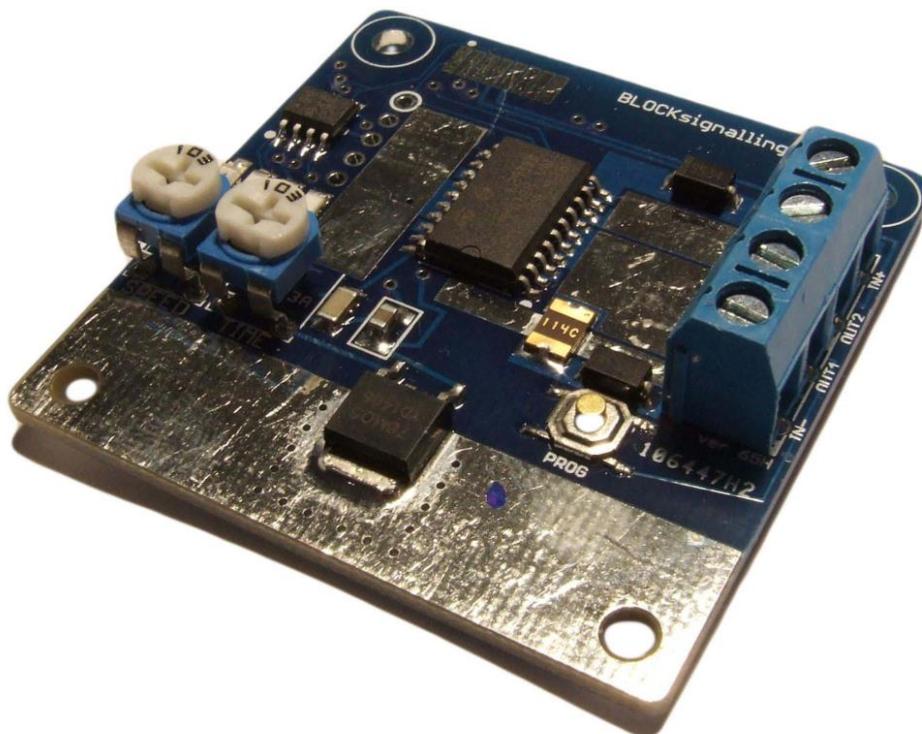


## DC SHUTTLE WITH SPEED CONTROL SS2A



### **DC Shuttle Train Controller with Adjustable Delay and Built-in Speed Controller**

- Automatically operates a train backwards and forwards along a single line
- Waiting time at the ends can be varied with a simple screwdriver adjustment
- The module includes speed control, so a separate controller is not required
- An acceleration function is also included for trains departing for a more realistic operation.
- An led on the PCB shows when the train is moving forwards, and flickers when it is reversing
- Fixed and random delays can be programmed easily for realistic operation
- Microprocessor controlled for accuracy
- Simple wiring and operation

The SS2A is one of our new range of DC shuttles, designed to add variety and interest on a layout by operating a model train back and forth along a section of line.

The train stops when it crosses a track gap at the end of the line, cutting off power to the locomotive. A diode is fixed across the gap and so allows the train to run in the opposite direction when the module changes the polarity to the track. Two diodes are supplied to fix across the track breaks.

The delay time can be set between 1 second to 10 minutes using the simple adjustment on the module. Easy programming allows the delays to be either fixed or random (between 25% and 100% of the set time on each run).

This model has a built-in DC throttle, so you can set the delay with one adjustment and the speed of the train with the other, whilst saving the cost of an additional DC throttle to control your shuttle trains.

An acceleration function is also included for trains departing for a more realistic operation.

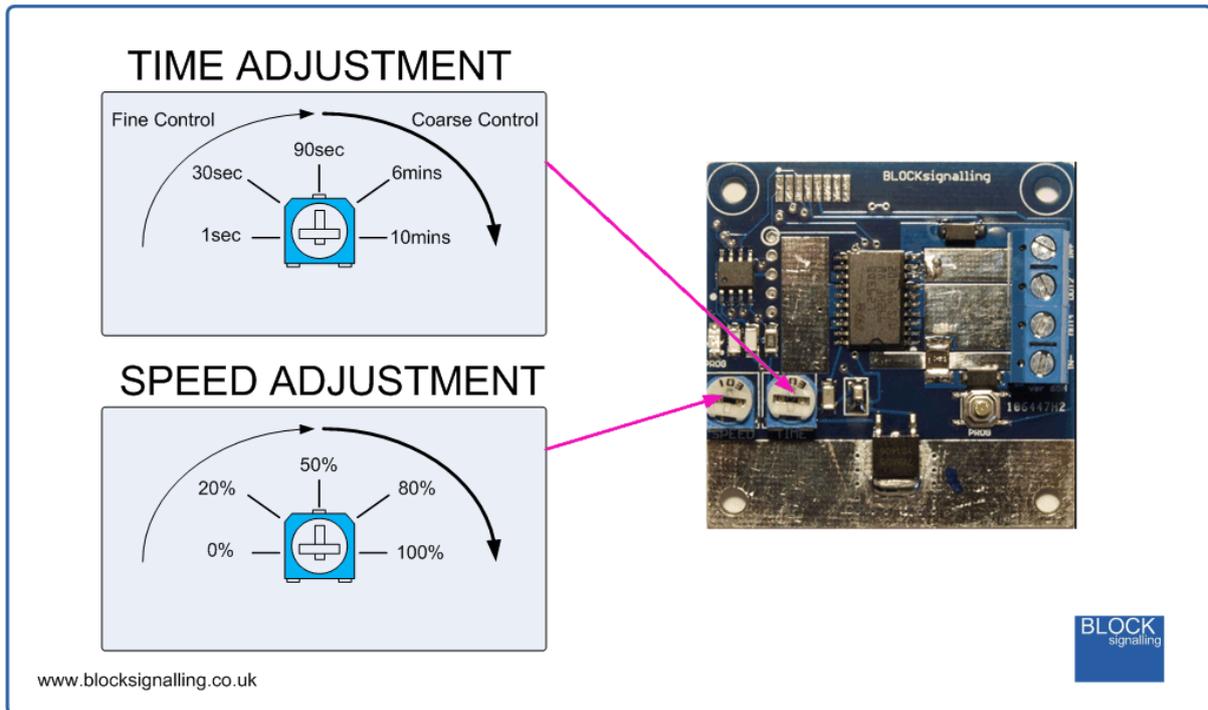
### **Timing Adjustment**

The timing is adjusted with a small screwdriver, which fits into a slot in the adjuster mounted on the PCB.

The adjustment is very fine for the first half of the rotation, setting the timing between 1 second and 90 seconds, then becomes more coarse up to the maximum setting of 10 minutes.

The time set is the interval between each change of the polarity of the feed to the track. It needs to be set to allow the train to reach the end of the line, and then wait for the required stopping time.

If the setting too low, the train will not reach the end of the line before changing direction.



The module reads the time setting when the power is applied, and each time the relays are switched.

Generally, it is easiest to set the approximate time using the diagram above, then switch off the power for 10 seconds or so. When the module is re-powered, it will read the setting and commence its operation.

Minor adjustments can be made whilst the unit is running, and they will be used at the next opportunity.

To select random timing, see below.

### **Power Supply**

The module requires a 12V DC power supply, with a minimum recommended capacity 0.5A for N and Z scale and 1.0A for OO and HO scale.

One of the wall socket type 12V DC power supplies is ideal. DO NOT use your existing DC Throttle or Train Controller as this will damage the SS2A.

The module is provided with a 2.1mm jack (centre pin positive) as an alternative to using the terminals to connect the power supply..

It is important to connect the power with the right polarity, otherwise the module will not operate.

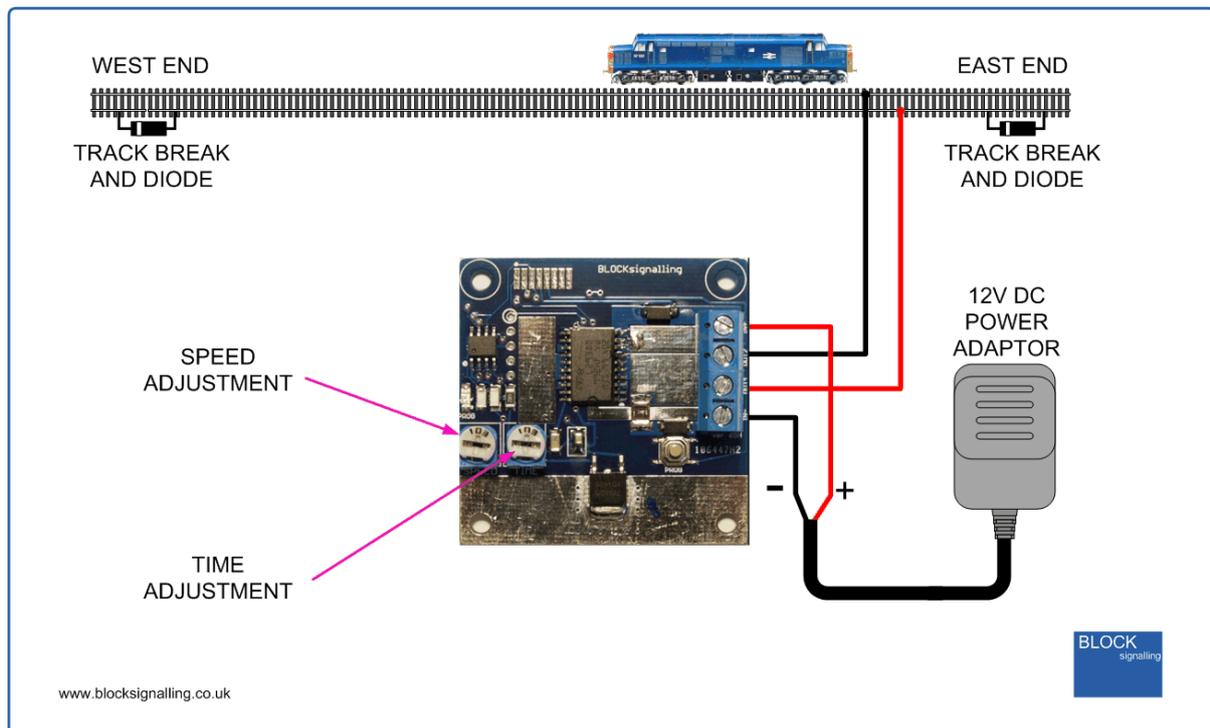
No damage will be caused by incorrect polarity connection, or using a power supply of other than 12V, although the module may get warm and shutdown to protect itself.

## Connecting Up

At each end of the track, a small break is required in one rail to allow diodes to be connected (these are included with the module).

The break can be cut with a small hacksaw or dremel. It is suggested that the gap is filled with a small amount of epoxy glue to prevent debris shorting the gap over time.

When the train passes the break in the track, the diode prevents traction current reaching the train until the polarity is reversed by the module.



## Speed Control

The module includes a speed controller which provides a switched 12V output to the rails which is pulsed to control the speed of the train.

The operating frequency of the pulsing (26kHz) has been chosen to be kind to motors and to be inaudible to humans.

Lower frequencies can result in noisy motors, either humming or whining. Both these noises are caused by the minute vibrations of the motor and its coil windings, and can cause damage in the long run, as well as being distracting to the operator.

Depending on the size of the locomotive, it may be necessary to advance the speed setting past the half-way mark to allow the train to move.

There is an acceleration function described later.

## Led Operation

There is a small red led on the module which lights to indicate which direction the train is running (and is also used during the programming procedure).

When the train is moving forwards, the led is mainly lit, only turning off briefly once a second to indicate the operation of the module timing.

When the train is moving backwards, the led is lit for 0.5 seconds on and 0.5 seconds off.

## Setting Timing to Fixed or Random

As supplied, the shuttle uses the same fixed timings on each run.

There is an option to switch on random timings, where on each run the timing will be set to between 25% and 100% of the time set. So, for instance if the timing is set to 4 minutes, each run will vary between 1 minute and 4 minutes.

To select random timings, 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** 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 seen **2 flashes** press the button. You will see a long flash of five seconds and then 10 rapid flashes. The reset procedure is then complete. If you make a mistake programming, simply repeat the process.

## Switching on Acceleration

As supplied, the acceleration function is switched on, and advances the power from off to the set speed over a period of about 5 seconds.

The acceleration function is used to start the trains movement smoothly, building up to full speed.

The smoothness of the acceleration will depend to an extent on the motor fitted and the smoothness of the drive components of the locomotive used.

If the time set on the module is set below the time required for the locomotive to reach the stopping diode or the end of the track, then the train will also smoothly decelerate.

## Changing the Rate of Acceleration and Deceleration

The rate of acceleration can be varied with setting 4, which has a default of 5 and can be set between 1 and 20 (where 20 is the fastest rate of acceleration).

If you want to change the rate of acceleration, say to a rate of 10, switch off the power to the module again and hold down the Push Button. Apply the power and continue holding the push button until **4 flashes** 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 **10 flashes** press the button. You will see a long flash of five seconds and then 10 rapid flashes. The reset procedure is then complete. If you make a mistake programming, simply repeat the process.

## 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 default settings. If you make a mistake programming, simply repeat the process.

## Program Flow Diagram

Programming is performed by holding down the Push Button when switching on the power.

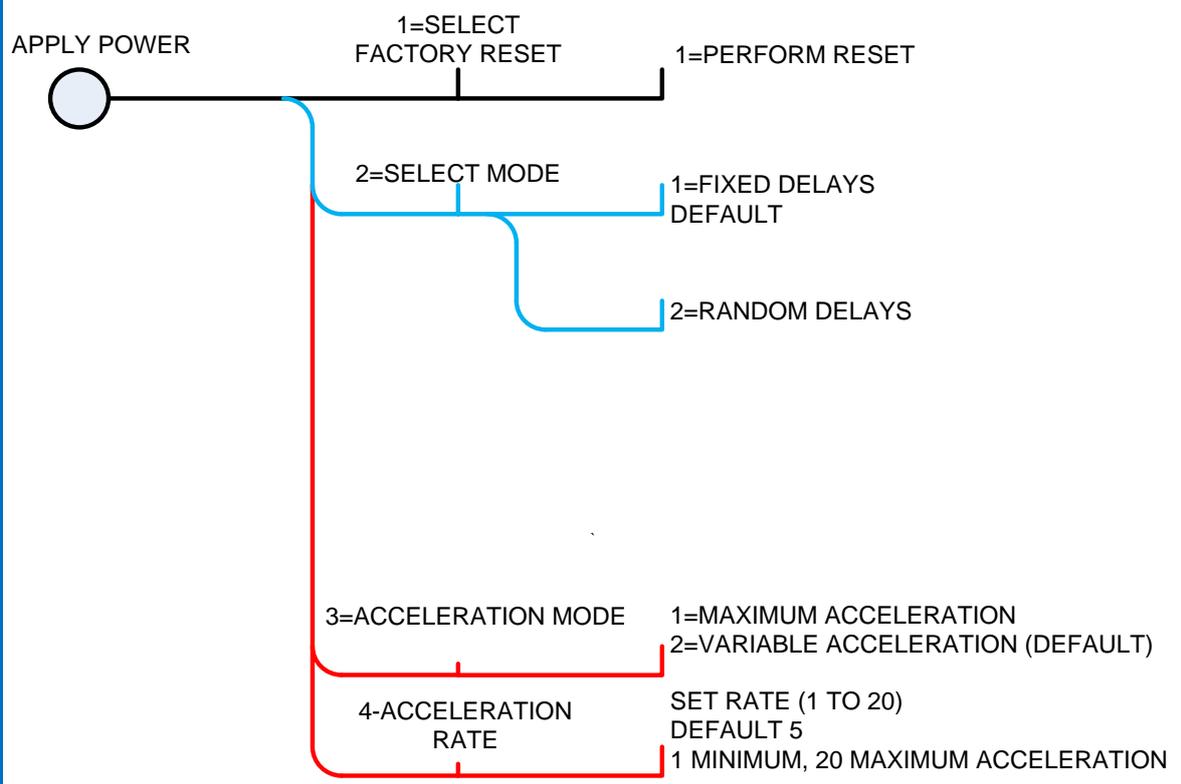
The red led on the PCB flashes at 1 second intervals. When the required number of flashes is seen (see below for the list of possible choices) the button is released to store the first value. At this point the led comes on for five seconds to confirm the value is stored.

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.



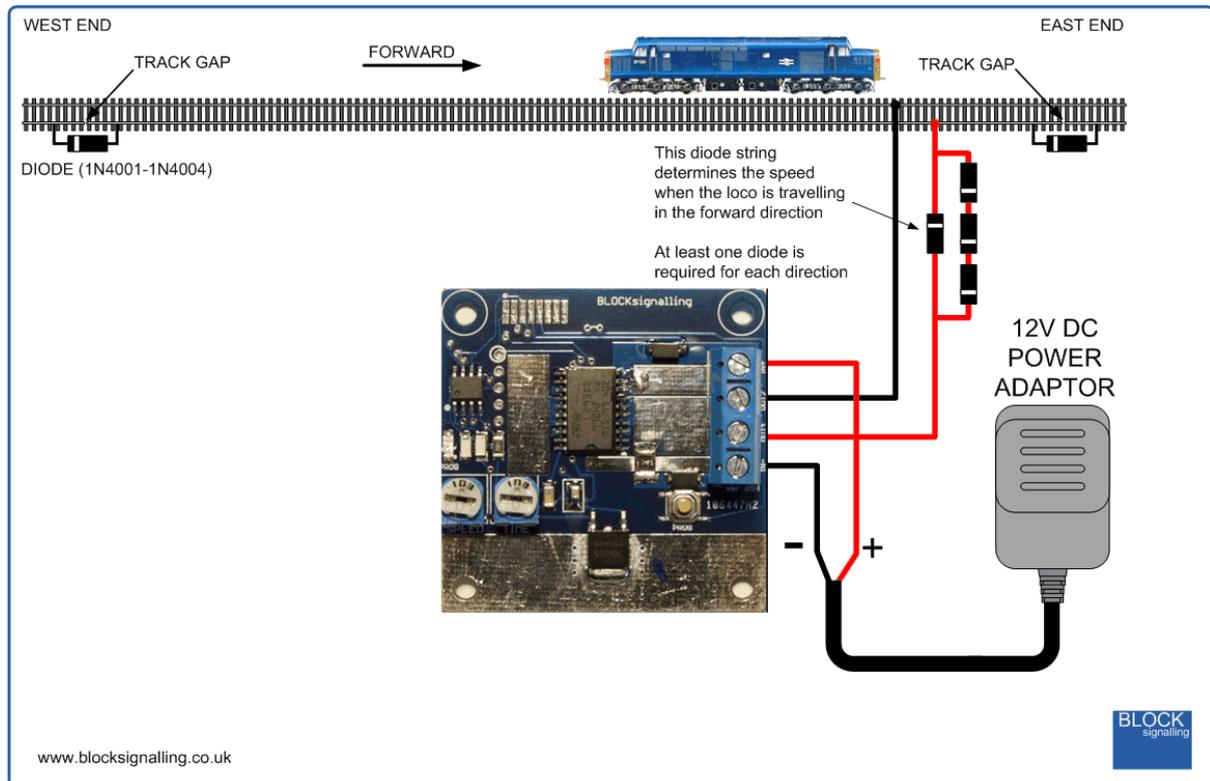
SS2A  
DC SHUTTLE



## Other Ideas

Trains can be operated at different speeds by inserting one or more diodes in the feed to the track. Each diode has an approximate 0.7V voltage drop.

Use a different number of diodes in each direction to create different speeds in each direction. You need at least one diode for each direction.



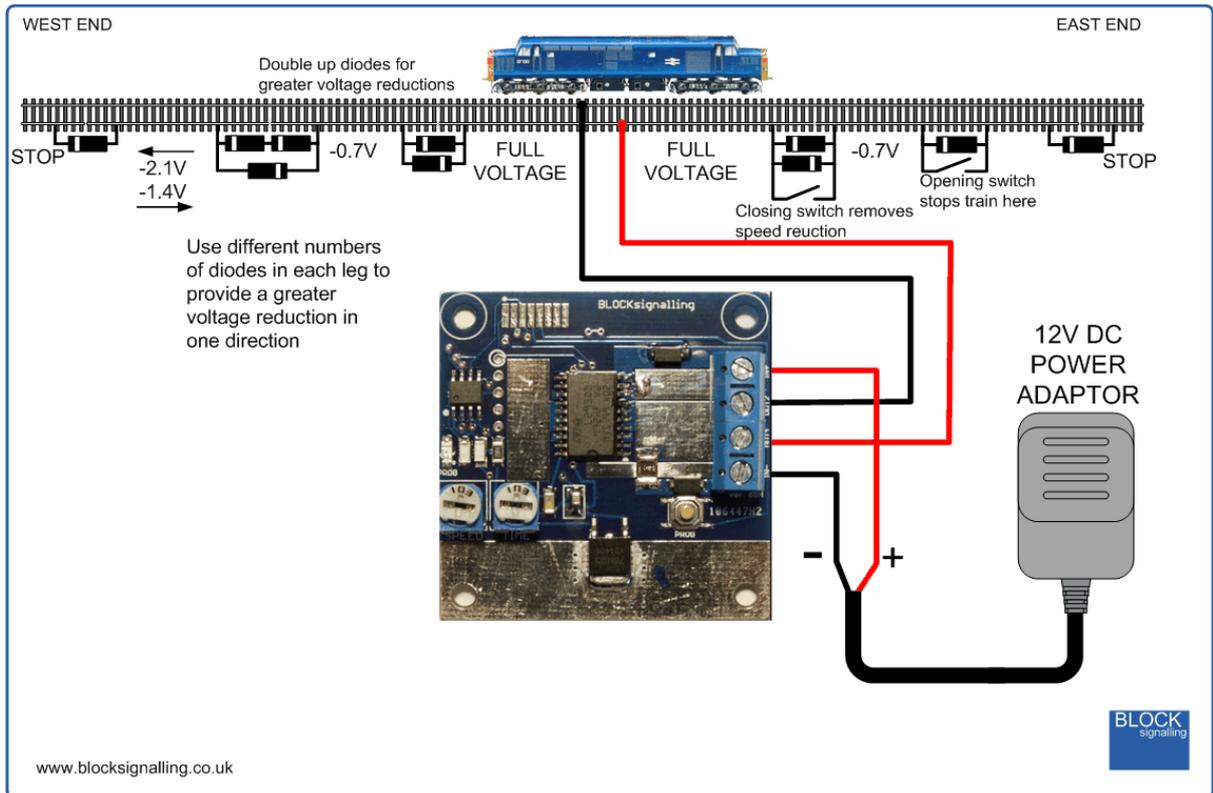
Creating additional track gaps, with associated diodes, allows differing voltages along a length of track, and so different operating speeds in each section.

Use one diode in each direction to drop the speed in the following section by equal amounts.

Use a different number of diodes in each direction to create different speeds in each direction. You need at least one diode for each direction.

Speed reductions can be removed by shorting across the diodes with a switch.

Different stop points can be created by inserting additional single diodes, and shorting across them when they are not required.



## Troubleshooting

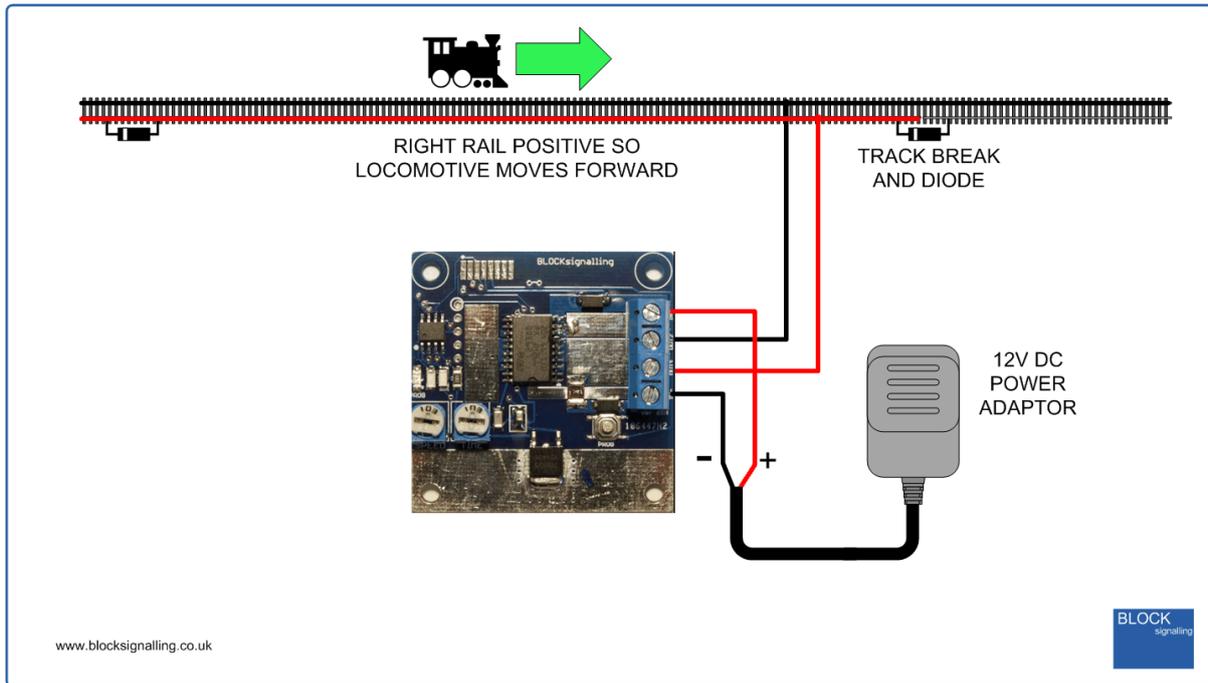
If you encounter problems getting up and running with the SS2A, this section should hopefully help solve your problems.

The function of the module is to periodically reverse the polarity of the tracks. This will cause any DC locomotive on the tracks to move forwards and backwards.

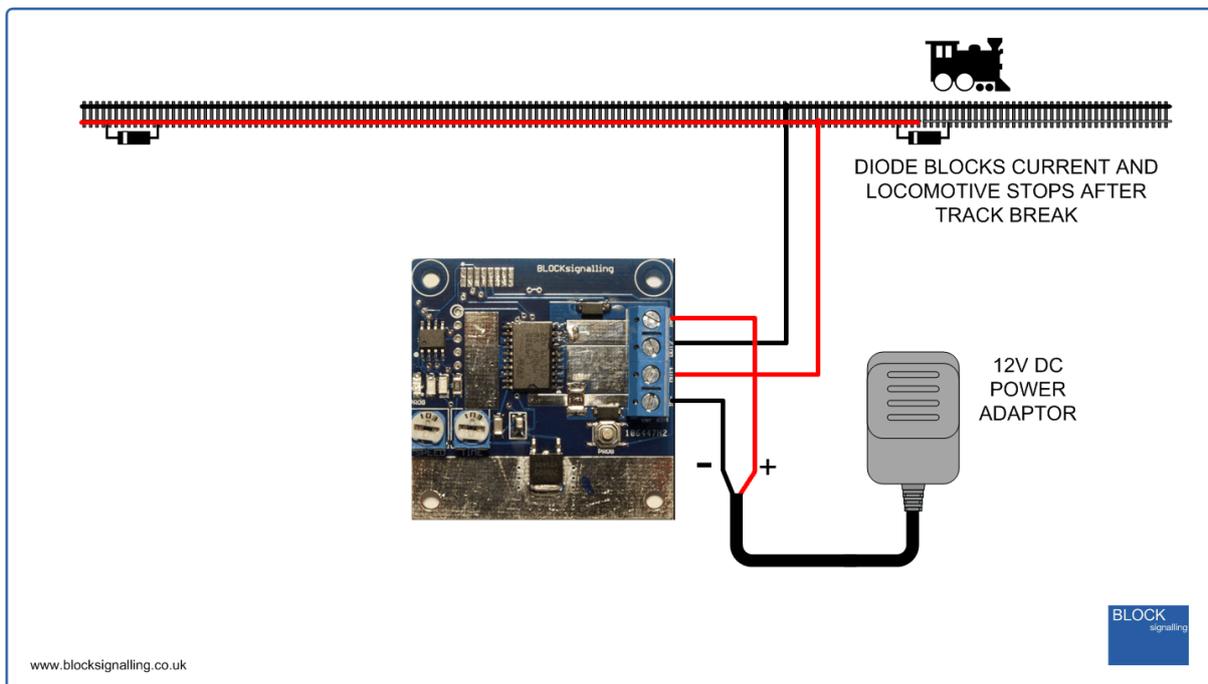
The convention is that a DC locomotive will move forwards when the right hand rail is positive and the left hand rail is negative, when viewed from the driver's position.

When the output of the SS2A feeds positive volts to the right hand rail, the whole right hand rail will be positive, up until the diode across the track gap. When the side of the diode with the white stripe is more positive than the side without the stripe, the diode will block current flow.

The train travels forwards.



When the train passes the diode, such that there is no longer a positive feed reaching its wheels, it will stop.



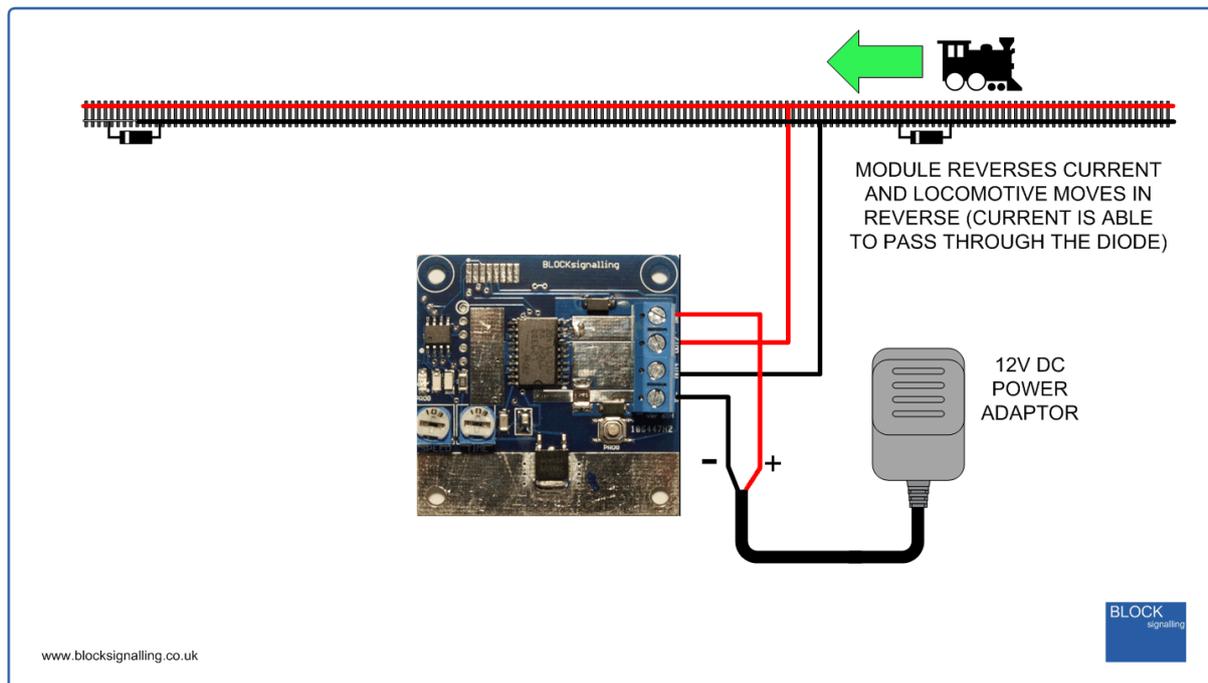
After some time, settable by using the adjuster on the module, the SS2A reverses the current.

Now the whole left rail is positive.

The right rail is negative, up until the second diode.

The locomotive now receives power from both rails, and runs in reverse.

The process repeats at the other end.



If the locomotive overruns the diodes at the end of the tracks, we recommend checking the diodes are connected the correct way around and the gap in the rails is clear of debris. Then swap the polarity of the connections to the rails. This should cure any overrunning problems.

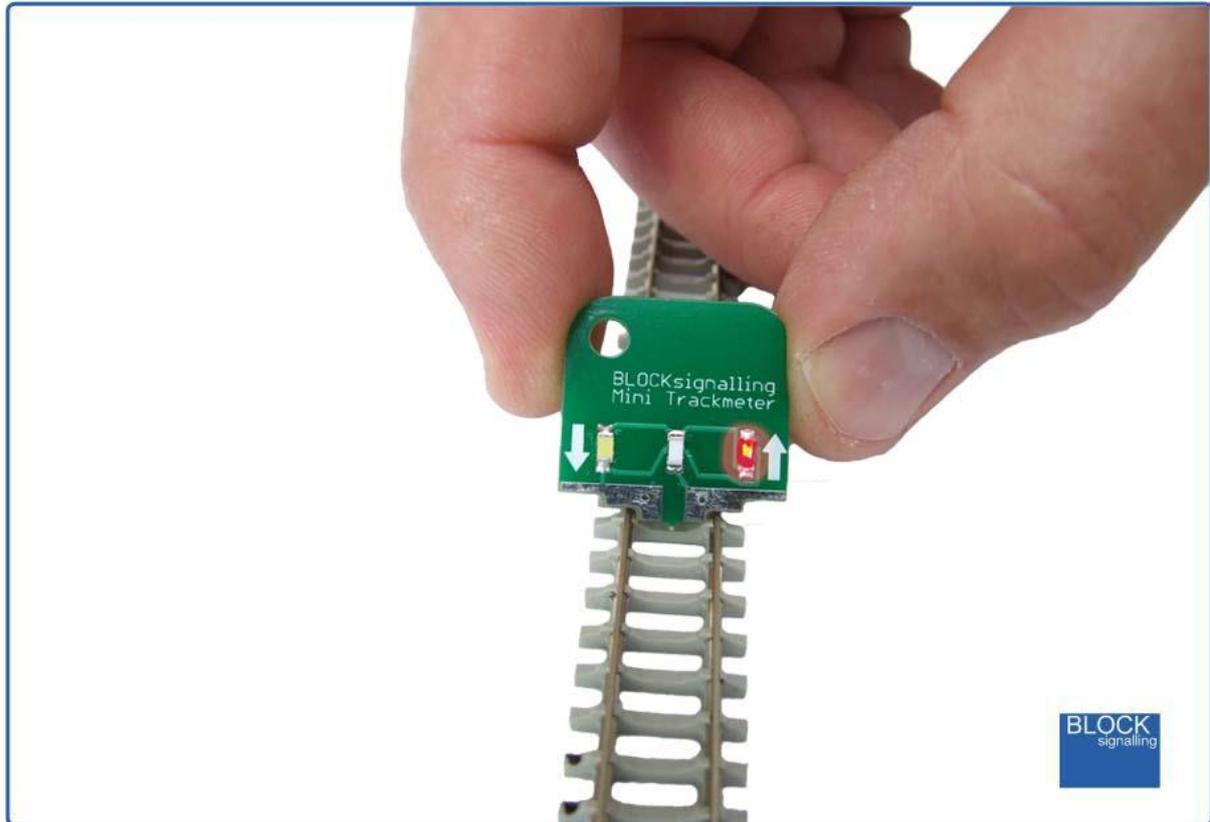
If you are still having problems, place the locomotive in the centre of the track and set the time control fully anti-clockwise and the speed control fully clockwise. The locomotive should move forward and reverse, changing direction once per second.

Now increase the time setting and the train should move forward and reverse with a greater time between reversals. You may want to reduce the speed setting slightly.

If the time is now increased so the train can completely cross one of the diodes at the end of the line, it should stop. If it doesn't, it is likely the motor connections inside the locomotive are incorrectly swapped, and although the train is traveling forwards, the polarity of the power it is receiving from the rails should really cause it to be running it in reverse.

In the drawings above, when the power is first applied to the module, with the track connections shown, the train should always move from west to east first.

If you want to confirm the track polarity, and the direction the locomotive will travel, then our Mini Trackmeter will quickly confirm the polarity.



If even after following the above you are still having problems, please follow the steps below:

1. Remove all wiring connections to module except the power supply.
2. The power supply positive connection must be to the Vin terminal and the power supply negative supply must be connected to the GND terminal (on modules without these terminals, connect the 12V DC power supply to IN+ and IN-). DO NOT use the output of an existing train controller as this will damage the module.
3. Turn on the power supply, and the red led on the PCB should light. It may flash, this is normal.
4. If the led does not flash, check the power supply is 12V DC and the polarity is correct. If you have a meter, you can check the supply has reached the module by measuring the voltage on the screws of the terminal block.
5. If you think it is a possibility that your power supply is faulty, you can connect a 9V PP3 battery to the terminals (this lower voltage will operate the module, but may not be able to run trains).
6. If the led is seen operating, and flashing at regular intervals, the main logic of the module is operating correctly. Switch off the module, and connect the track wiring.
7. Place a train the centre of the track run and turn on the power.
8. The train should move forward (with the positive rail to the right of the driver). If the train does not move, turn the speed control fully clockwise.
9. The train should run forwards until its wheels cross the track gap and diode. It should stop at this point.
10. If it reverses before reaching the diode, increase the time setting on the module.
11. If it crosses the diode and continues running, check the correct orientation of the diode, and that the track gap is clear of debris. Check also for the correct polarity of the track connections.