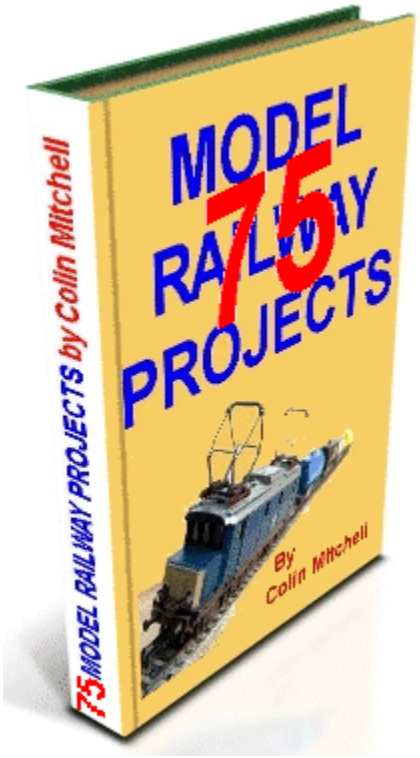


Our other free eBooks,
50 - 555 Circuits
1 - 100 Transistor Circuits **and:** **101 - 200 Transistor Circuits**
100 IC Circuits

For a list of every electronic symbol, see: Circuit Symbols.

For more articles and projects for the hobbyist: **see TALKING ELECTRONICS WEBSITE**

email Colin Mitchell: talking@tpg.com.au

CONTENTS

INTRODUCTION

This e-book presents some interesting projects for Model Railways.
Talking Electronics has produced two books for Model Railway enthusiasts (book-2 is now out of print).
The two books are:
Electronics for Model Railways 1: (**ALL** the projects are .pdf on the website)
Electronics for Model Railways 2: (**most** of the projects are .pdf on the website)
Look on Talking Electronics website in the left-hand column.
Since releasing these two books, we have designed some extra projects and more are being released all the time.
The projects will be presented in this eBook and you will need to come back on a regular basis to see the updates.

Colin Mitchell

If you have DCC **Digital Command Control** on your model railway, or are thinking about using it or starting a layout with this feature, here is a website dedicated to helping you:
http://www.dccconcepts.com.au/

Digital Command Control is a standard for a system to operate model railways so that two or more locomotives can be controlled independently on the same section of track.
Talking Electronics has a simple DCC controller for two trains on the same track and decoders that convert your DC locos to DCC.

NOTE:

Many of the projects and circuit and ideas in this eBook are available from **Talking Electronics** as complete kits, fully assembled, or as components at very low prices.
Talking Electronics has sold over 300,000 kits during the past 40 years and about 100,00 have been Model Railway kits. You can now get many of the kits fully assembled and tested for those who have a layout but not a soldiering iron.
Many of the projects are so new and different and complex that you will not understand them fully. Email: Colin Mitchell and ask for assistance before buying or doing anything.

CHAPTER ONE

THE POWER SUPPLY

Every project needs POWER. Power is ENERGY and it comes from a battery or a POWER SUPPLY.
We are going to describe a POWER SUPPLY that connects to the mains of your house.
A Power Supply provides TWO THINGS. It provide a VOLTAGE and a CURRENT.
The voltage can be oscillating "up-and-down" and we call this ALTERNATING VOLTAGE and it is given the letters AC. The letters AC actually mean ALTERNATING CURRENT and the term comes from the very beginning of supplying energy to houses and the two rival companies had a war. One company supplied DIRECT VOLTAGE and the other supplied ALTERNATING VOLTAGE. The first was called DC and the second called AC.
The voltage at all power points of a house is ALTERNATING and to convert it to DC requires a transformer, a rectifier and a smoothing capacitor called an electrolytic.
We will not be concerned with any of these components but the three values we will be covering is: THE **VOLTAGE** THE **CURRENT** and if the output is **AC** or **DC**.
A POWER SUPPLY plugs into your wall socket and delivers a VOLTAGE, CURRENT and lets you know if the output is AC or DC. A Power Supply can also be called a Wall Wart, Plug Pack, Adapter or "Converter."

A POWER SUPPLY FOR YOUR MODEL RAILWAY

You will need at least 2 or 3 different power supplies for your layout. This is because a layout requires at least to different voltages.
Normally, these are very expensive, buy we are going to show how to use all sorts of "junk" and "discarded" power supplies from computers, shavers, toothbrushes, toys, printers, faxes, mobile phones, old electric drill chargers and anything you no-longer use, and convert them into a power supply.
They will cost you little or nothing and they will work PERFECTLY.
But you need to know what you are doing as there are lots of different options.
The Li-ion 4-cell power supply we will be describing is equal to $100 power supply (from a model railway supplier) and the $35 Power Supply (we will be describing) using 5 Li-ion cells can be used as a BENCH POWER SUPPLY for all your testing and is equal to a $100 product.
And some of the other power supplies we will be describing ill cost you either nothing or just a few dollars.
Once you have a power supply, we will describe the next item on your list a THROTTLE. This is the module that connected between a power supply and delivers a voltage and current to the track to control the speed of the loco.

A typical "Wall Wart" or "Plug Pack" or "Adapter"

Power supplies are also called wall warts, plug packs, chargers or adaptors and must be of the type that is SAFE. In other words, you must be able to touch the output wires and the tap in the kitchen and not get killed.
This is not a joke. If the adaptor is only designed to be used with a fully plastic item, it may be lacking isolation as you cannot touch any of the wiring. This will only refer to very old devices where a simple capacitor was used to convert the household voltage to a situation where the output was fairly low current.
Throw out anything that you are not absolutely sure of its safety-factor.
Now we have a handful of say 10 different, old, unwanted, useless adaptors.

We are going to show how to connect two or three together to produce a voltage suitable for many of our railway projects.

Make 4 piles. The first will have current ratings from 100mA to 500mA.
The next will have current ratings from 600mA to 1 amp
The third pile will be 1 amp and higher.
And the fourth pile is for those adaptors that deliver AC.
From these piles you will be able to make a power supply using two adaptors and wiring the outputs IN SERIES.
Many of the CDU projects from Talking Electronics need an input of 20v DC to 25v DC. The current can be as low as 100mA as the electrolytics in the CDU will take up to 1 amp if the the power supply can deliver this current, but if the available current is 100mA, the CDU will simply take longer to charge the electrolytic.
So, almost any power supply can be used and it is the voltage that is needed so the electrolytic charges to the maximum.
If you have two 12v DC adaptors with a current rating from 100mA to 1 amp, they can be combined together by connecting the output wires IN SERIES. If one adaptor is 100mA and the other 1amp, they can be combined and all that will happen is the output current will be limited to 100mA. You can even connect 3 adaptors in series to get a total voltage of 25v.
This is one way to use low-output-voltage adaptors to power the CDU project on your model railway.
Some adaptors are only 3v to 4v to 5v and they can all be combined.

It is difficult to combine AC adaptors as the voltage from each adapter is rising and falling and if the rise-and-fall from one is not identical to the other, the output voltage will be unknown. You can try connecting two in series and see if the voltage and current is as expected.
AC adaptors are very uncommon. In general you can expect the output to be DC.

USING ADAPTORS IN PARALLEL

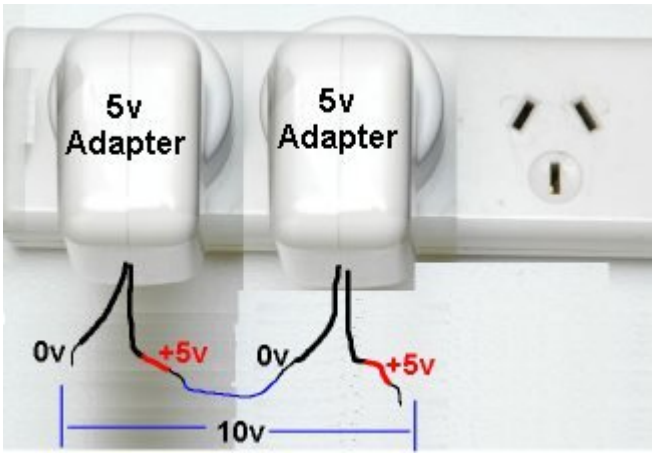
You can also connect adaptors in PARALLEL. This involves connecting the negative output of one the the negative of the other and the two positives together.
Ideally, the output voltage of each adaptor should be the same as this will equalise the load-sharing.
But many adaptors have a high output voltage that drops as the load is applied.
For instance a 12v 500mA adaptor can be as high as 17v on no-load and this voltage will drop to 12v when 500mA is flowing.
The other adaptor may be 14v on no-load and 12v when 500mA is flowing.
These two adaptors can produce a 12v 1 amp power supply **ONLY IF** the actual sharing between the two is **EQUAL**.
It is pointless placing a 12v and 5v adaptor in parallel as the 5v adapter will never deliver any current.
The two adapter share 50:50 when the output voltage is exactly the same. This will never be the case but no damage will be done as each adapter has a diode on the output that prevent one adapter passing any current to the other.

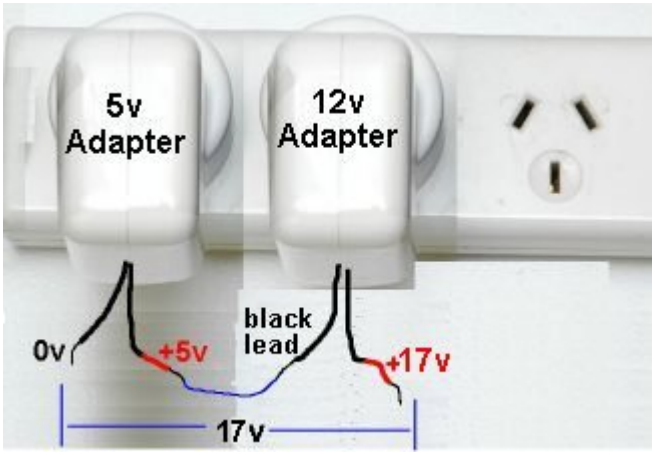
This is a good way to use up the box of old adapters.

Here is a typical 18v power supply for a model railway. This is the ideal supply, but it is expensive and our aim is to show how to produce the same output voltage by using much cheaper items (Plug Packs etc.)

USING ADAPTORS IN SERIES

Here are two Plug Packs connected in series:





You can connect any TWO or THREE together and the output voltage will be the sum of all the voltages and the current will be determined by the lowest current of the 3 adapters.

This is very handy for CAPACITOR DISCHARGE UNITS as they need a voltage of approx 16v to 25v DC to fully charge the capacitors.

If you do not have any old Plug Packs, you can buy new ones on eBay for a few dollars.

You can buy 1Amp or 2Amp Plug Packs.
You will need:
1 x 12v adapter and 1 x 5v adapter for a **THROTTLE**.
2 x 12v 1Amp adapters for **a Capacitor Discharge Unit**.
Total of 4 Plug Packs.

Here are some examples:

5v 1Amp $2.00 posted

DC12V 1A Adapter $2.50 posted

THE BEST ADAPTOR:

The best DC adapter for all the CDU modules is a 24v or 30v supply made from two 12v

adaptors in series of three 10v adaptors in series.
If the CDU module has an on-board regulator, the 30v supply is the best as it will charge the electros to a maximum of 27v.
For all the other CDU modules, you should use two 12v adaptors in series and the electros will charge to about 23v.

THE ALTERNATIVE TO A WALL WORT

Because a Wall Wort producing 13v AC or 27v DC is fairly difficult to obtain (almost impossible) Talking Electronics has produced a number of CDU modules that accept almost any voltage (AC or DC or DCC) from 9v to 15v (either AC or DC) and the on-board voltage generating circuit will produce an output of exactly 27v DC.
The latest module to have this feature is **JIM's CDU MkII** and it has a mini trim pot to adjust the output voltage from 13v to 27v DC to cater for all different types of solenoid points.
This module has on-board switches to control the position of the point and each module is designed to be connected to a **single** point or **two** or **three** points that ALL need to be activated AT THE SAME TIME. You can see the project **HERE**.
This is just one way to get around the problem for the moment, but at some point in your plans to produce a large layout, you will need a POWER SUPPLY. You can spend a lot of money on a POWER SUPPLY but Talking Electronics is always aiming to show the cheapest and best way to get something at the lowest cost.

Let's look at what we are talking about:

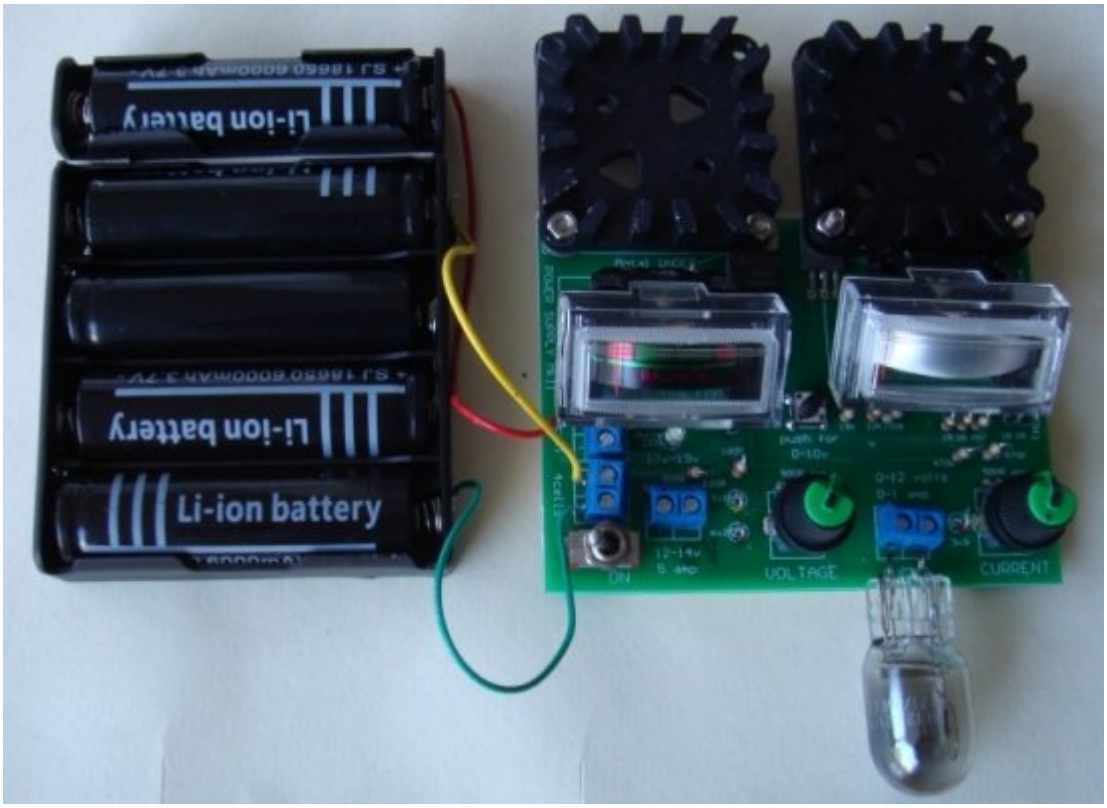
BENCH POWER SUPPLY

A **Bench Power Supply** is the name given to a power supply that looks like the following images:

They come in all sorts of arrangements and offer current limiting and output voltages from 0v to 35v (or higher) at 1 amp to 10 Amp or more.
But these cost a lot and you can build a similar "instrument" (a piece of test gear is called an INSTRUMENT) for less and since it will be "out of a case" you will be constantly reminded of how it has been put together.

The following project is a 0v to 12v **BENCH POWER SUPPLY** with current limiting and has an output of 1 amp. This is sufficient for all types of testing and you can increase the values by referring to the circuit.
The whole idea is to create projects at the lowest cost and have them open for viewing so you can remember how they were assembled.

Here is a set of 4 Li-ion cells. Just use the 4 lower cells in a 4-cell carrier. The top cell is just to increase the voltage slightly so the project will produce slightly more than 12v at 1 amp.

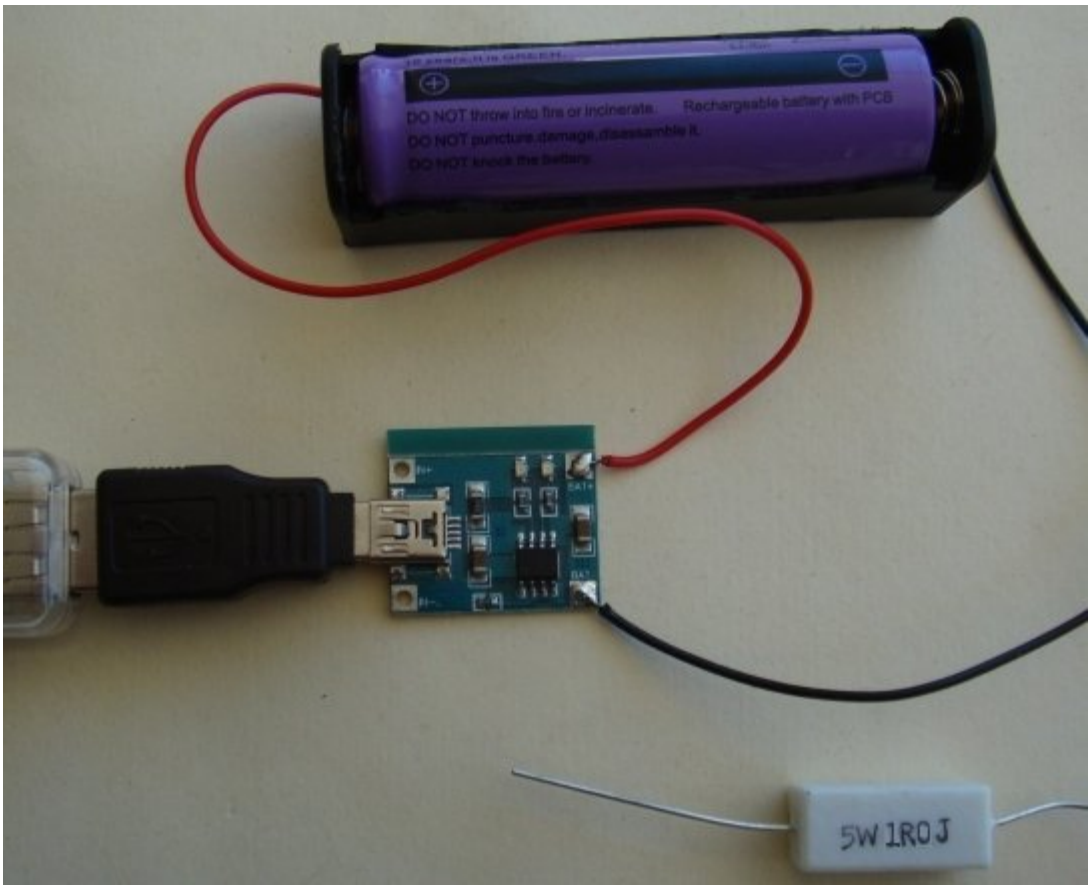


You can buy Li-ion cells for about $2.50 each on eBay. They have a capacity of about 2 Amp-hour to 3 amp-hour.

The 4-cell carrier can be bought on eBay for about $2.50

The following 4-cell charger can be bought on eBay for about $3.50.
This will charge the cells at about 70mA to 150mA and it will take about 24 hours to fully charge a depleted set of cells.

The charger below will charge a single cell at about 500mA to 700mA and connects to your USB port on a laptop. You can only charge one cell at a time with this arrangement.



The 1 ohm resistor will discharge the cell quickly. The cell voltage must not go below a minimum voltage of 2.8v. You need to place a voltmeter across the resistor while discharging to make sure you do not discharge the cell below its recommended minimum. The module in the photo charges the cell quite quickly and at 4.2v the cell is charged to 90% (or more) and the circuit turns OFF.
You must use a charger that turns OFF when the cell is charged as this type of cell cannot be left charging on a "trickle charger" as the cell will produce internal "whiskers" and it will get damaged.

More details of the project shown above can be found HERE. It describes a 1 amp adjustable **POWER SUPPLY** that can be used to power your locos or as a **BENCH POWER SUPPLY** for all your testing.

CURRENT

How much current do you need? That is: how many AMPS do you need?
A small loco takes 300mA to 600mA and you need a **1AMP supply** to make sure the necessary current can be supplied as the motor will take 800mA to 900mA when starting and accelerating and when hauling a number of coaches.
For a DC layout, you will generally only be running one loco at a time and a 1-Amp supply will be sufficient.
The current values mentioned above apply when the supply is 12v.
If the supply drops to say 10v, the current will be less and if the supply increases to 14v, the current will increase by a considerable amount. It is impossible to state the actual values because the current taken by a motor increases and decreases due to the load and this load is not only the velocity of the train, but the acceleration and inclination of the track and also the rpm of the motor as it takes more energy to rotate at higher rpm.

CONCLUSION

You need to buy or make 2 POWER SUPPLIES:
16v to 17v @ 1 amp POWER SUPPLY for a throttle (to drive a loco). (suitable for 1 or 2 locos).
24v POWER SUPPLY for a Capacitor Discharge Unit. (less than 100mA needed)
Cost will less than $15.00 for up to 4 Plug Packs. (see above for details of the Plug Packs you need to buy.
If you build a **Bench Power Supply** (see Power Supply MkII) you will have an adjustable output

voltage (0v to 12v DC) and you will be able to limit the current (from 30mA to 1 amp) so the project you are testing will not be damaged.

When you have the 2 **Power Supplies,** you can decide on the **Capacitor Discharge Units** and the **Throttle** module.

Under NO circumstances should you build a power supply with soldered wires or leads going to the mains or any wiring with bare MAINS connections. One day a child may come and play with your equipment and touch exposed wires and get thrown across the room.
Always use Plug Packs (Wall Warts) or Power Supplies in a professional case. They are called "double insulated" and that means they do not have to have a earth lead. It also infers they do not have a metal case and this makes them extremely safe.

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CHAPTER TWO

THE POINT

Using a motor to control a point

This is PART "A" of our discussion on controlling a point. They are called POINT CONTROLLERS
(see PART "B" to control a point containing a solenoid)

POINTS - TURNOUTS Talking Electronics makes 8 different modules to assist and change and active the points in your layout (to suit different voltages and different situations). That's why you have to read Part "A" and Part "B"

A Point Controller is a "device" or "MOTOR" or "SOLENOID" that changes the point from "ahead" to "Siding."
The ACTUATING MECHANISM can be double-acting solenoid to move the rails from one position to the other. Or it can be done with a motor and gearbox or a micro motor and gearbox or a SERVO or even a LINEAR ACTUATOR. These all come in different sizes and at different costs. That's why there is a number of different projects.
This section does not cover the SOLENOID POINT. See **Chapter Three** to control a SOLENOID POINT with a CAPACITOR DISCHARGE UNIT.

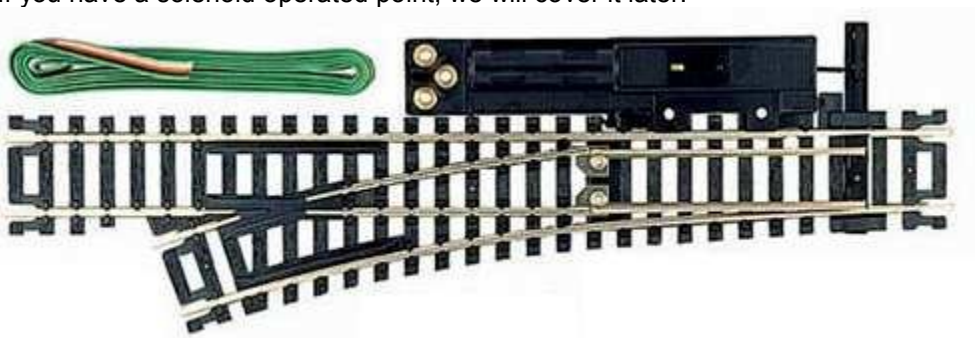
All layouts need a point or lots of points so you can make an impressive layout and have the the trains leave and enter the main line and provide shunting yards and loops and interconnecting lines.
There are so many choices for a point and so many different expenses that we have simplified everything and created the best control modules on the market at the lowest cost for all the different situations.

WHERE DO YOU START?

Start by buying the cheapest left or right hand point FOR MANUAL OPERATION. This is the version we will convert to either remote or automatic operation.

This is a MANUAL POINT

If you have a solenoid operated point, we will cover it later:

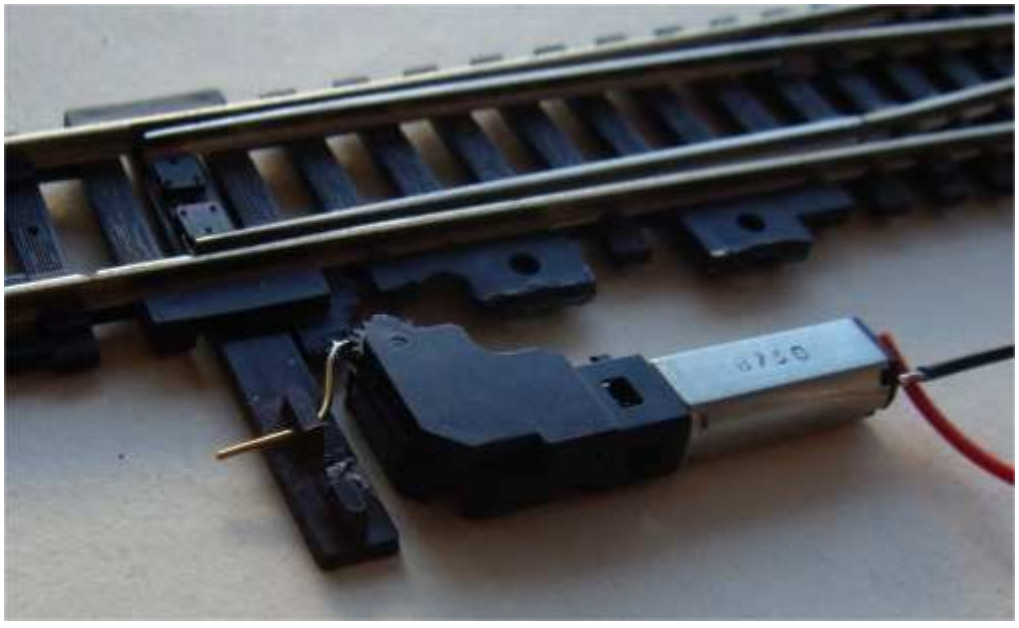


This is a point with a solenoid actuator to move the rails. We will cover this later in the article.

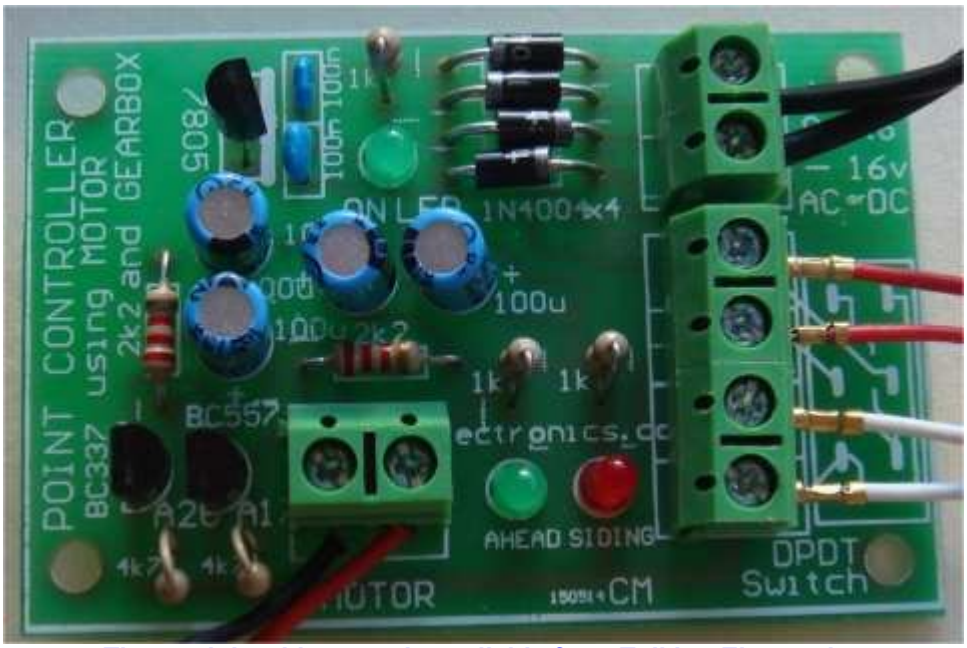
CHOICE NUMBER 1:

This module converts a manual point into a remotely controlled point.
There are a number of modules available and the differences will be cost, size, and fast or slowing changing of the point.
The first choice is: **POINT CONTROLLER using 3v MOTOR and WORM GEARBOX for $20.50.**
Click Here to order.

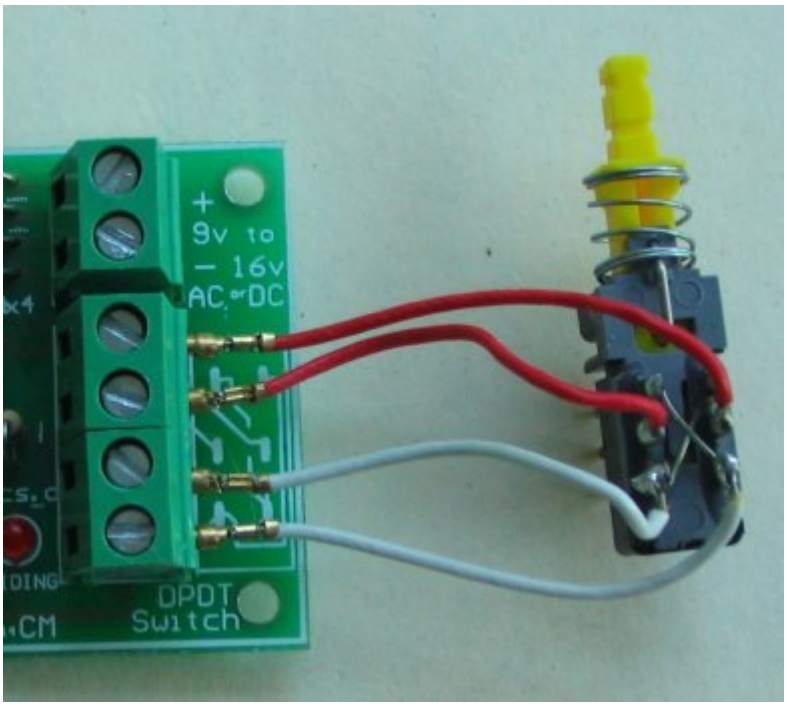
We connect a motor and worm gearbox as shown in the following image to the actuating lever on the point:



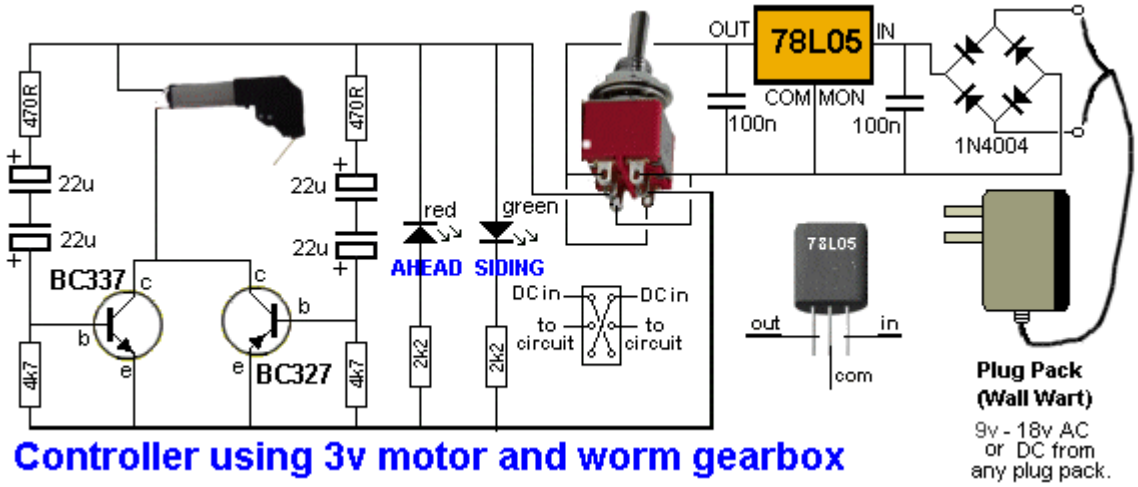
The following image is the module that controls and limits the motor's operation. It allows the motor to be connected to a 9v to 16v AC or DC supply.



The module with motor is available from Talking Electronics for $25.00 including postage.



You get micro motor and module and DPDT push-push switch and the position of the point is shown on the red and green LEDs on the module. The movement of the point is fairly rapid. There are other modules with slow movement.



This is the circuit using 3v micro motor with worm gearbox.

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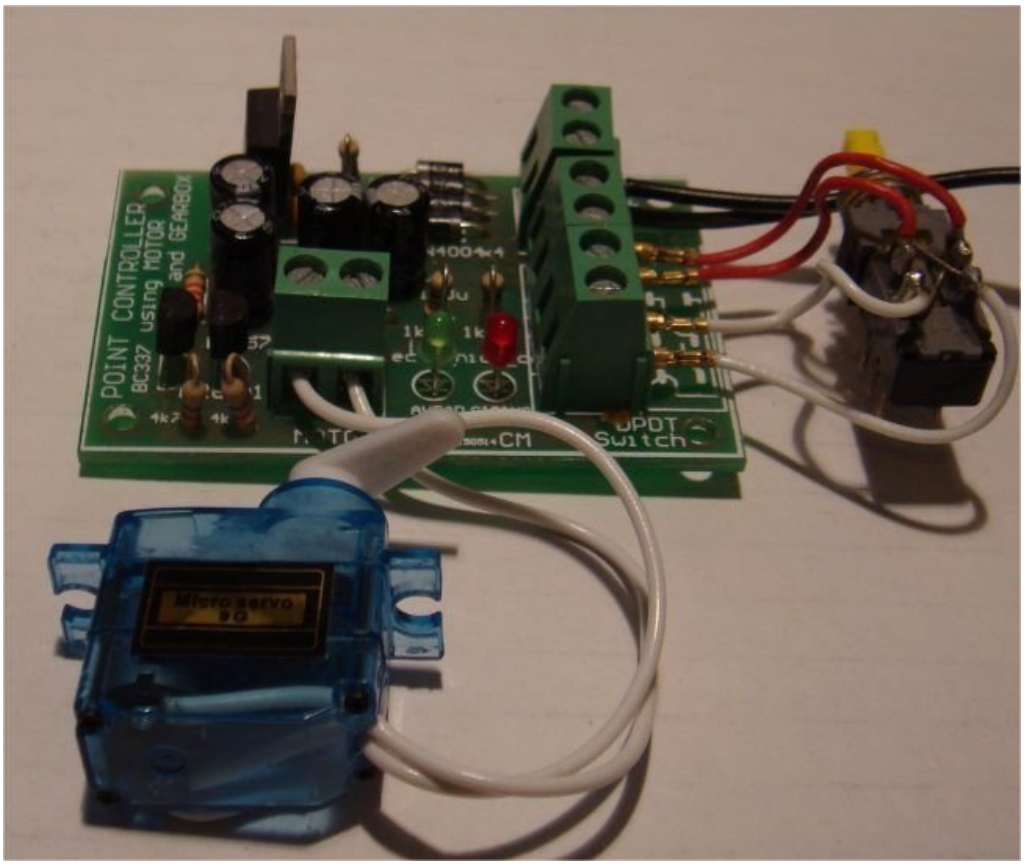
CHOICE NUMBER 2:

In place of the micro motor and worm gearbox shown above, you can use a converted servo, as shown in the following image. The servo is converted to a MOTOR and GEARBOX.
This module is called **POINT CONTROLLER using converted SERVO for $19.00 plus $6.50 postage.**
Click Here to order.



The activating module comes with a push-push switch and knob, that clicks when pushed and unclicks when pushed again.
The module limits the output arm of the servo to less than 45 degrees and the position of the point is shown on the red and green LEDs. A length of gold wire is included for the linkage.
The movement of the point is fairly rapid. There are other modules with slow movement.

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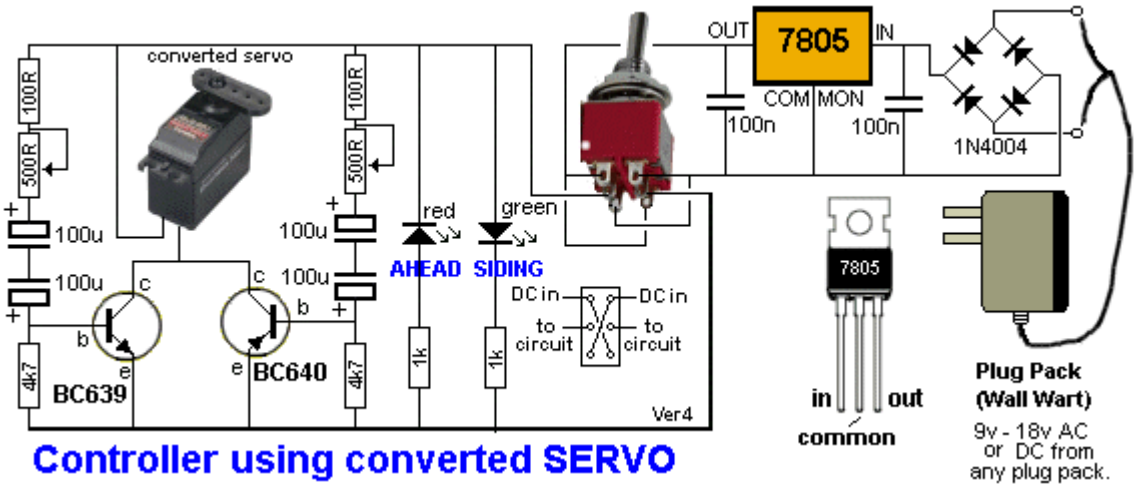
CHOICE NUMBER 3:

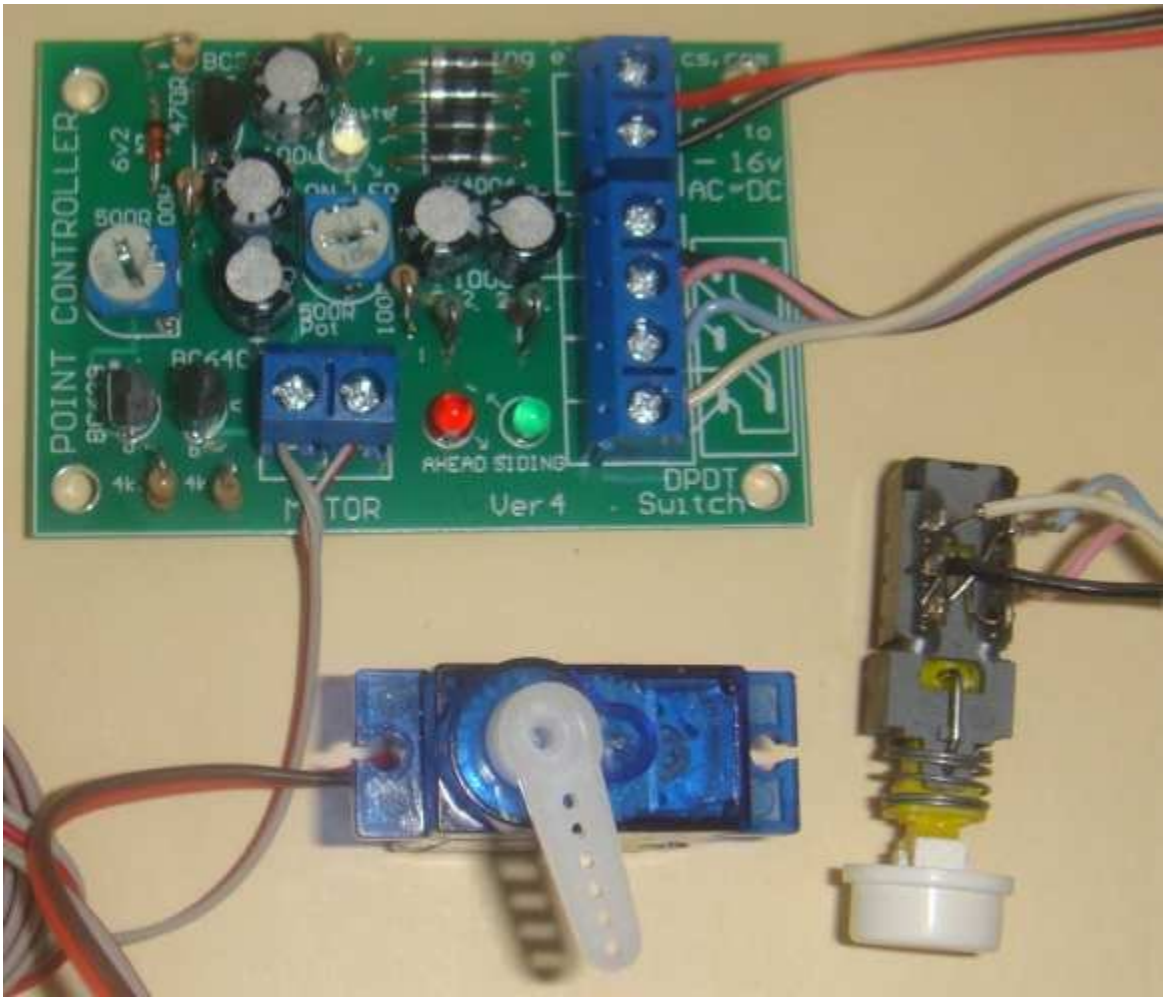
This module is identical to Choice Number 2, but has 2 mini trim pots to adjust the amount of travel of the arm on the servo..

This choice is: **POINT CONTROLLER using converted SERVO ver 4 for $21.50.**

Click Here to order.



The Printed Circuit Board has 2 x 500R mini trim pots to adjust the amount of travel of the output arm.



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CHOICE NUMBER 4:

This module is called **POINT CONTROLLER using 555 IC for $18.00 plus $6.50 postage.**
Click Here to order.
The on-board toggle switch changes the point via a servo **fairly slowly** and this is the main difference from the other modules. The servo and gold-wire linkage are included with the module. The module outputs a PWM signal to the servo to provide a limit-to-rotation in both directions and this is adjustable on the new version via mini trim pot (not shown on photo).

The on-board LEDs show the position of the point.

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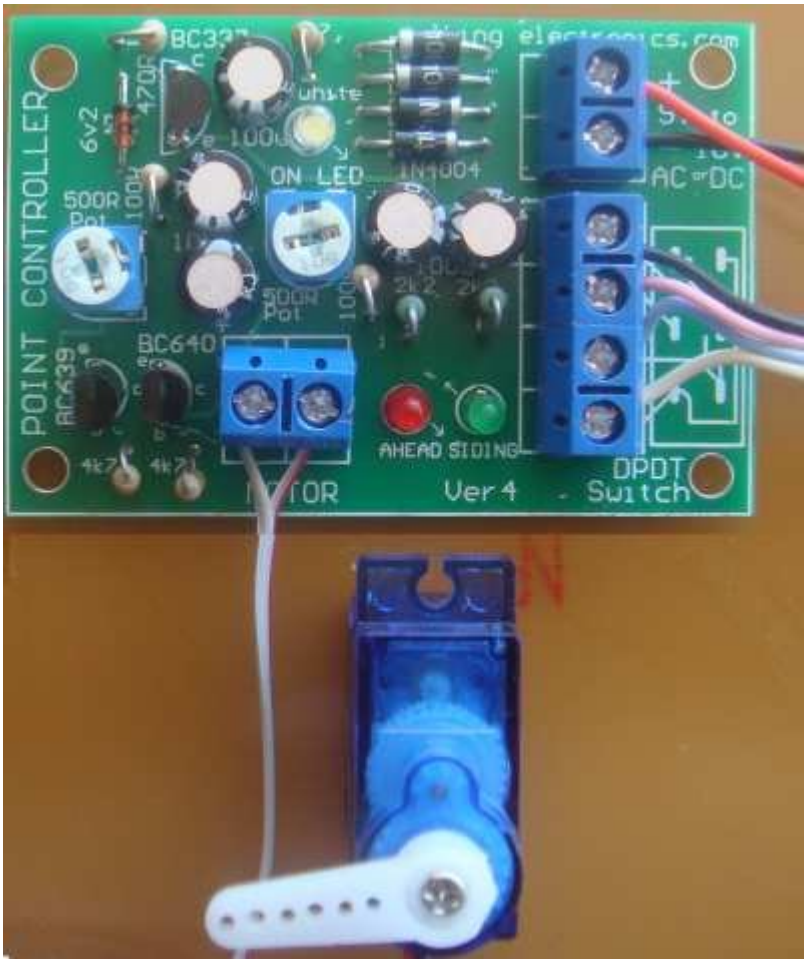
CHOICE NUMBER 5:

This module is called **POINT CONTROLLER using 555 IC with mini trim pots Ver4** for $20.00. (plus postage $6.50). **Click Here to order.**



Click Here to order.
This is the latest version with mini trim pots to adjust the end positions of the **converted servo.**

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CHOICE NUMBER 6:

If you want the servo to move slowly to produce a realistic effect, we have a module called **JIM's SLOW SERVO for $xx0.00** including module, servos and extension lead.
Click Here to order. This module allows the servo to move very slowly. (PC Boards are currently being produced)

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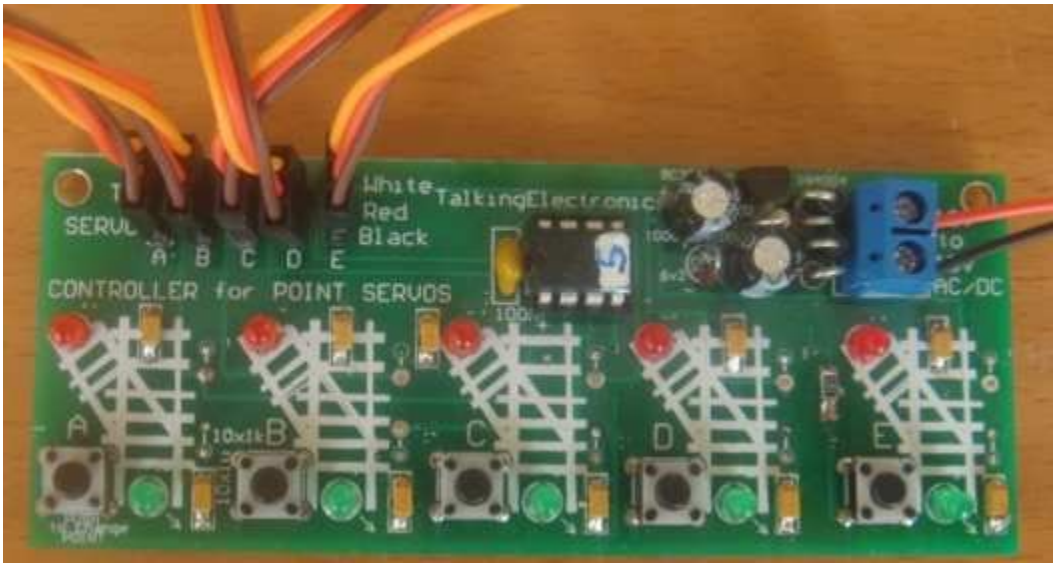
CHOICE NUMBER 7:

If your layout has a number of points that need controlling, we have a **5 SERVO Controller** module that controls 5 servo's separately with very slow action.
This module is called **5 POINT CONTROLLER for $45.00** including module with microcontroller, 5 servos and 5 extension leads. The servos provided with this module are the small 9g version as these servos are guaranteed to work very very slowly from a particular manufacturer. The servos are $2.50 each and the extension leads for the servos are $1.50 each. You can also get aluminium brackets to hold the servo under your layout for $2.50 each.
The **5 POINT CONTROLLER costs $20.00** if you have your own servos, but remember we test all modules with the very small servos before posting, to make sure they all respond to the PWM signals. The new module uses a PIC16F628 microcontroller as it has more input/output lines and the on-board LEDs show the position of each point.
Click Here to order.



The on-board tactile buttons need to be pressed for about 1/2 second for the program to recognise the button and activate the servo to set the point to the correct position. You need to set each point so that the PC board reflects the correct position of the point. Do this will all 5 points and you are ready to drive the loco.

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SUMMARY

A manual point costs between $15.00 and $25.00. (you can buy these from any model railway shop) The modules above cater for all sorts of different requirements (such as speed of activation, cost, 1 or 5 points) and this means a remotely activated point can be added to your layout for as little as $40.00

But there are other options, so keep reading.
And there are a number of options for a point that has SOLENOID OPERATION - and this is covered next.

to Index

CHAPTER THREE

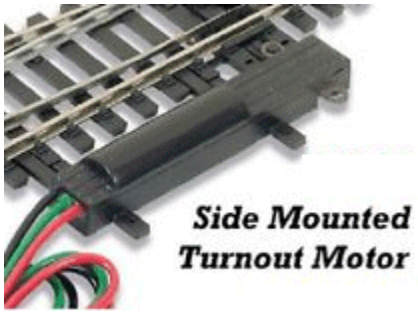
THE POINT

Controlling a SOLENOID point

This is PART "B" of our discussion on controlling a point. This Part uses a Capacitor Discharge circuit to control a solenoid on your point to prevent it "burning out."

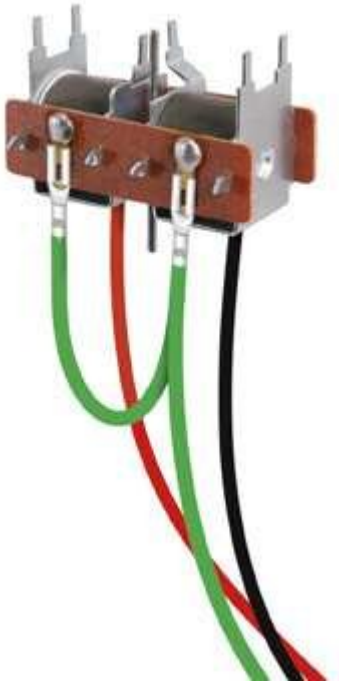
(see PART "A" to control a point with a motor)

The most common type of point motor is a **solenoid** that moves the rails from one position to the other.
It is also called a TURN-OUT MOTOR:



This is s PL-11 Point Motor

Here is the inside of a PL-11 POINT MOTOR.
It must be activated for less than 1 second.
It was activated for 4 seconds and it MELTED !!
The plastic core melted and bubbled through the coil
and the activating rod is FROZEN. That's what this article is all about.
If you add a CDU module to activate these
POINT MOTORS they will not get damaged.



PECO PL-10 or PL-34 POINT MOTOR
and the 3 wires needed to activate the two solenoids

The SOLENOID Point Motor consists of two coils of wire that alternately pull a metal rod into the middle of the solenoid and at the same time change the position of the point.
It is also called a double-acting solenoid because it will both PUSH and PULL.
The "core" or "plunger" is not a magnet and it will only PULL into a solenoid. The solenoid will accept AC or DC and it can also be called an ELECTROMAGNET.
Because an electromagnet only "pulls," you need two to produce PUSH and PULL motion. It is really PULL-PULL motion. The core only PULLS into a solenoid.
That's why you need 2 coils.
But the problem is the coils have very low resistance.
The resistance of the coil is about 4.5 ohms for some types and 11 ohms for others and when connected to 12v, the current will be nearly 1 to 3 amps. They must only be activated for less than half a second and if the 12v is connected for more than 10 seconds, the plastic case will start to smell and melt. In a few more seconds the solenoid will be completely damaged. The photo above was damaged in 4 seconds !!
To prevent this from occurring, you need an electronic module that delivers the current for a very short period of time (so that nothing gets warm).
This module is called a **CAPACITOR DISCHARGE UNIT** and it contains 2 or more 1,000u (or 2,200u or 4,700u) electrolytic capacitors that deliver the required energy.
These capacitors get charged slowly and when they are fully charged, you can press a switch and operate the point. It does not matter how long you hold the switch because the capacitors are drained in less than a second.

If you operate them from the 12v train supply or the 16v AC supply from the train transformer, some will take more than 3 amps and produce a more than 30 watts of heat. This is equal to a small soldering iron and it will quickly melt the plastic case.
If you already have a PASSING SWITCH or a "spring return toggle switch" with a centre-off position, it will work perfectly, but if you have visitors working the control panel, they may leave the switch ON or change it very slowly and it can cause the solenoid to heat up.
To prevent any of these catastrophes, we have designed a number of CDU - CAPACITOR DISCHARGE UNITS to operate the points safely. These CDU modules are connected between the
PASSING SWITCH and the power supply to give you double protection.

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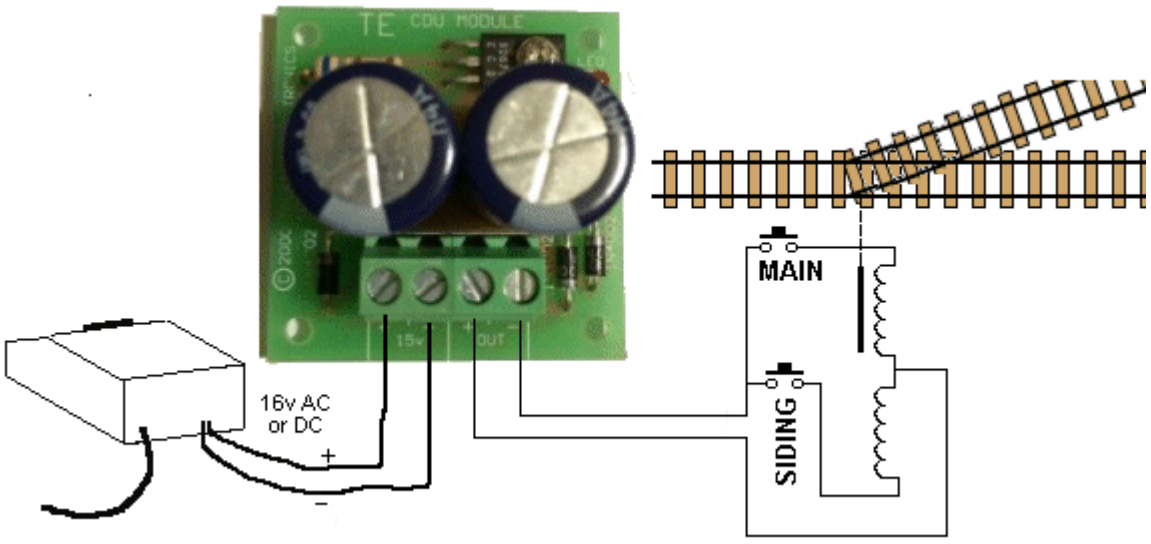
CHOICE NUMBER 8:

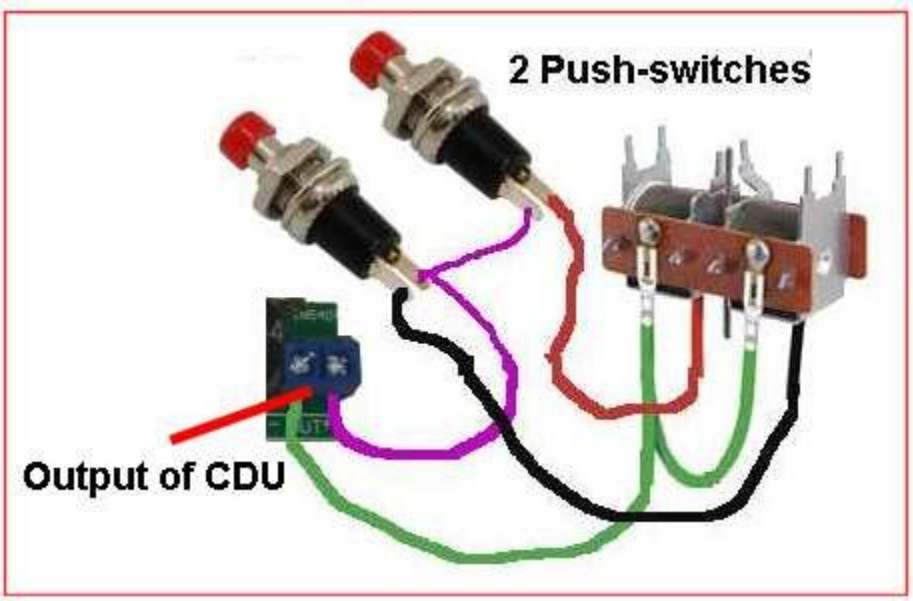
The simplest and cheapest **CAPACITOR DISCHARGE UNIT MkIIB** is shown in the following image: **CDU MkIIBM $14.50 plus $6.50**
Click Here to order.

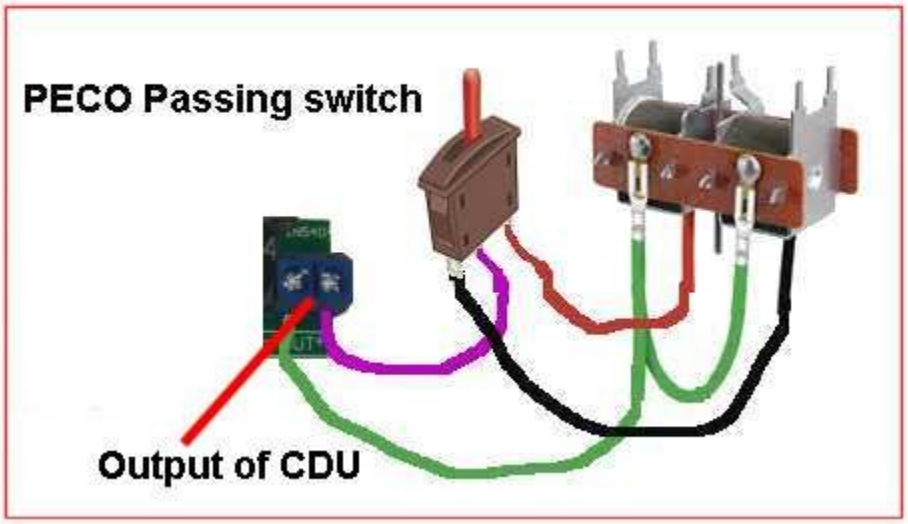
This is CDU MkIIBM $14.50 plus $6.50 fully assembled

The screw terminals make it easy to fit to your layout.
Here are the connections to the Power Supply and point:

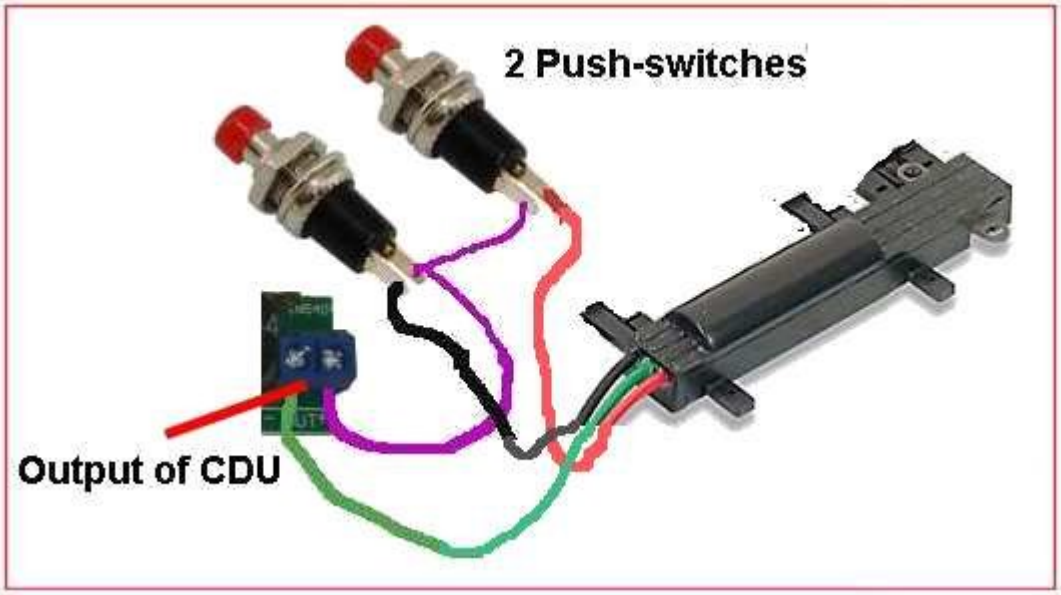


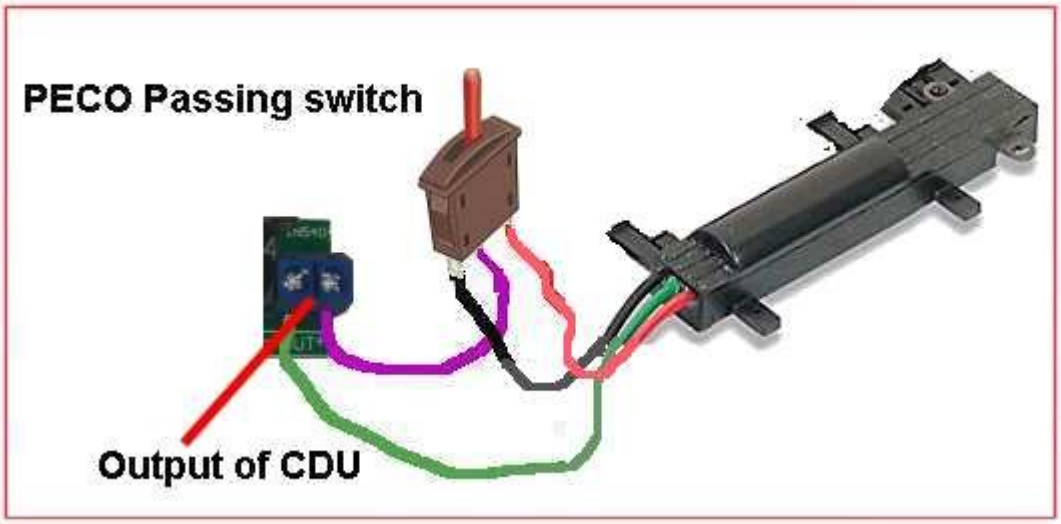
The two push switches in the wiring diagram above are also shown in the two following diagrams:



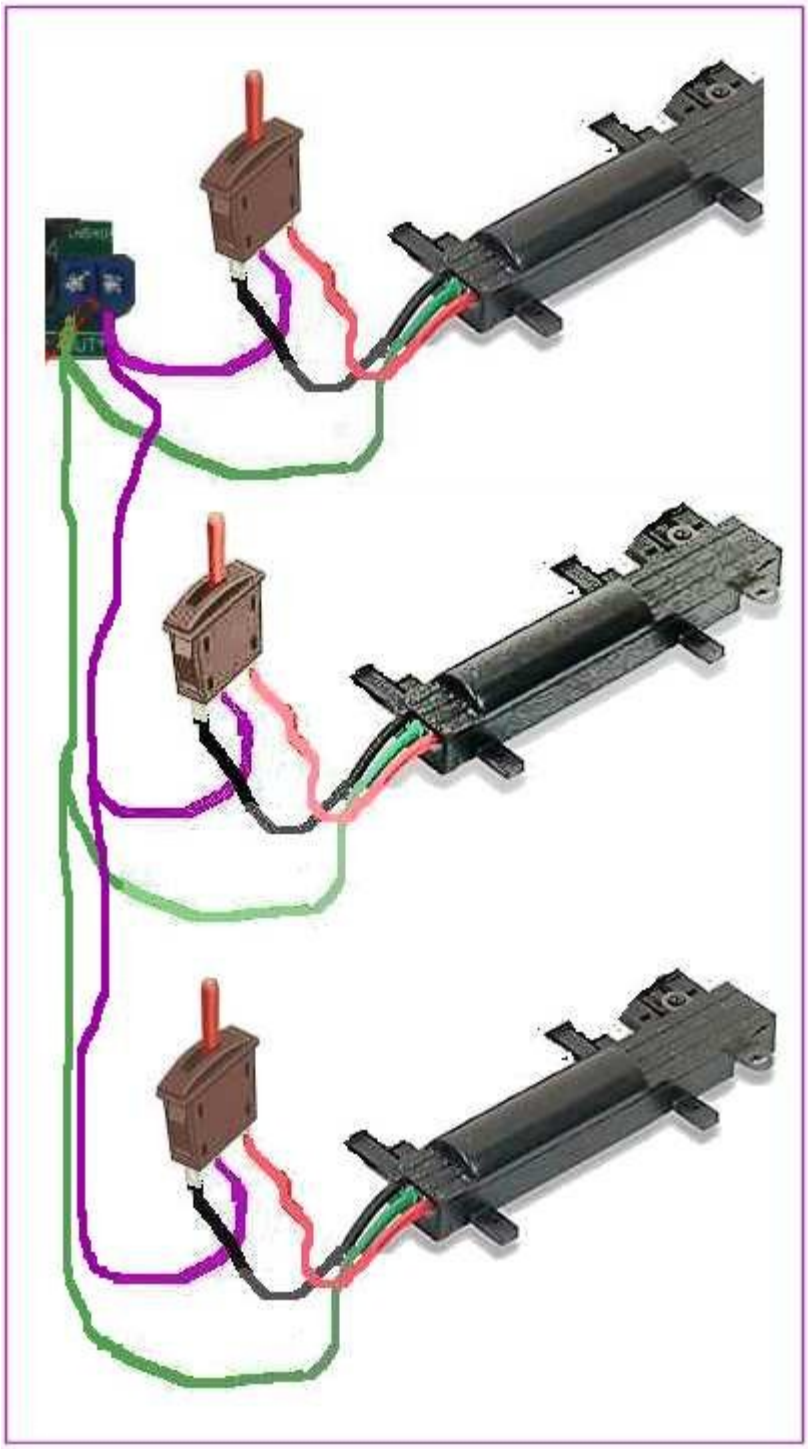


The PECO Passing switch only makes contact when the red lever touches and pushes the contact. This occurs when the lever is in the "12 O'Clock" position and you must move it past this position to prevent the point motor "burning-out."





The green wire is called the COMMON

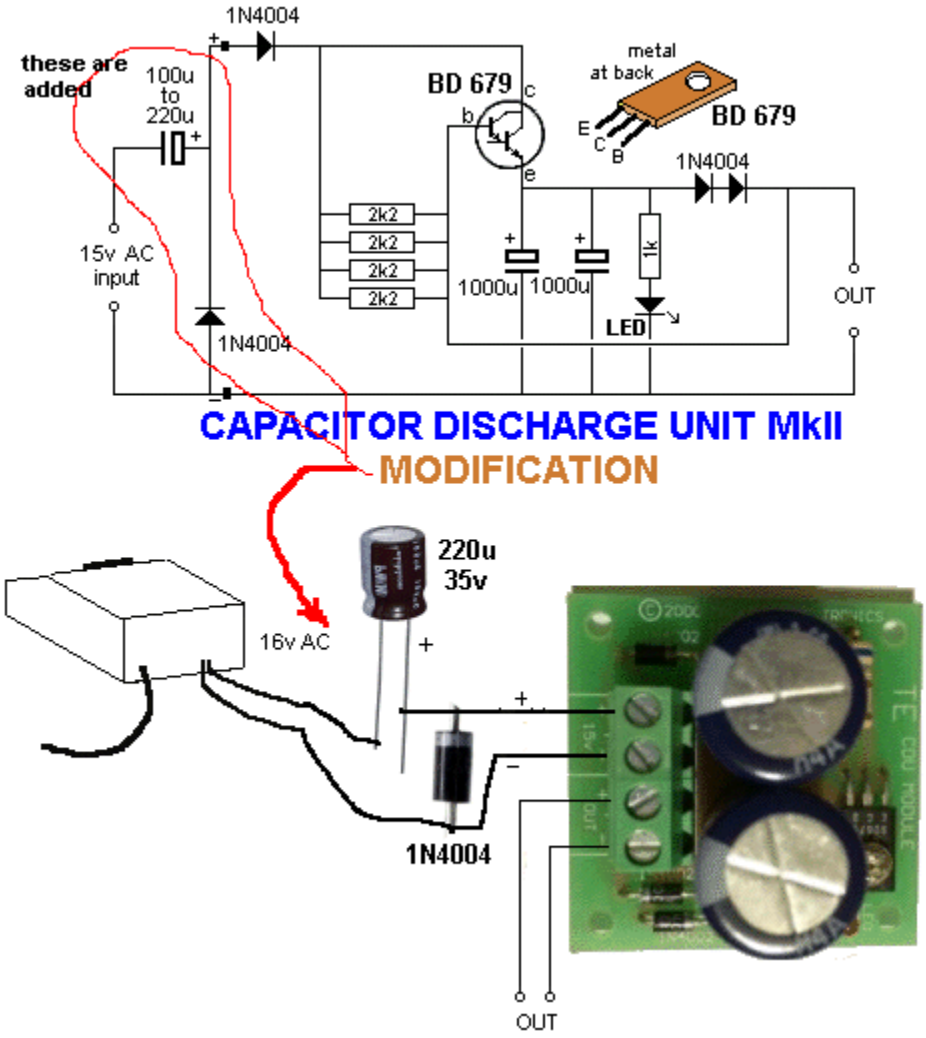


A single CDU can be used to operate 2 or more point motors provided you allow a few seconds been each activation, for the CDU to re-charge.

Our CDU module fits between the Power Supply and the switch or switches to a **SOLENOID POINT MOTOR**. It is designed to deliver a short pulse of energy to the solenoid to change the position of the point. A **Passing Switch** will deliver a pulse of energy but if it gets stuck in the mid-position, our CDU will prevent the point motor "burning out."
If you do not include a **Capacitor Discharge Unit**, and you activate any type of switch for more than 10 seconds, the flow of current will heat up the solenoid and "burn it out." The CDU prevents this.
To go over it again, the CDU module can be used with a **PECO PASSING SWITCH** so that if the lever is moved too slowly or kept at "12 O'Clock" too long, the CDU will only allow a short pulse of energy. And you have **double protection !!**

If your transformer does not supply 15vAC to 16vAC, you can increase the input voltage by adding a 100u to 220u electrolytic and 1N4004 diode to the input to create a voltage doubling

arrangement. You can also change one or both the 1,000u electrolytics for 2,200u. This will deliver a much larger pulse to the point-motor and guarantee operation.



By adding one power diode and 220u electrolytic, the 16v AC input will be "doubled." You need to ask for 35v electrolytics before you do this as the final voltage on them will be very close to 30v to 35v DC

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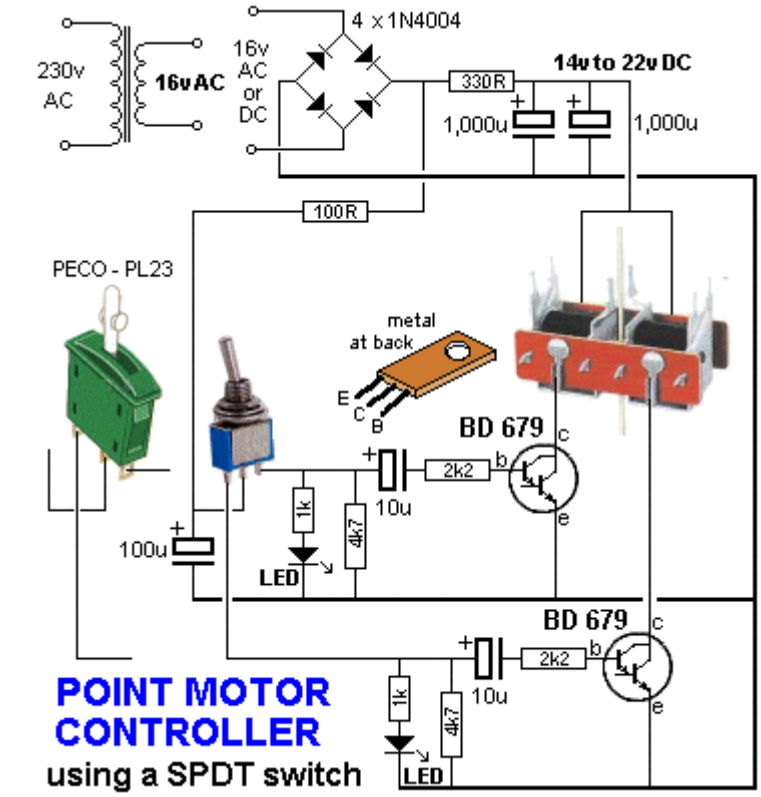
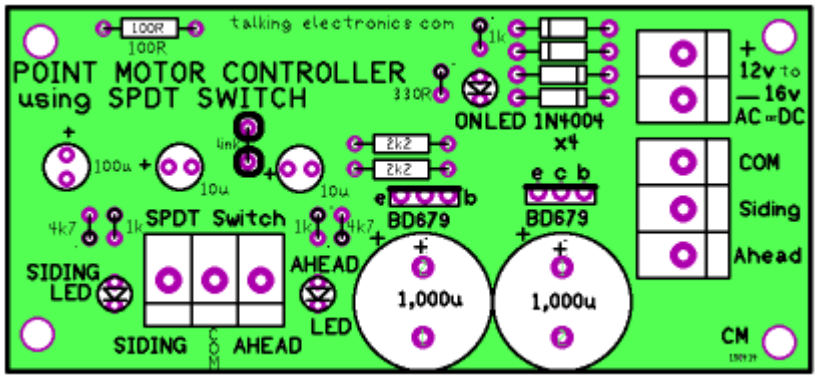
CHOICE NUMBER 9:

If you want to use a **toggle switch** and 2 LEDs to show the position of a point, this **POINT MOTOR CONTROLLER** Module offers these features.
POINT MOTOR CONTROLLER $13.50 plus $6.50
Click Here to order.





See the full article: HERE

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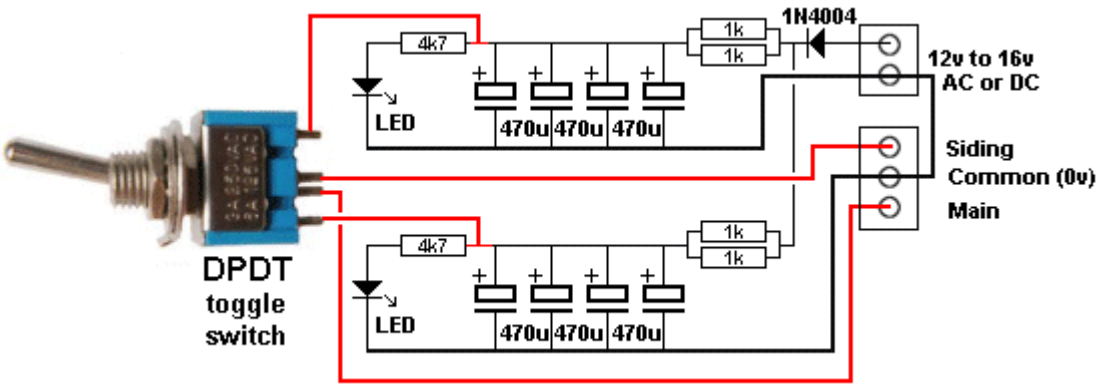
CHOICE NUMBER 10:

Talking Electronics has an **In-line version** that takes up less space on your console. This **In-line CDU** module has two LEDs that show the position of the point. It is fitted to your control panel and the LEDs show the position of a point. This very handy for a point that cannot be seen from the control area.
The module is very slim and more than one can be placed side-by-side to control all the points in your layout. Each module is connected **directly** to a point.
It is called **CDU In-Line** and costs **$12.50 plus $6.50 postage.** It is shown in the following image:
Click Here to order.



The input voltage needs to be 12v to 16v AC or DC and you may need two adaptors in series to get this voltage. See Chapter 1 for the Plug Packs (or Choice Number 11).

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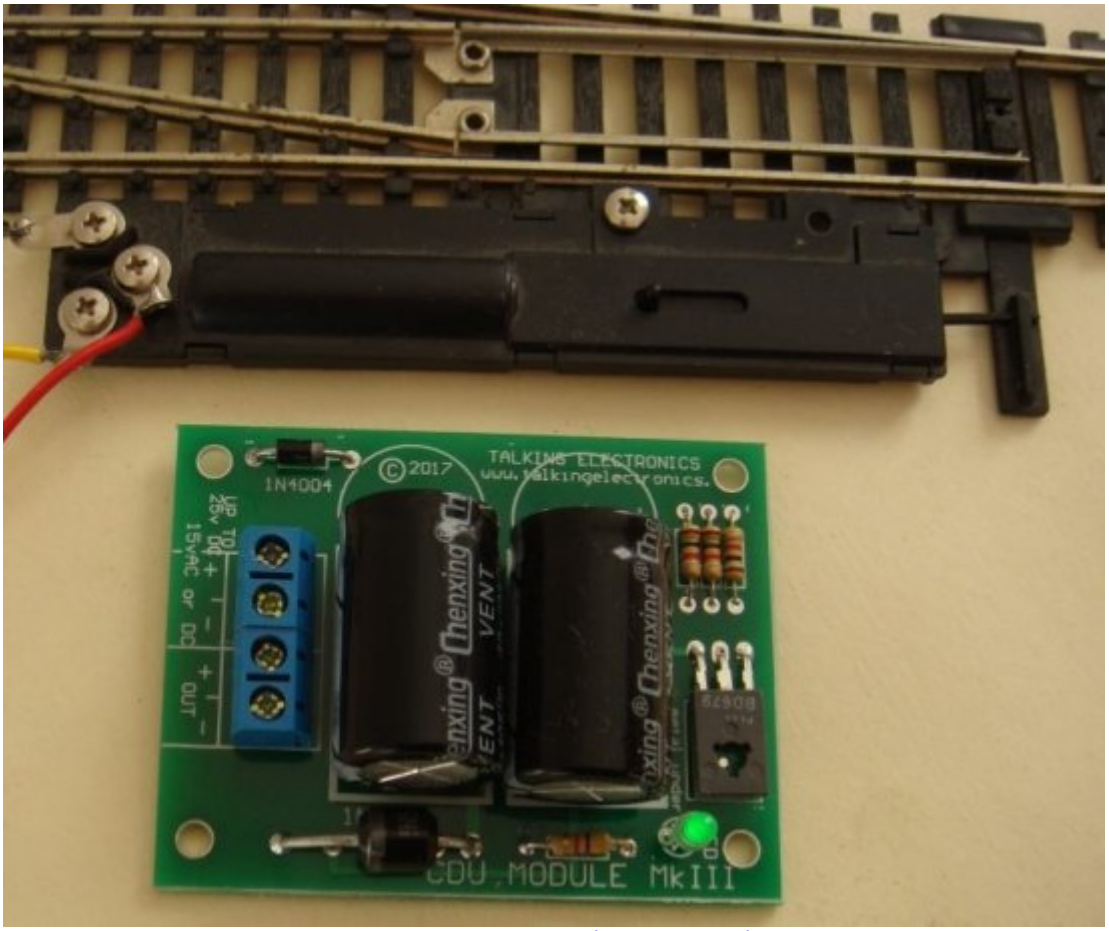
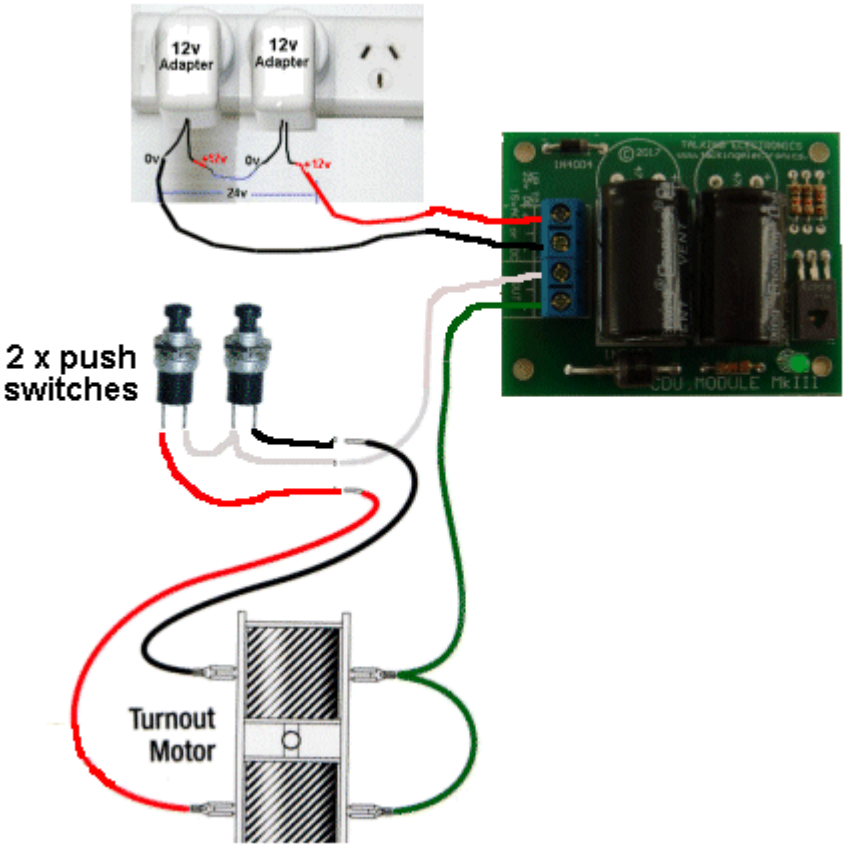
CHOICE NUMBER 11:

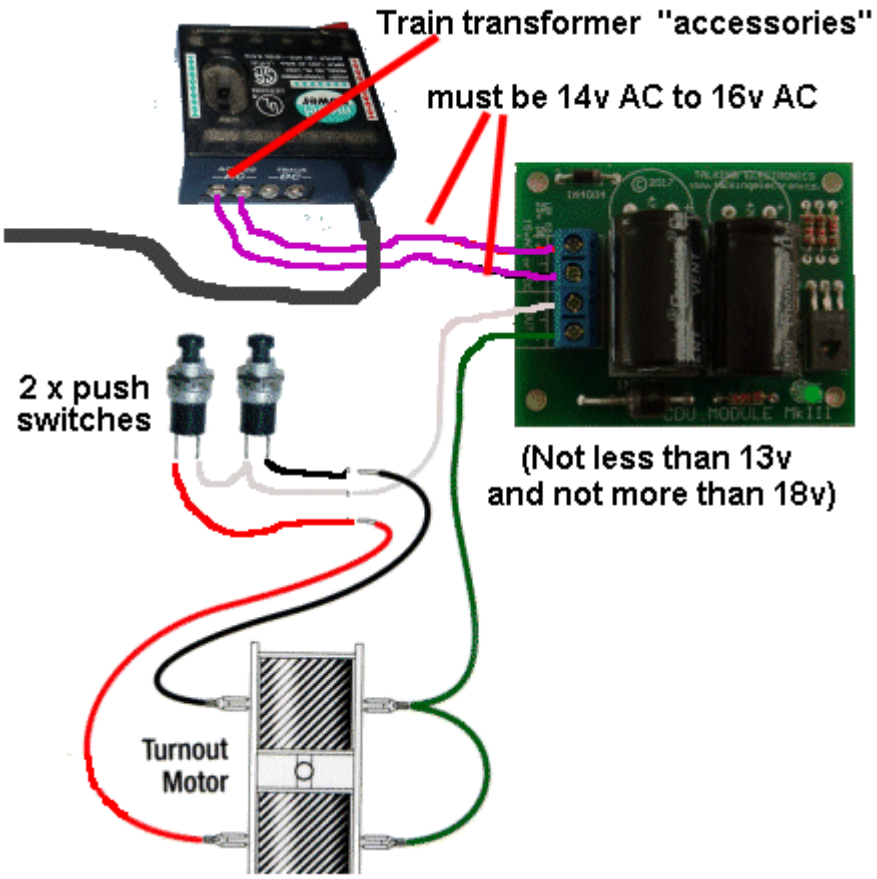
For layouts that need 2 or more points changed at the same time, a larger version is available with 2 x 4700u electro's:
It is **CAPACITOR DISCHARGE UNIT MkIII** and is shown in the following image:
CDU MkIII fully built and tested $16.50 plus $6.50 postage
Click Here to order.



CDU MkIII fully built and tested $16.50 plus $6.50 postage



Connecting CDU MkIII to 24v DC supply



Connecting CDU MkIII to 14v - 16v AC supply

You can use the "accessories" output of a train transformer if it is DC (14v DC to 24v DC) or if the accessories output is AC (14v AC to 18v AC). The module has been tested up to 20v AC but it is best to keep to 18v AC max.

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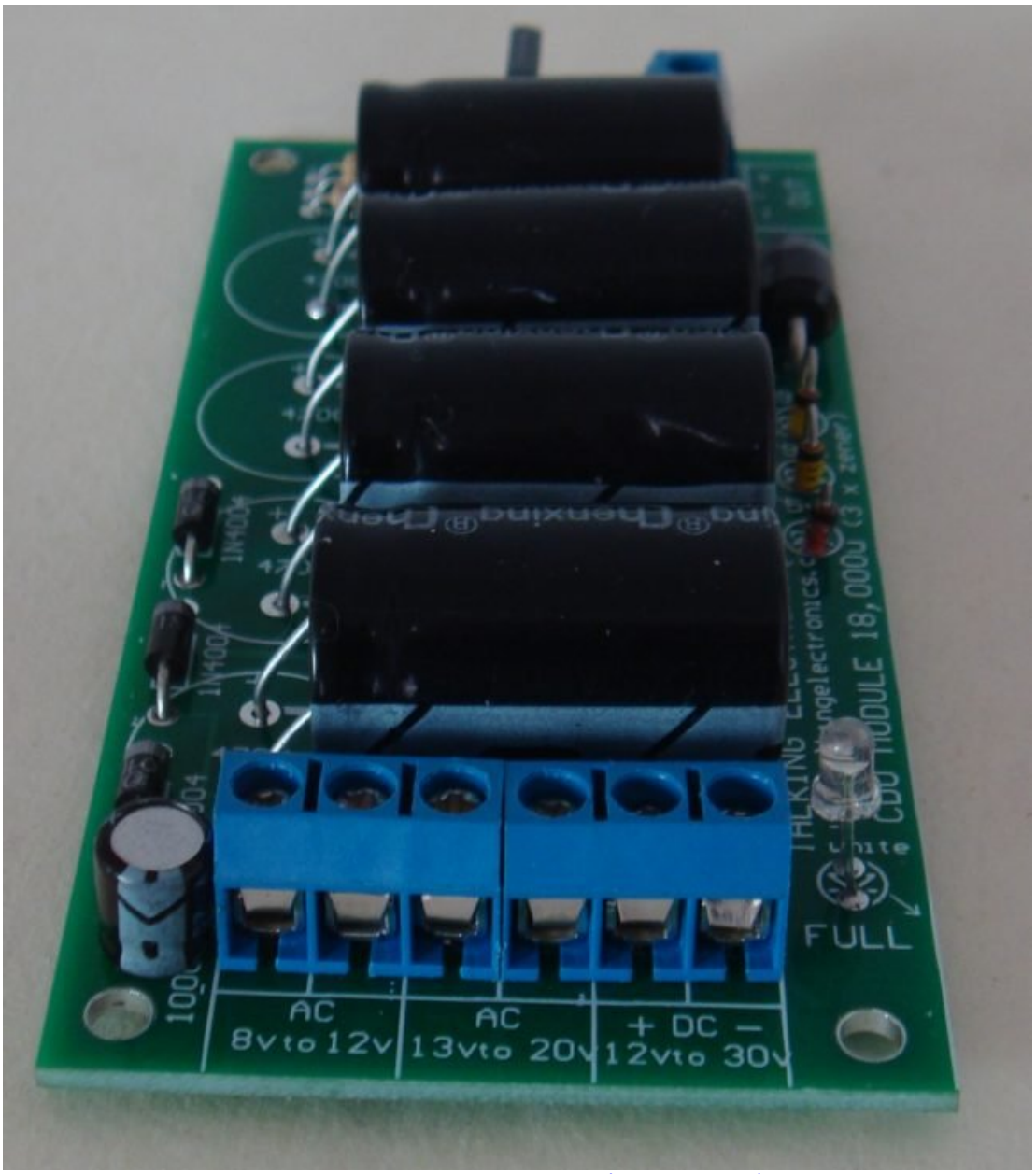
A larger CDU is also available from Talking Electronics, to change up to 8 points at the same time:

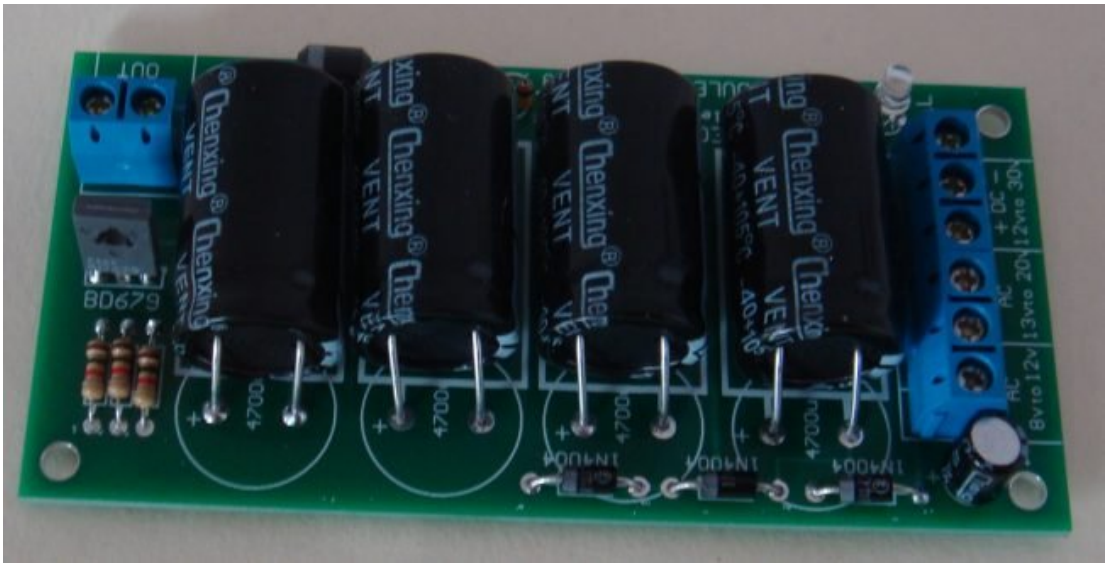
CHOICE NUMBER 12:

It is **CDU 18,000u Flat version** and costs **$18.00 plus $6.50 postage.** It is shown in the following image:

Click Here to order.



CDU Module 18,000 fully built and tested $22.00 plus $6.50 postage



This Capacitor Discharge Unit is easy to connect to your layout with screw terminals.
You need two push switches to change the position of the point. The LED on the board shows the electrolytics are charged.

SPECIAL FEATURES
Input voltage can be AC or DC. But you MUST use the correct set of terminals. It did not work for one customer because he connected DC to the AC terminals. There is a 100u electrolytic on the AC terminals and "it will not let the DC in." The 100u is for a voltage-doubling network at the side of the board as shown in the image above.
Three sets of input terminals are provided.
8v to 12v AC
13v to 20v AC
12v to 30v DC
The project comes with instructions for connecting to a plug pack (wall wart) plus information to connect two plug packs (in series) to get the required voltage.
The CDU 18,000u has zener diode regulation to prevent over-charging.

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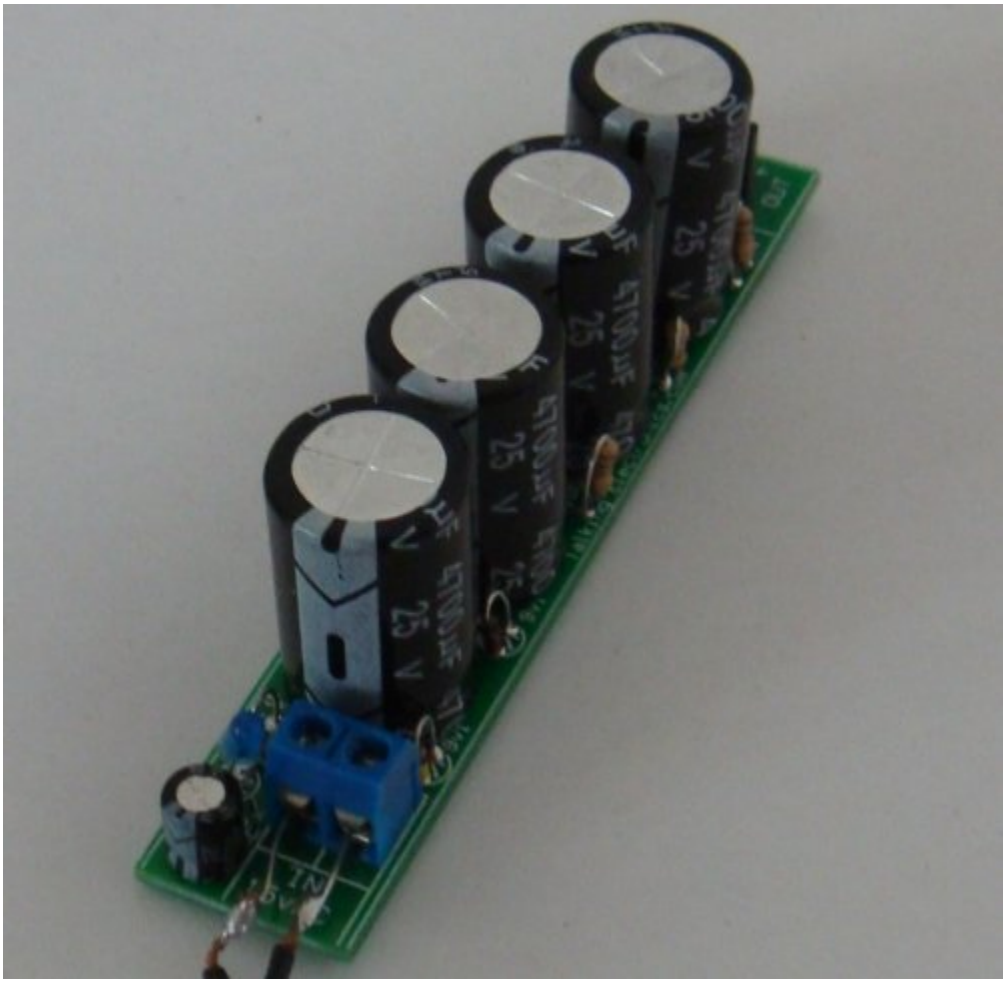
CHOICE NUMBER 13:

A **slimline** version of **CDU 18,000u** is available from Talking Electronics, to change up to 8 points at the same time:
It has the same capacity (4 x 4700u electrolytics - the same storage capacity as choice number 12) but **only one input option: 15v AC.**

It is **CDU 18,000u Slimline** and costs **$19.00 plus $6.50 postage.** It is shown in the following image:
Click Here to order.



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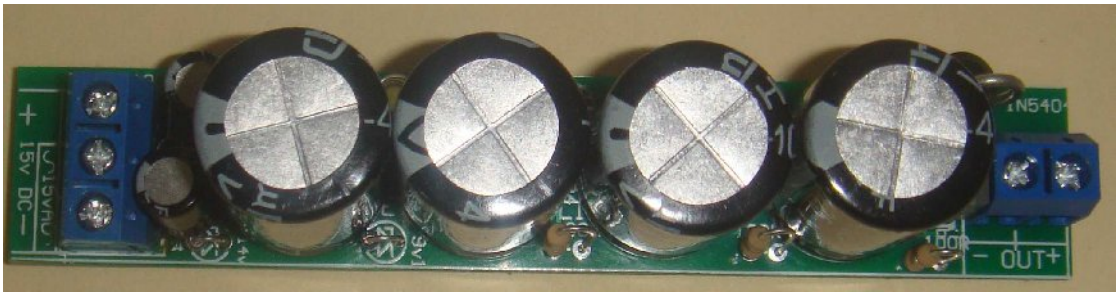
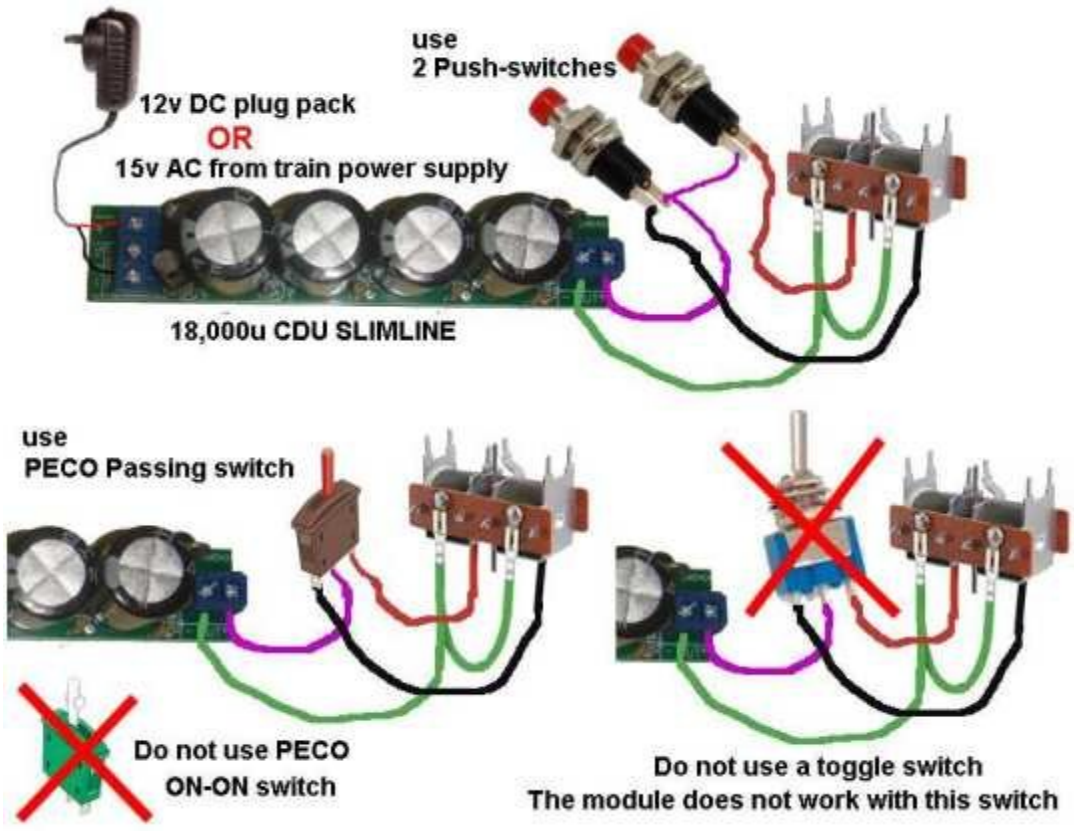
CHOICE NUMBER 14:

A NEW version off **CDU 18,000u Slimline** has both AC input and DC input and you can decide which input to use. The DC input can be 12v DC to 16v DC and the AC input can be 15v AC from

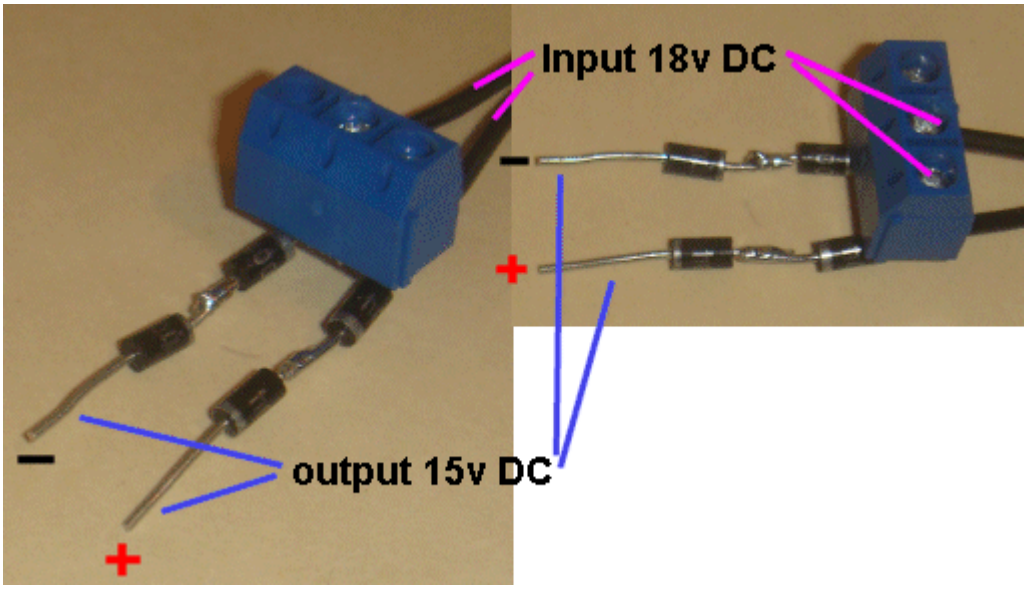
a train transformer.
The circuit on the underside of the PC board DOUBLES the DC voltage and the chip has a maximum operating voltage of 18v. But we do not want to exceed 15.5v as the chip will be damaged if it sees more than 18v. The on-board zener regulator limits the voltage on the electro's to 25.5v and 15.5v will deliver 25v, due to 5v losses in the circuitry.
CDU 18,000u Slimline - NEW Version costs **$19.50 plus $6.50 postage.** It is shown in the following image:
Click Here to order.





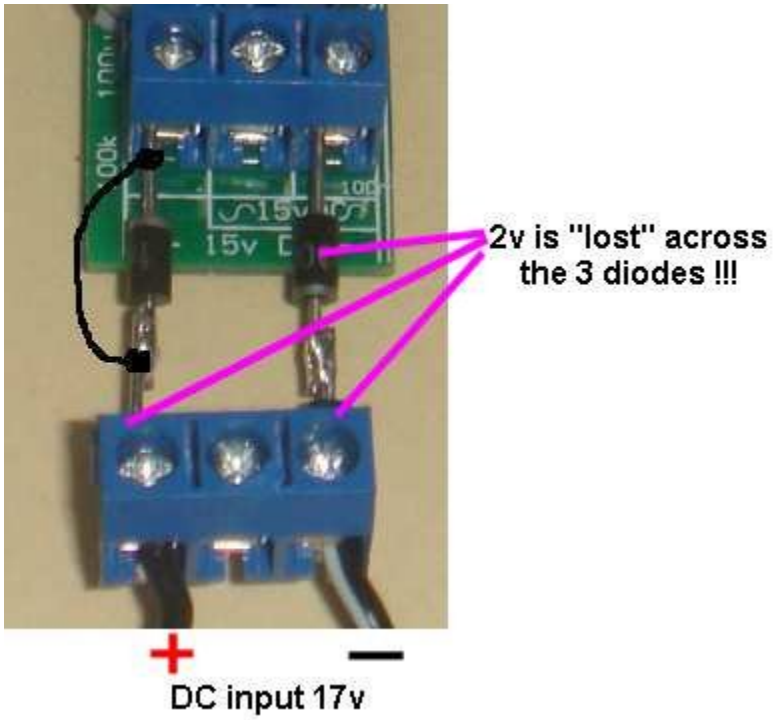
The DC input voltage for **CDU 18,000u Slimline - NEW Version must be 16v MAXIMUM** and each module comes with a VOLTAGE REDUCER module so you can adjust the voltage on the module to 15.5v

VOLTAGE REDUCER



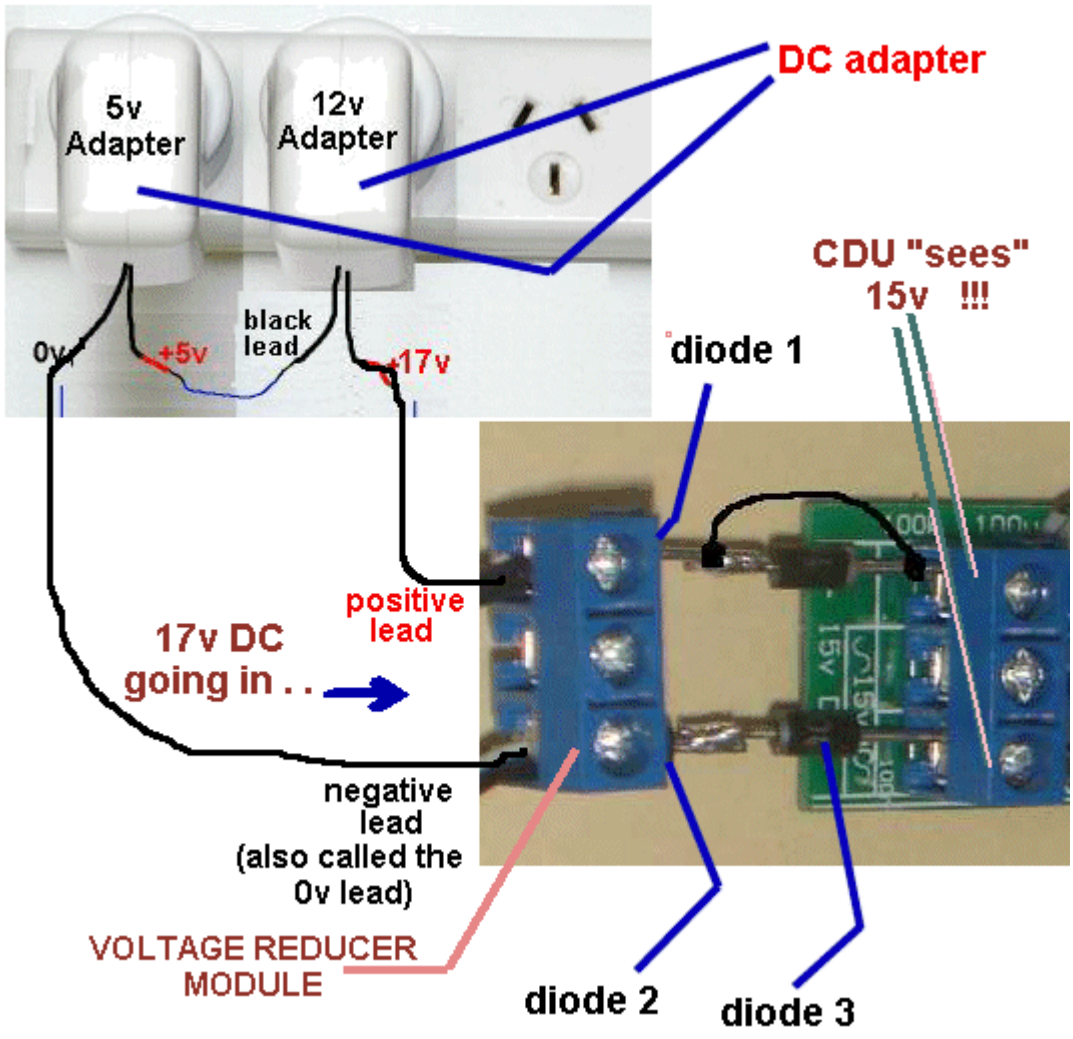
The **VOLTAGE REDUCER** MODULE consists of a 3-terminal block and 4 power diodes and screws into the 3-terminal block on the module.
This is how the Voltage Reducer Module works: Each diode reduces the incoming voltage by 0.75v, making a total of 3v.
When you get **CDU 18,000u Slimline - NEW Version,** check the voltage of your power supply (before touching the module) and make sure it is less than 18v. The voltage reducer module only works for voltages: 16v, 17v and 18v.
If it is 18v, connect the VOLTAGE REDUCER to **CDU 18,000u Slimline - NEW Version** as shown in the following image:

If the input voltage is 17v, you can remove one of the diodes by soldering a link across one of the diodes (to short it out), as shown in the following image:



If the input voltage is 16v you can remove 2 diodes and if it is 15v, you do not need the VOLTAGE REDUCER MODULE.

If you want to deliver 15.5v DC to **CDU 18,000u Slimline - NEW Version** with two plug packs, here is the circuit:



An easy way to get 15.5v for CDU 18,000u Slimline - NEW Version is with two plug packs - 5v and 12v.
You can also use three 5v plug packs and you will find many of these in your parts-bin from old mobile phones !!!!

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CHOICE NUMBER 15:

Jim's CDU MkII

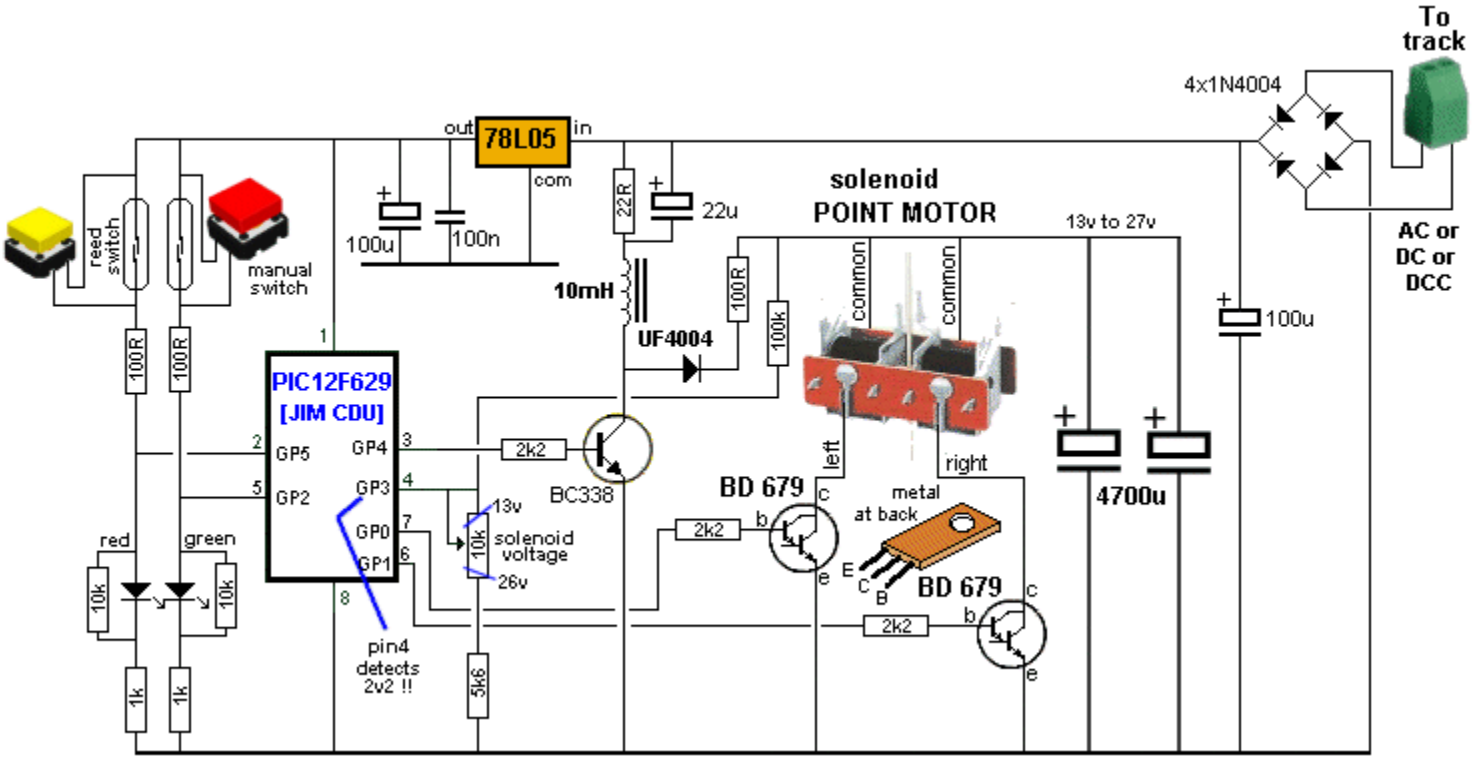
Buy a kit: Jim's CDU MkII **$24.50** plus $6.50 post
Fully assembled and tested: $30.50 plus $6.50 post

This project combines a number of features from three of the projects we have previously designed for Model Railway Hobbyists. It is available as a kit or fully built and tested.
Now you can have 3 features in one module.
The first feature is the power supply. This module connects to your track and you don't have to provide 15v AC or a higher voltage to charge the electrolytics. The module has an on-board charging and voltage generating section that accepts almost any voltage and charges the electrolytics to a maximum of 27v.
The next feature is the variable voltage (or maximum voltage) for the electro's. You can reduce the voltage to as low as 13v for those solenoid points that do not need a large amount of energy for their activation.
The third feature is the reed switch inputs. This allows the module to be used automatically to control a solenoid point so the point gets changed correctly when the train approaches from the other direction.
And lastly, the kit comes with a **TRACK-PICKOFF MkII** connector that fits between the sleepers and connects to the rails with springy connectors.

THE CIRCUIT

All the work is done with the microcontroller.
The charging of the electro's, the timing to activate the solenoid and the detection of the reed switches.
The rail voltage is passed to the project via a bridge and this allows AC DC or DCC to be converted into DC and stored to a small extent in the first 100u. The 100u on the output of the 78L05 provides a small amount of reservoir for the micro and we are assuming the train will be moving most of the time to maintain supply for the micro.
The micro drives a BC 338 transistor with short pulses to allow current to flow into (through) the inductor and produce magnetic flux. When the transistor turns OFF, the magnetic field collapses and produces a very high voltage spike. This spike passes through the high-speed 4004 diode and into the 4,700u electros. The spike is really about 50v but the energy in the spike is converted into charging current and the electros would charge to more the 40. But they will explode if the voltage rises above 30v so the voltage on the electros is monitored by the 100k resistor and 10k pot.
The PIC micro detects a HIGH when an input is 2.2v and the 10k pot can be adjusted produce a voltage from 13v to 27v.
The project takes a very small amount of energy from the track during the charging process and this will not be noticed when powering a train around the layout.
The indicator LEDs on pins 2 and 5 are output devices as GP2 and GP5 are constantly changed from input to output lines. They normally illuminate one of the LEDs, but every 100mS, the program converts the lines to input to detect if a reed switch has been activated.
When they are input lines, we want them to have 0v on them and the 10k resistors across the LEDs provide this feature. Without the 10k resistors, the impedance of the LEDs is very high and the input lines can "float" and if a white LED is used as an indicator, this "float" voltage can be as high as 3.3v. The micro sees any voltage above 2.2v as a HIGH and the circuit would not work correctly.

If a reed switch is activated, the line will be HIGH and the program will respond accordingly.



JIM's CDU MkII circuit

SOLDERING THE KIT

Soldering these kits is simple if you have a bit of experience in soldering small components because all the parts are identified on the PC Board. You will need tweezers for the surface-mount components. We supply solder THAT IS NOT CHINESE SOLDER. Do not use Chinese solder as it does not contain the correct percentage of tin and lead and it does not "run" or melt or flow properly and does not produce a shiny joint.

The first things you add to the board are the 13 surface mount resistors. Add a small amount of solder to one land for each resistor and pick them up with tweezers with the numbers showing and solder one end with the solder that is already on the land. Then go around and solder the other ends by adding a small amount of solder to each resistor.

The rest of the components are through-hole and it does not matter if you start at one end of the board or with the small components first.

Every component is identified on the board and most of the parts have to be fitted around the correct way - so look at the legend on the board.

The LEDs must be soldered very quickly otherwise they will be damaged.

The mark of a well-designed PCB is being able to put it together with a handful of parts and no other reference.

And the mark of a well-designed circuit is 100% operation with every board. You cannot afford to be messing around, "adjusting" the component values and trying to work out why it does not work.

That's why every value has a reason and a purpose. This can only be gained by working on hundreds of circuits and gaining the experience, knowledge and understanding.

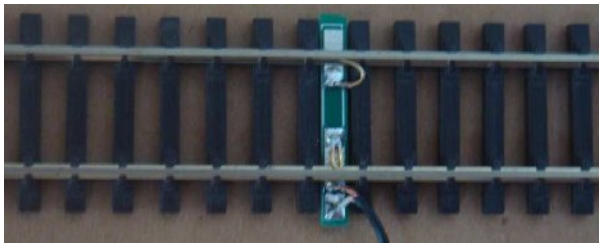
The circuits are provided with all the projects to give you this experience.

And to help you fix something, if it "blows up."

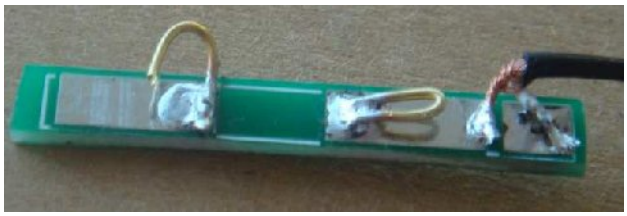
The photo's above show the complete module (before all the leads are connected). The electro's will be bent over and laying flat above the top of the board on modules pre-built and posted through the mail as they are too tall to be posted.

POWER CONNECTOR

The power for this project can come from a power supply 9v to 15v AC or DC or DCC. In fact it can be ANYTHING !!
You can also connect the project to the track with a very small THIN PC board that fits between the sleepers. It is called **Track Pick-Off MkII.** It has two springy clips that touch the inner parts of the rails and make electrical contact. .
The PC board comes with the two springy clips soldered in place and you need to remove the plastic from between two sleepers to allow the board to fit (as shown in the photo below). Twist the board into position and give the spring clip a twist with a pair of pliers so it pushes against the rail.



A close-up of the springy gold wires and the fine screened lead



Jim's CDU MkII
PARTS LIST

$24.50 plus $6.50 post

Order a kit

1 - 22R surface mount
2 - 100R
1 - 220R
2 - 1k
3 - 2k2
1 - 5k6
2 - 10k
1 - 100k

1 - 100k mini trim pot

1 - 100n monoblock
1 - 22u
2 - 100u
2 - 4,700u 25v electrolytics

4 - 1N4004 power diodes
1 - UF4004 high speed 1amp diode

1 - 78L05 5v regulator
1 - BC338
2 - BD679 transistors
1 - PIC12F629 micro with "JimCDU"

1 - 3mm red LEDED
1 - 3mm green LED
3 - 2-way screw terminal blocks
1 - 3-way screw terminal block
1 - slide switch
2 - tactile switches
1 - 10mH choke

1 - 8 pin IC socket
30cm very fine solder

1 - Jim's CDU MkII PCB

extras $4.50:

2 - 2-way screw terminal blocks
2 - reed switches
2 - super-magnets
2 - 1.2m screened lead for reed switches
1- **Track Pick-off MkII** PCB with springy connectors
1m - fine screened power lead for above
2 - tactile switches for remote operation
1 - PCB to mount the 2 tactile switches
1 - 3m flat lead for switches (4 core)

CONCLUSION

This is a very interesting project to convert a solenoid operated point into semi-automatic operation by adding the two reed switches so the train will set the point correctly when entering the point from the opposite direction.
The module shows the position of the point via a red and green LED and it's very easy to set-up with the Power Connector and extension switches.

CHOICE NUMBER 16:

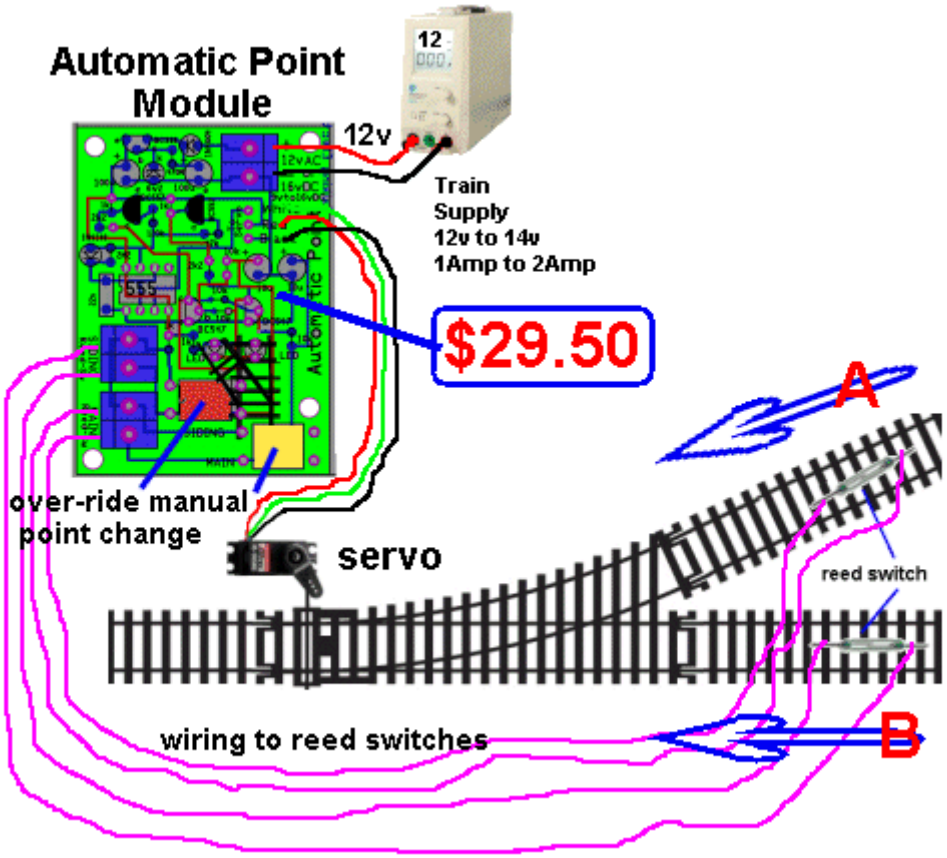
Automatic Point

Automatic Point is available as a kit from:
Talking Electronics for $29.50 incl reed switches and servo.
Click HERE for details.

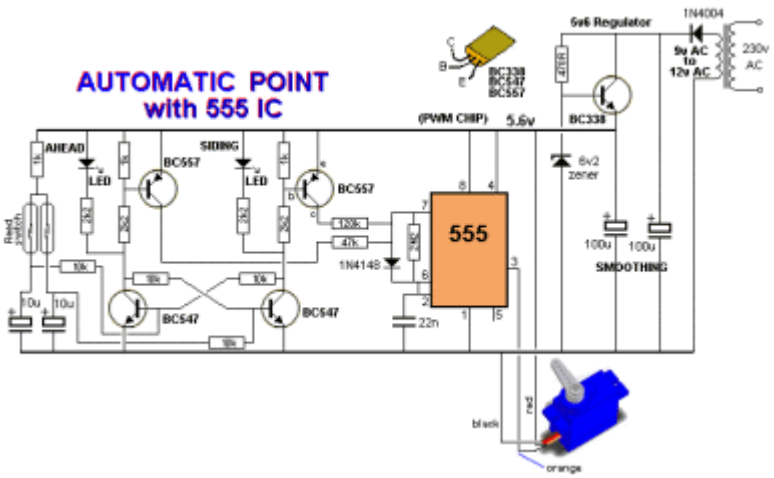
Turn your manually-operated point into an automatically operated point.
Here is a typical turn-out.

You can convert it to an automatic point, with over-ride via two push-buttons and it will cost less than buying a solenoid actuator for the point, plus a CDU module.
AUTOMATIC POINT project comes with 2 reed switches and a motor/gearbox and when the train approaches the point from the siding or via the other rail entering the point, the loco is detected and the circuit changes the point to accept the train. This prevent derailments and saves you having to remember to constantly change the point.
You will have to manually choose when to send the train to the siding.
The project only prevents a derailment when returning.

AUTOMATIC POINT is powered by the track voltage and will operate on a voltage between 9v and 16v DC. It has a 100u storage capacitor to allow the circuit to work when the rail voltage is intermittent.
The servo takes less current and less voltage than a solenoid operated point and that makes it ideal for remote points. You can use thin cable for the wiring.

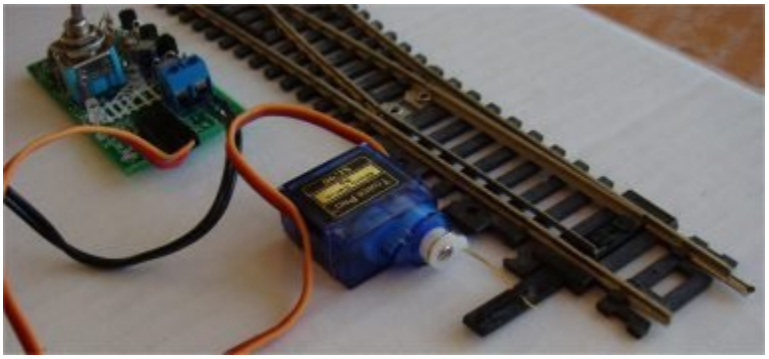


Turn your manual point into an AUTOMATIC POINT br> When a train comes from direction AAAA or B, the
point gets automatically set to prevent a derailment



There are many ways to position the servo to allow the lever to control the point.
Placing the servo on its side will give better alignment, as shown below:

The image on the left is just an example to show the connection of the servo to the point. The servo can lay down to take up less room.



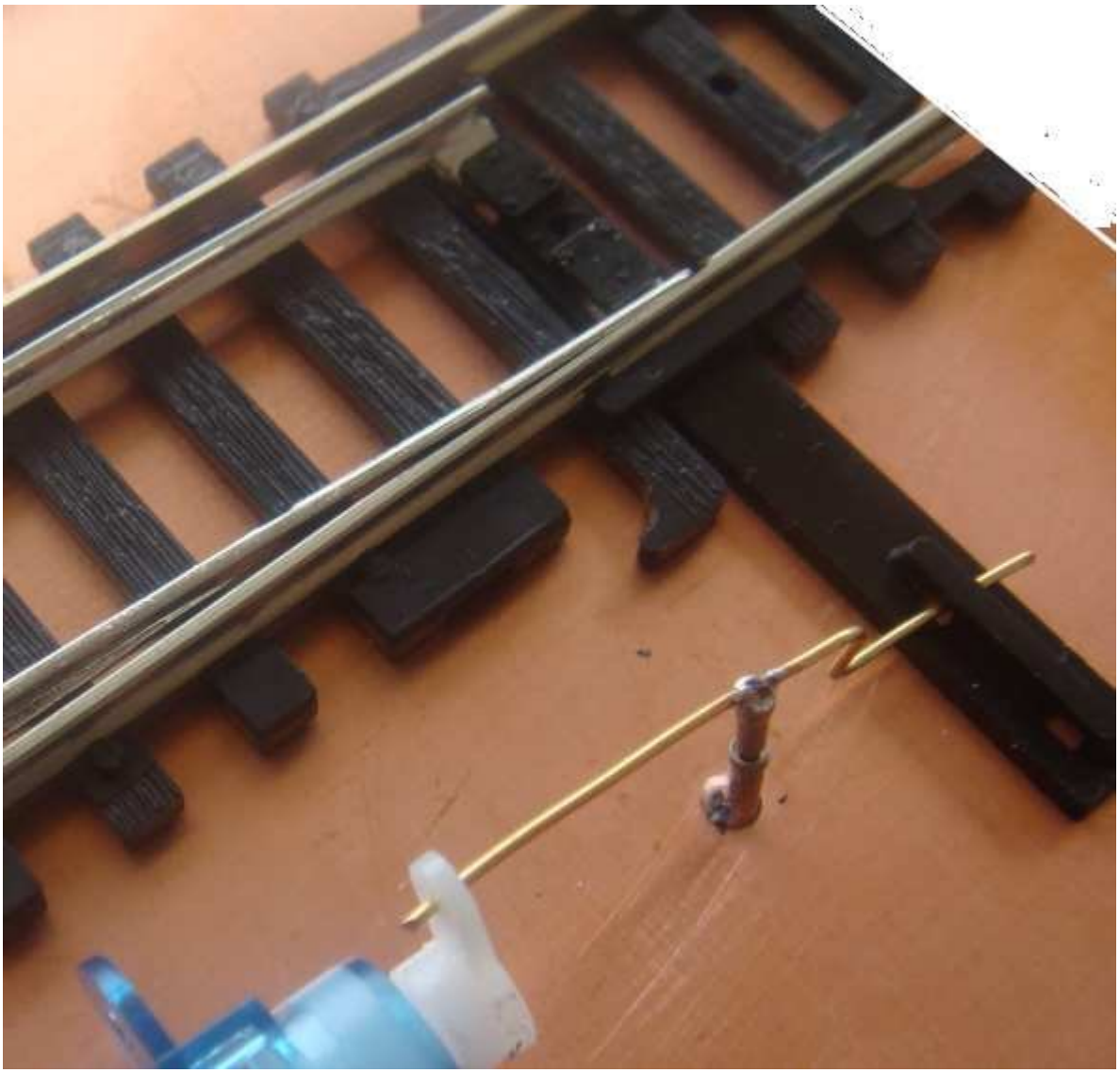
The servo rotates less than 70° and the gold wire is called the "linkage."
Any electro-mechanical device (motor, solenoid, servo) that operates a point is called a SWITCH MACHINE.
This project will only operate a normal (unconverted) SERVO as the circuit sends PWM signals to the servo to set its angle of rotation.
Talking Electronics has other projects that operate a motor and gearbox or a solenoid, but this project is specially designed to turn a manual point into an automatic point at the lowest cost.
The servo can be placed under your layout or in a plastic model such as a Platelayers Hut.

A platelayers hut can be used to hide the servo

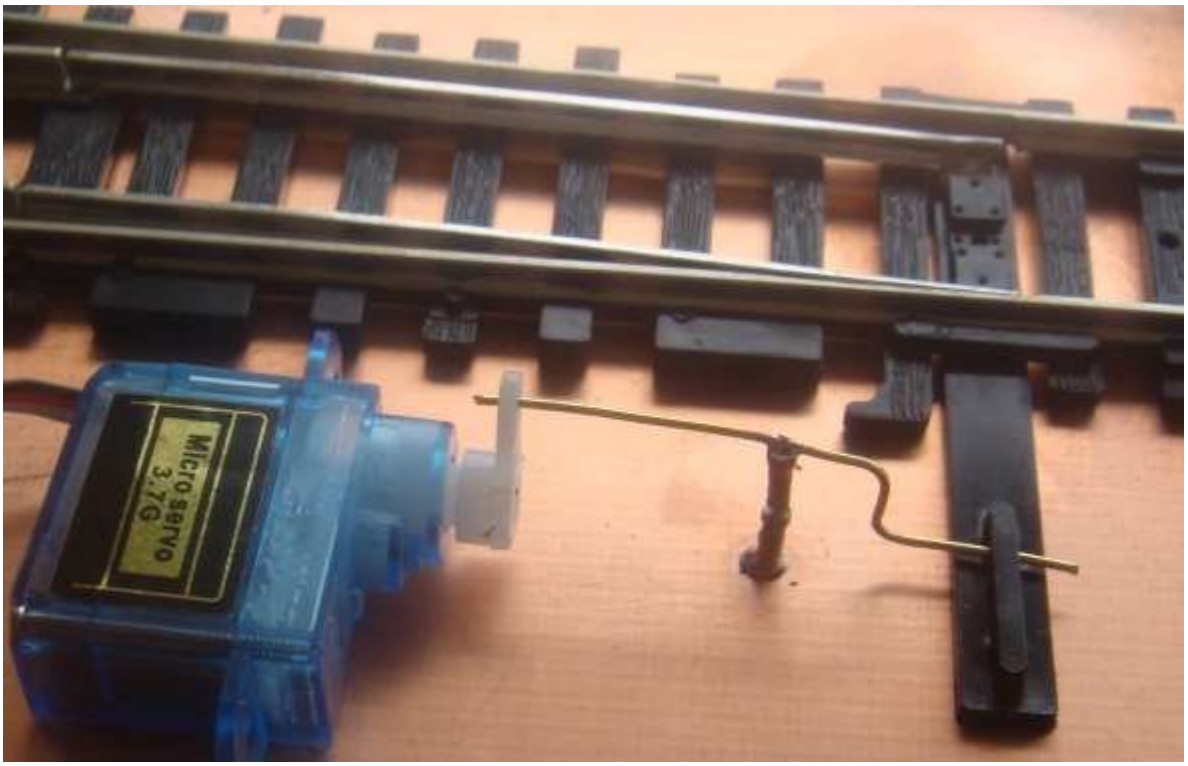
There are many ways to connect the servo to the "switching lever" and here's one way that adjusts the movement of the arm on the servo to the travel needed by the switching lever.
It consists of a machine pin fitted to your layout and another machine pin fitted into it. This forms a

pivot and you can adjust the travel by providing the correct ratio for the gold wire before the pivot and after the pivot.
This arrangement also puts a small amount of tension on the rails, allowing the loco to pass if the point is not set correctly.

The following images clearly show how the 3.7g SERVO is connected to the point via a LINKAGE:



The Machine pin in the centre of the linkage acts as a pivot and the "crank" in the lever is simply to align the activating arm to the lever on the track.

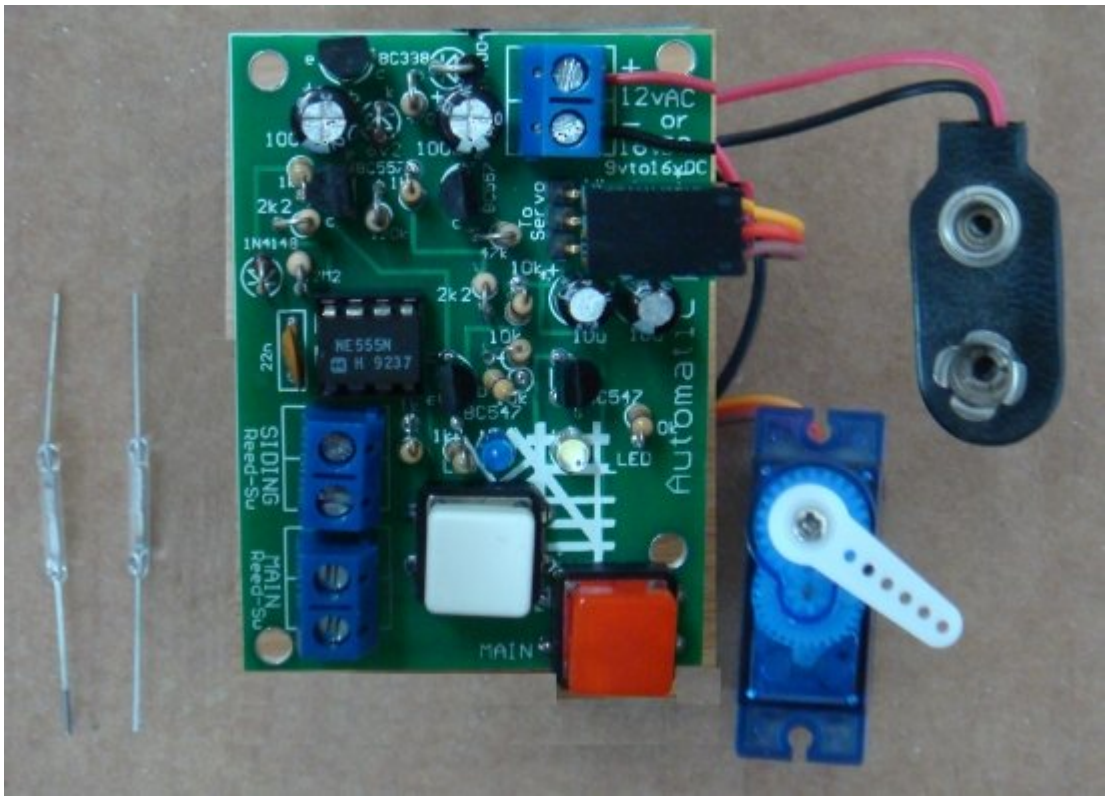


THE SUPPLY

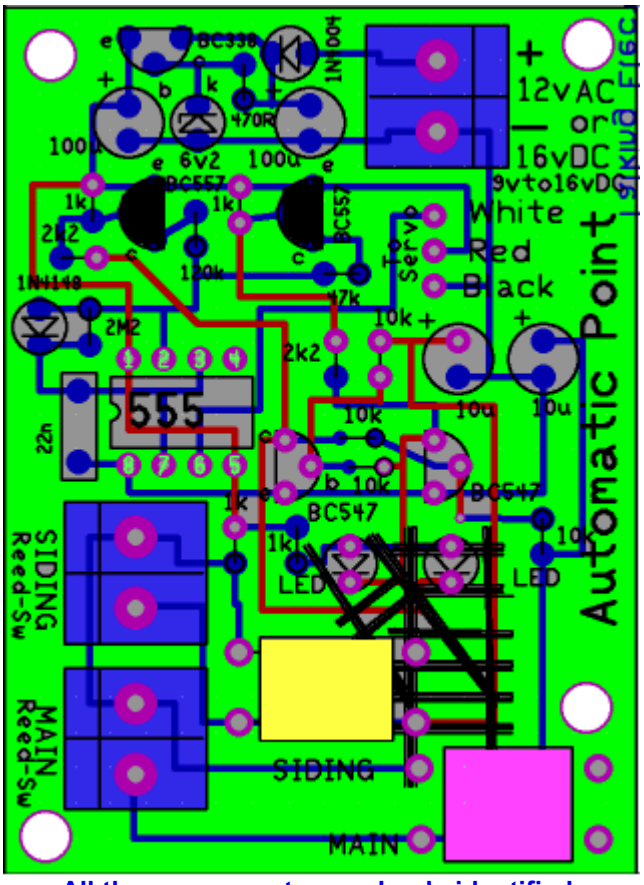
The supply for this project is 9v to 16v DC - but is is best to deliver a maximum of 12v. A voltage higher than 12v will make the 470R and BC338 slightly hotter.
You can deliver 12v AC as the diode and 100u will convert this to a DC voltage and the BC338 will smooth the output with the aid of the 6v2 zener diode.
Nothing in the circuit is susceptible to a small amount of ripple, so AC input is not a problem.

CONSTRUCTION

Assembly of the PC board is straightforward.
Fit the resistors first and then the electros, transistors, LEDs and diodes. The last parts to fit are the terminal blocks and switches.
You will need wiring to a 12v supply and you will need to connect the mini reed switches to the screened audio cable and add metal ends to the wires so they can be fitted to the screw terminals.
All these parts are included in the kit as well as 2 very strong super magnets. These are to be fitted under two locos.



Everything fits neatly on the board



All the components are clearly identified.

The two reed switches are carefully soldered to the leads (very fine screened audio lead).
2 very strong rare-earth magnets operate the reed switches at 2-3cm
(reed switches separately with 2 magnets cost $4.00)

SETTING-UP THE MAGNETS

The kit comes with 2 x 10mm super magnets about 1mm thick and to get the best magnetism from these magnets, place them on the bench about 5mm apart with one magnet having the North pole up and the other South pole up.
Don't worry yet. When the opposite poles are up, the reed switch will activate when it is lowered over the magnets at 10mm distance. If no reaction, flip one magnet over. The response will be dramatic. Now glue the magnets to the underside of a loco with N-pole up and the other S-pole up. One up and one down creates a circular magnetic path through the "leaves" of the reed switch and makes one leaf "N" at the tip and the other "S" at the tip and the two leaves click together.

FITTING the REED SWITCHES

Fit the two reed switches near the point but give the servo time to change the point before the loco gets to the point.
Connect the 12v supply and one of the LEDs will illuminate. It indicates the position of the point. Press the other button and the point will change. Drive the train through the point (from left to right) and when you return from the siding, the point will be ready for the train.

PARTS LIST
Automatic Point
$29.50 including reed switches and servo.
Click HERE to buy the kit.

1 - 470R
4 - 1k
2 - 2k2
4 - 10k
1 - 47k
1 - 120k
1 - 2M2

1 - 22n ceramic capacitor
2 - 10u electrolytics
2 - 100u electrolytics
1 - 1N 4148 diode
1 - 1N 4004 diode
1 - 6v2 zener

2 - BC547 transistors

2 - BC557 transistors
1 - BC338 transistor
1 - 555 IC
1 - 8 pin IC socket
1 - 3mm white LED
1 - 3mm blue LED
2 - 40cm lengths twin hook-up flex
3 - 60cm lengths screened lead
2 - reed switches
2 - rare-earth magnets
3 - 2-screw terminal blocks
2 - large push buttons with caps
1 - servo with "arms" and 2cm gold wire
1 - 3-pin 90° male connector for servo
30cm fine solder
1 - Automatic Point PC Board

CHOICE NUMBER 17:

The next module changes the point automatically and has 3 other features so you can design a layout with a loop.
This module is called: LOOP with 2 RELAYS and MOTOR.
You can use either a 3v micro motor and gearbox or a SERVO or a converted SERVO.
You need a loop at the end of your layout and you can select either a SERVO or a converted SERVO to do the activation. The project also comes with a 2-aspect signal.

Loop with 2 Relays and Motor costs $xx.50 plus $6.50 postage. It is shown in the following image:
Click Here to order.

Let's look at the 17 choices :different designs and describe the differences.
You will see some choices turn a manual point into a remotely-operated point and some prevent a solenoid point: "burning out"
These choices are classified as the BASIC DESIGNS.
They are the simplest designs to do the simplest job.
These 17 choices are classified as the BASIC DESIGNS.
Later, we will explain modules that change the point slowly and modules that automatically change the point when the loco approaches and modules that show the position of the point on your control panel.
For a simple layout and those who are just starting to improve their layout, the choices above will provide the answer to remotely control a point and also show its position on your control panel.
Read the features of each module and make sure you have the required voltage available. o cheaply get almost any voltage (and current) from one or two PLUG PACKS. These provide safety and security and prevent you being able to touch the 110v or 240v MAINS.
Under NO circumstances should you make your own POWER SUPPLY with soldered wiring and leads around your control panel carrying MAINS VOLTAGES. One day a young visitor may come in and be looking and feeling around your wiring and touch something LIVE !!!

CHAPTER FOUR

THROTTLES

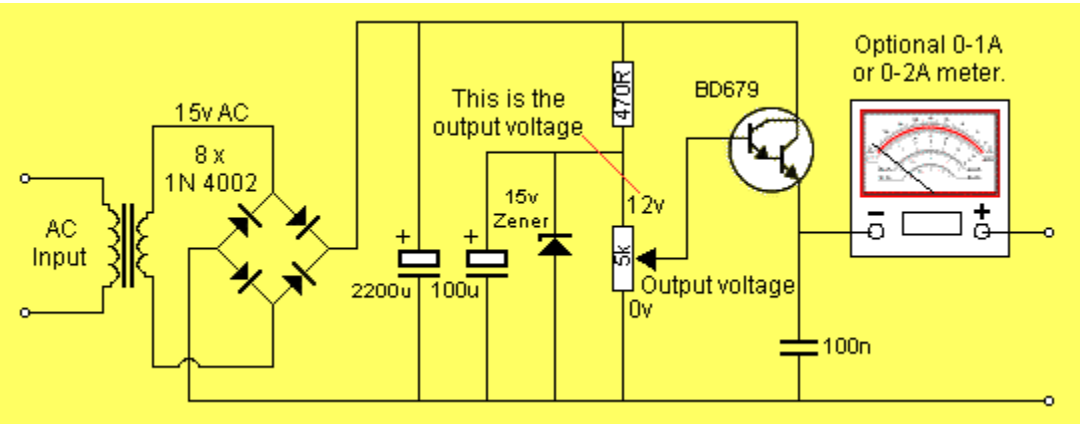
Talking Electronics has produced a number of different TRAIN THROTTLES.
These need either AC or DC input and produce 0v to 12v DC output.

If you have an AC supply such as: 10v AC to 12v AC, the **Throttle Circuit** below will produce an output of 0v to 12v DC - that is what it is designed to do.
If you have a 12v DC supply, the voltage-drops across the input power diodes and the control circuitry, will reduce the output to about 10v DC. You can lose up to 2v DC across the diode junctions.
This means you need an input voltage of 14v DC and this will require 2 adaptors in series or a set of 4 Li-ion cells.
The POWER SUPPLY project described above uses 4 Li-ion cells to provide a voltage of about 14.2v DC to 14.8v DC and is adjustable. It can be used as a TRAIN THROTTLE.

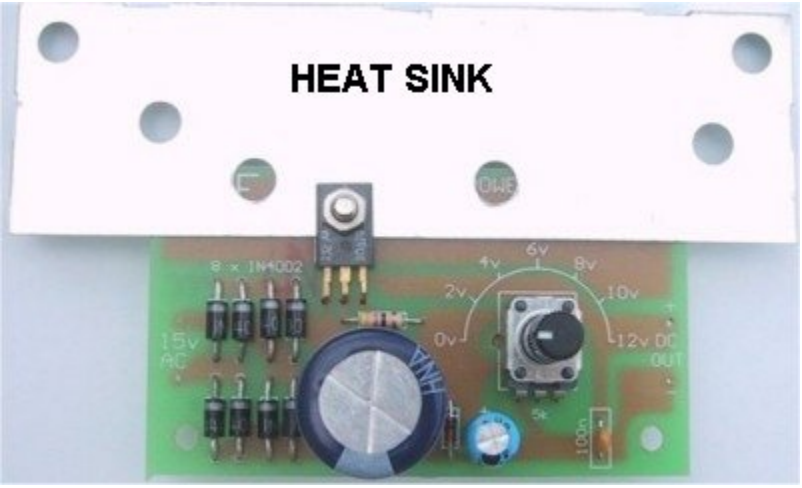
Most locos take about 500mA and need a voltage of about 12v for full speed.
A 1Amp power supply or 1Amp THROTTLE will just be capable of operating two loco's.

There are two types of **TRAIN THROTTLE**:
TypeA produces an output 0v to 12v DC and you need a reversing switch to reverse the train.
TypeB has a control with 0v in centre-position and "left" reverses the train at a gradual increase and "right" drives the train forward at an increasing velocity. No change-over switch needed.
This type of Train Throttle can be PWM and provides pulses of energy. This design "kicks" the motor and allows it to start the train very slowly. The "kicks" are very rapid and sometimes you can hear the "buzz" from the motor.
These circuits require an input voltage of 14v DC, so the full 12v DC can be delivered to the motor (as up to 2v DC is lost in the circuitry).

Here is a circuit and photo for typeA and the wiring for the reversing switch:



Two Amp Power Supply circuit diagram. It is also called 2-amp THROTTLE

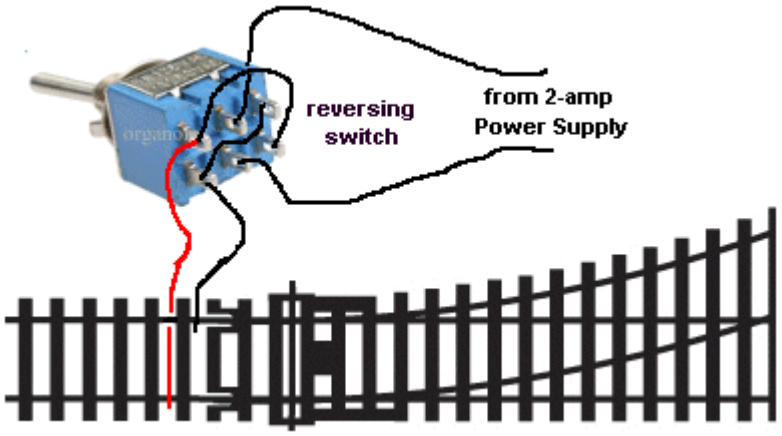


The completed project, showing the placement of the parts
The input voltage can be AC or DC.
The DC voltage needs to be at least 16v6 to get 12v DC out. If you supply 17v to 20v DC, nothing will be damaged. Just the 470R resistor will get slightly hotter when the input voltage is above 18v.

The 2-Amp POWER SUPPLY project is HERE
Kits come with 0-2 Amp meter to show the current.
$12.50 USD plus $6.50 USD postage.

Click Here to order.

You will need a double-pole double-throw toggle switch to reverse the train. Ask for it. $2.50 extra.



Connecting a reversing switch

oooooooooooooo000000000000000000000000000000ooooooooooooooo

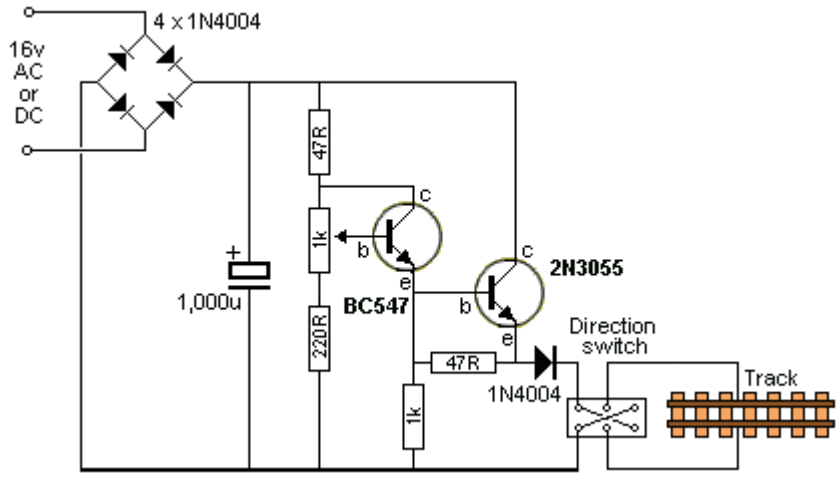
TRAIN THROTTLE No2. (kit: $18.00 with leads) Click Here to order.

See the project: HERE

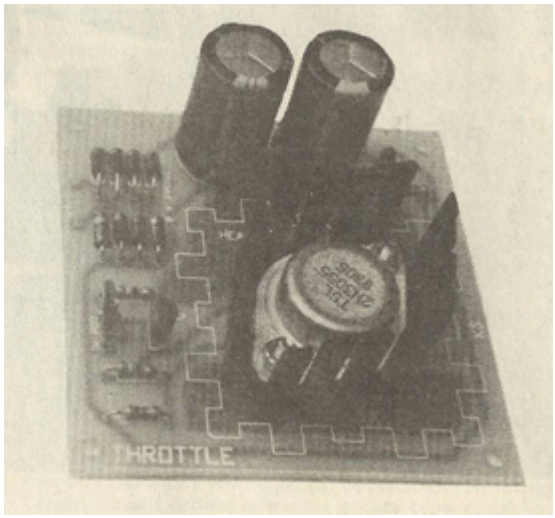
This circuit connects an AC transformer (or a DC supply) to a track to provide a voltage from 0v to max voltage (depending on the voltage of the transformer).
The transformer can be AC or DC and any voltage from 12v to 18v.
The throttle handle connects to the 1k pot.
The diode on the output protects the transistors from reverse polarity (if another controller is also connected to the rails).
The circuit is limited to about 1amp due to the 1N4004 diodes.

Transformer with 12v AC output and 18v AC

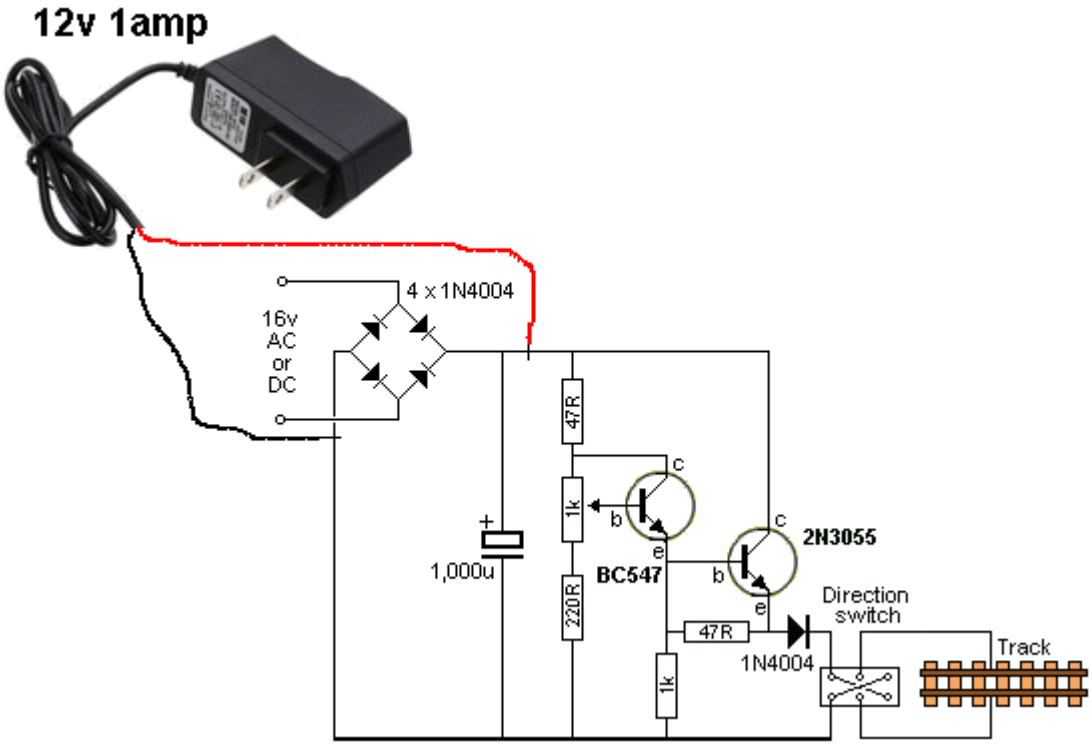
An impressive throttle can be built by using the following circuit and the THROTTLE PC Board in the kit (the lever handle shown above is not available).



Train Throttle Circuit

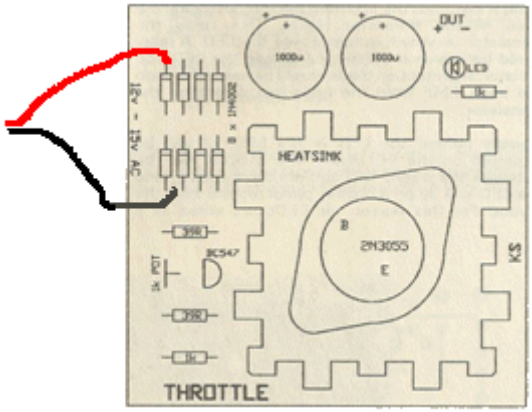


The 8 power diodes are now replaced by 4 x 1N5404

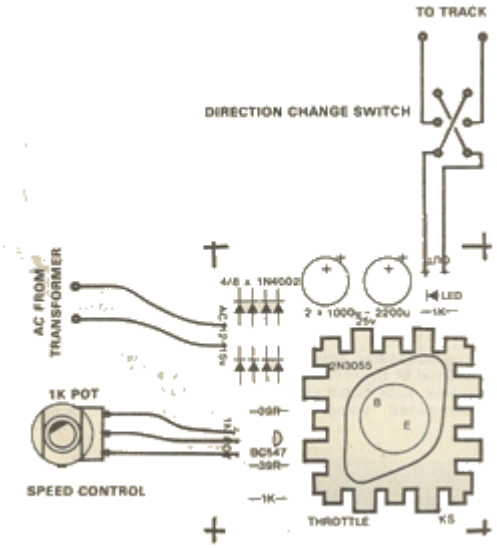


AC plug packs are very difficult to buy, but 12v 1-amp or 2-amp can be purchased at very low cost.
You can increase the output by 1.5v if you connect the positive and negative leads

of the plug pack to the points on the PC:



The layout of the PC Board.
You can connect the plug pack directly to the points shown on the diagram above. You do not have to remove the diodes.



Wiring the pot, power input and reversing switch to the PC board

The Control knob for the Throttle kit

ooooooooooooooo000000000000000000000000000ooooooooooooooo

THROTTLE WITH PWM Kit: $28.50 plus $6.50 postage.

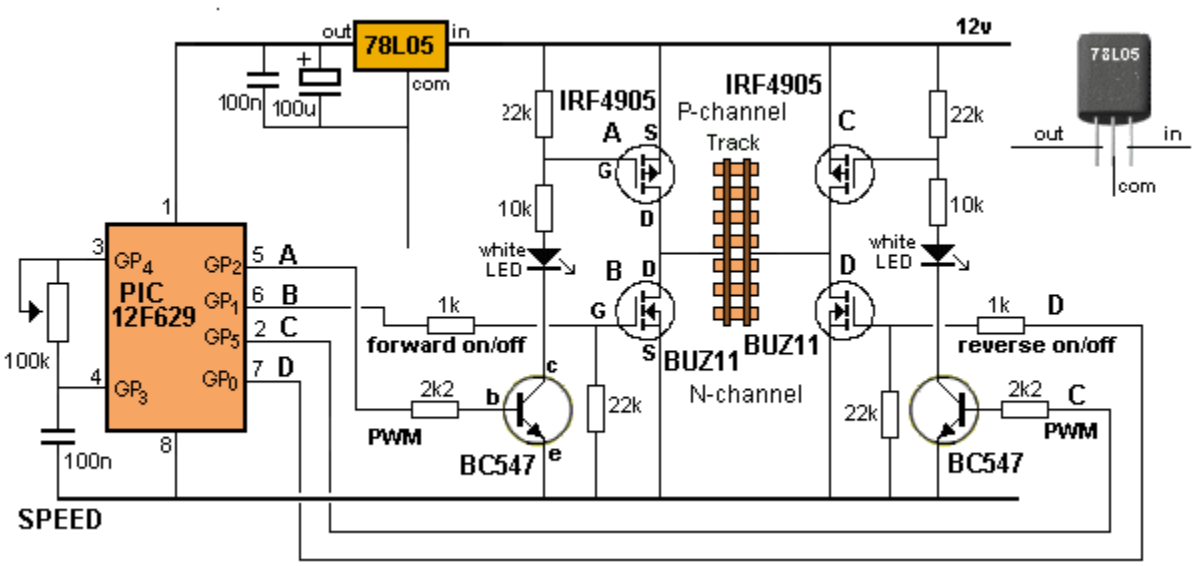
Click HERE to buy a kit.

Built and Tested: $35.00 plus $6.50 postage. Click HERE to buy a module.

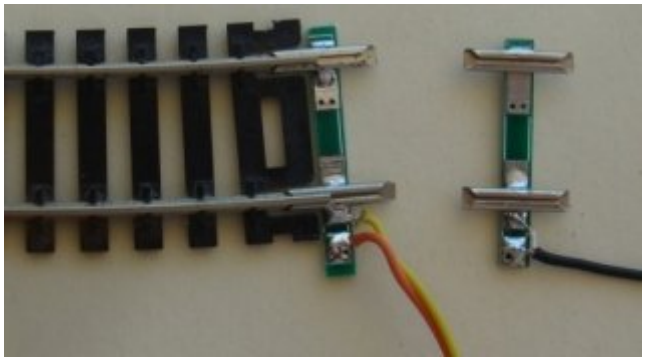
This is our latest design with forward and reverse via the yellow CONTROL POT. This project does not need a reversing switch as the pot provides zero speed when at 12 O'clock and reverse when turned to the left and forward when turned to the right. The output is Pulse Width Modulated (PWM) to give the loco smooth starting.

The module is capable of delivering 3 amps and the power diodes are 5 amp. Additional heatsink fins will be

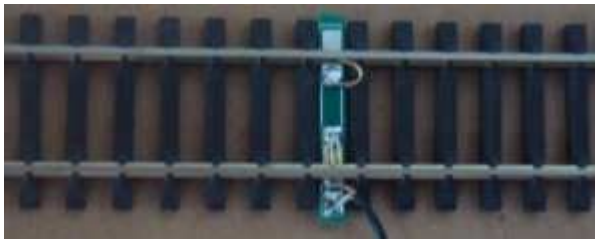
needed for currents above 2 amp. But we suggest a 1-amp supply for most loco's
The 4 FETs in the output bridge are capable of handing more than 10 amp and the trackwork on the board can be modified to handle a fairly high current by soldering tinned copper wire along the tracks identified with additional solder pads. This means the controller can be used for garden layouts where the loco will draw in excess of 5 amps.
The switch at the right is the on-off switch. The two LEDs on the board indicate forward and reverse, in case you cannot see the loco on a large layout.



All the digital signals are controlled by the microcontroller and the pot determines the timing of the waveform and the activation of the H-bridge.
The two lower MOSFETs turn ON or OFF to take one track or the other track to 0v. At the same time the top, opposite, MOSFET is switched On and OFF at a fairly low frequency (about 600Hz) to provide pulses to the motor.
The ON-time is increased, compared to the OFF-time to increase the speed of the loco.
The **THROTTLE WITH PWM** module comes with connectors that are fitted in place of rail joiners to deliver the voltage from the throttle to the track.



You can request the following type if you do not want to use the rail joiners:



UPGRADE YOUR CONTROLLER

There are lots of controllers that can be connected to the **THROTTLE WITH PWM** project above to deliver PWM output with a control knob that provides both forward and reverse direction.
If you have one of the controllers shown below or a similar type that has a 0-100 scale AND a reversing switch, you can connect the output of the controller to the input of **THROTTLE WITH PWM** and get the new features.

HERE'S WHAT TO DO

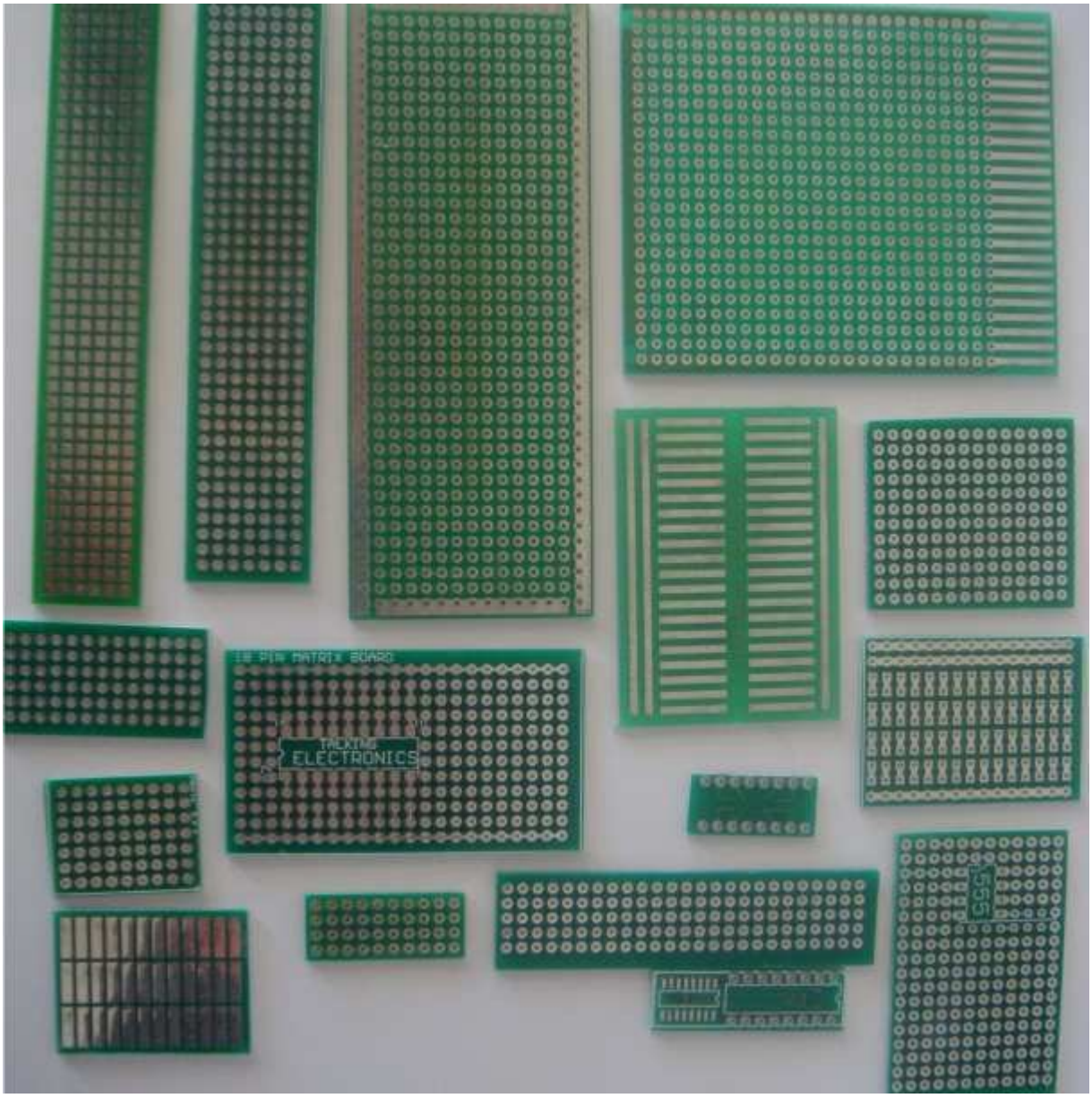
Connect your throttle to the mains and turn the knob or lever to maximum.
Measure the voltage coming out of the throttle and make sure you identify the positive lead.
Now turn it off and connect the positive lead to the "+" DC screw terminal on **THROTTLE WITH PWM** module.
Now connect the other lead to the "-" DC terminal on **THROTTLE WITH PWM** module.
Put you throttle under your layout, making sure you do not touch the handle or the reversing switch.
Now connect your track to the two screw terminals marked "to track" on the **THROTTLE WITH PWM** module.
The **THROTTLE WITH PWM** module will use your throttle as a power supply and deliver PWM to your layout via the forward/reverse knob on **THROTTLE WITH PWM.**

The above 7 controllers are suitable for adding to THROTTLE WITH PWM module

Theory, Test Gear & More Projects

MATRIX BOARDS

Talking Electronics has produced a lot of matrix board in all sorts of sizes and shapes so the board is ready and neat for the layout of components. These boards cost just $2.00 for the small boards, $2.50 for the medium size and $3.00 for the larger boards.
Simply email Colin with the number and size and they can be sent to you.
Click Here to order.



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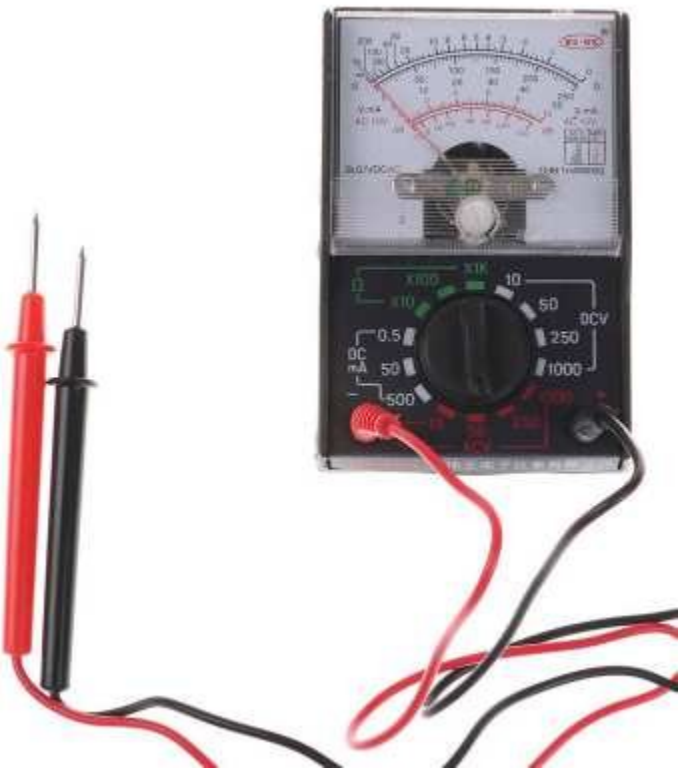
THEORY
THE MULTIMETER

I test all my projects with a $5.00 multimeter !!

WHY???
Because an analogue multimeter puts a load on a circuit and the reading MUST be genuine.
Secondly, an analogue multimeter will show fluctuations in a circuit and show when a certain part of a circuit is not maintaining stability.
And thirdly, an analogue multimeter will respond to changes and pulses much faster than a digital meter.
Lastly, if I can design and test a circuit with a cheap meter, everyone else should be able to do the same when using a more-expensive meter.
Finally, an analogue meter lasts a lifetime. And if you damage it, the cost is only $5.00
And you get 500mA range, a digital meter gives 200mA.
Analogue Meters are on eBay
I have digital meter when I want to read voltages accurately.



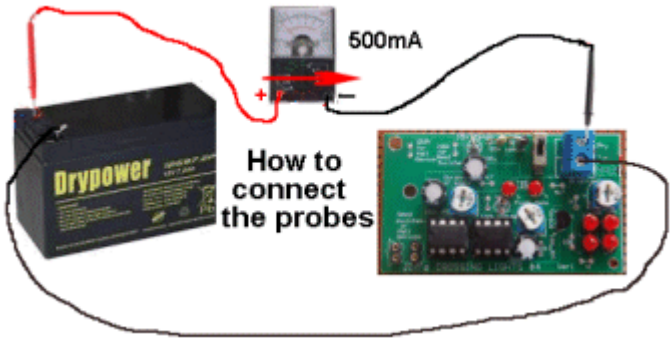
If you buy two multimeters, you can test currents up to 1 amp by placing the multimeters in PARALLEL as shown in the following diagram:

The red and black probes go to the positive and negative terminals of the project you are testing and you simply **ADD** the current readings (shown by the pointer on each meter) to

get a final value (up to one amp).

Current flows through the multimeter from the positive probe to the negative probe and the arrow on top of the meter above shows this direction.
This is how we arrive at that statement:
When taking a measurement of CURRENT, the voltage on the positive probe will be **very slightly higher** than the voltage on the negative probe, because a very small voltage will be dropped across the CURRENT RESISTOR inside the meter. The meter is actually measuring the voltage across this resistor and you are reading the pointer where the scale says **0-500mA**.
We know that current flows from positive to negative and when you trace the circuit above, you can see the meter is part of this circuit.
When measuring CURRENT, you use exactly the same reasoning as when you are measuring voltage.
Look at the circuit or project and work out which point will have the (slightly) higher voltage. The red probe goes to this point.
When measuring CURRENT, even the wires will have a slightly higher voltage at one end. This is the end for the red probe.
When measuring CURRENT, the circuit has to be CUT and the probes inserted into the CUT. You cannot measure the current taken by a component by placing the probes "across it." You have to cut a wire or a track or desolder one of the wires.

If you cannot remember how to connect a multimeter when testing CURRENT, tilt it slightly so the positive terminal is **higher** than the negative terminal and lay the red probe on the bench**, HIGHER** than the black probe.
Now connect the red probe to the positive terminal of the battery and the black probe to the positive "input" of the project. Use another jumper to connect the negative of the battery to the negative (0v) of the project.



See how the current has to flow across the meter (from left to right) to make the point read "up-scale". The probes are connected to the battery as shown in the diagram above.

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THEORY

SERVOS

There are many different types of SERVOS on the market. Some are very cheap while others are very expensive. The main difference in cost is due to plastic gears Vs metal gears. We only need plastic gears.
We have simplified the requirement and come to the conclusion that there are two types suitable for controlling a point. The "normal" size is called "9g" and the "Micro" size is called "3.7g." You can see by the dimensions above that the difference is only very slight.

But you have to be careful.
There are many different manufacturers with the same plastic body and the same appearance. Some will work in our applications and some will not. The program in the "electronics" is slightly different.
In some of our projects, we slow-down the rotation of the arm to make the movement "realistic."
All the **Micro SERVOS** work in this "slow-down" application, but only 30% of the 9g models work successfully - some jitter when travelling slowly and there is no way to determine the faulty ones without testing each servo.
In addition, some of the 9g models can rotate 360° because there is no "stop" on the output shaft. This is not a problem **in any way**.
All it means is this: the shaft cannot get jammed against the "end-stop." You cannot digitally rotate the shaft any more than about 180° to 270°, as the electronics is only designed to allow this much rotation. But if you position the shaft at the exact "dead-spot," the servo will not know "which way to turn" and you have to activate it twice and it will swing around to the correct position. Under normal operating conditions, the servo will never land on the "dead-spot" and you will never have a problem.
In all other respects, the two servos are identical. The Micro version is slightly more expensive and ideal for controlling a point as it can easily be housed in a PlateLayers hut. (see image up further)

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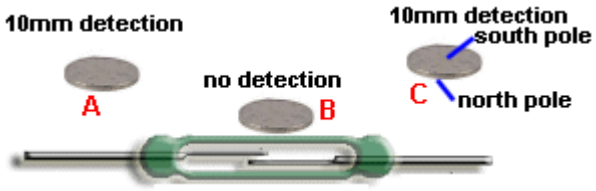
THEORY
REED SWITCH DETECTION

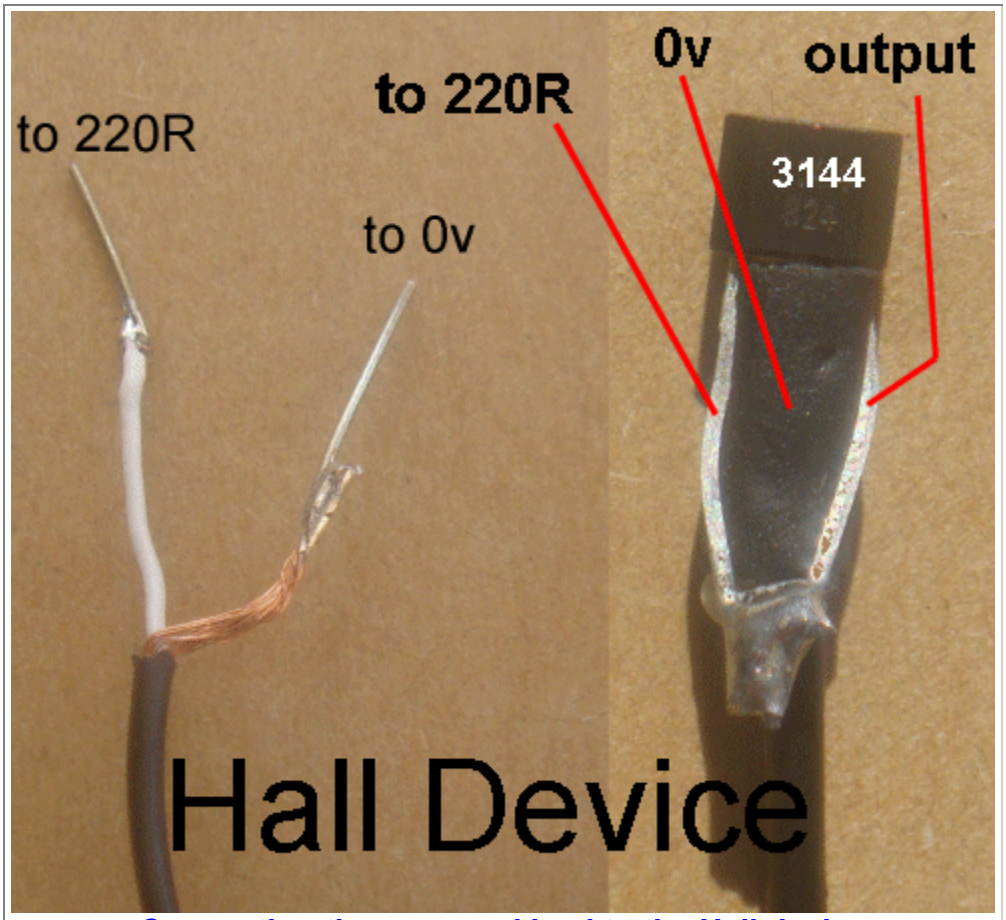


The reed switch only detects a magnet when the magnet is in positions **A** and **C.** This is because the magnetic flux produced by the magnet "hits" the left or right reed and magnetises it in a process called TEMPORARY MAGNETISM or INFLUENCED MAGNETISM and since the other reed is not magnetised, the two reeds "stick together." When the magnet is in the centre of the reed, both reeds get magnetised by the North pole of the magnet and they do not make contact.
This means the reed switch MUST be placed "along the track" (parallel with the rails) so the magnet has the greatest opportunity to activate the reed.

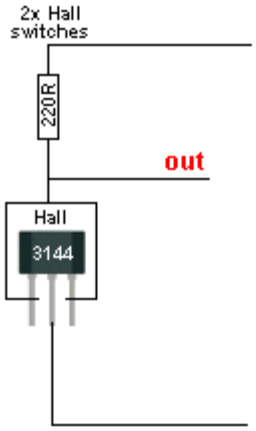
to Index

THEORY
Hall Device

The Hall Device must be connected the right way to the circuit.
Here is a close-up the Hall device with the output lead connected to the first lead. These two are connected to the white lead of the screened audio cable. The middle wire is the ground connection and it goes to the screening wires.
This is very unusual way to wire a Hall device, and is just another clever trick by Colin Mitchell to show how you can do just about anything with electronics.

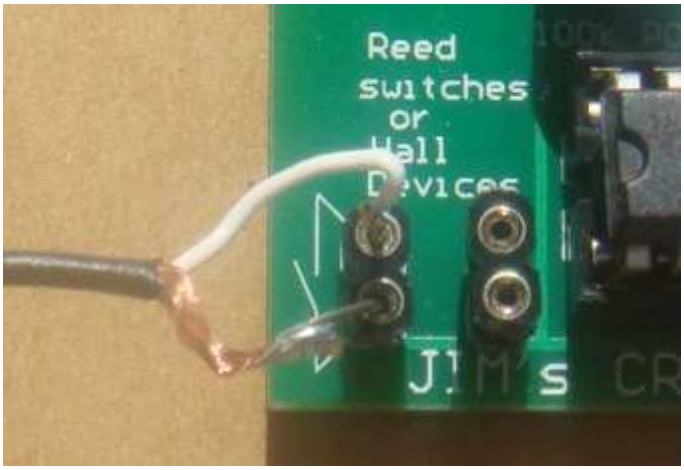


Connecting the screened lead to the Hall device

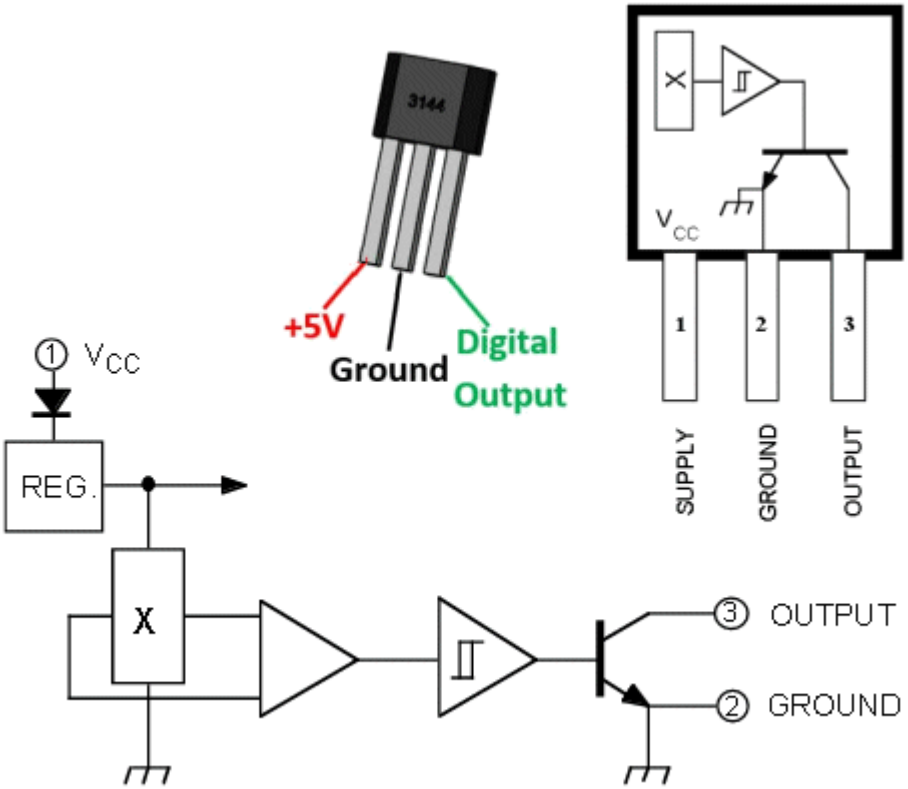


This is the circuit for the Hall Device

This is just one way to connect it to a circuit when you want to be able to connect a Hall Device or a reed switch to the same input terminals of a project.



Connecting the Hall wires to the module



The internal circuit of the 3144 contains a number of "Building Blocks"

The Hall device is being used in an unusual way in this project, with the output connected to the "supply terminal."
The circuit above shows some of the "building blocks" inside the 3144 and one of the features is the amplifier block that detects a signal from the Hall block to turn ON the output transistor. Some of the other Hall devices turn-on-slowly as a magnet is brought closer to the detecting face. Make sure you do not use one with this feature, as we have not checked it and it may not turn on hard enough to start the module flashing. The main reason for it not working is the low impedance of the input line (on the Flashing Lights Module) - due to the 220R load resistor.

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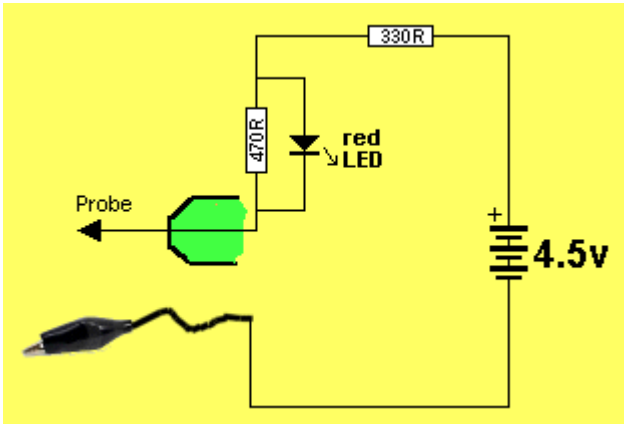
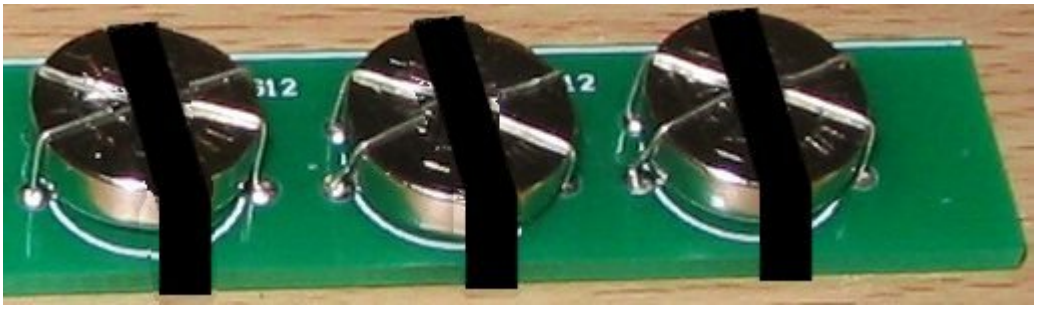
TEST EQUIPMENT

LED TESTER

This project tests LEDs and tests for continuity and tests for other things as well.
It's a very handy piece of test gear.
See the full project HERE



The LED Tester Project



The 3 button cells are held in place with narrow heatshrink after soldering fine tinned copper wire over the cells. You can then cover the cells with duct tape.

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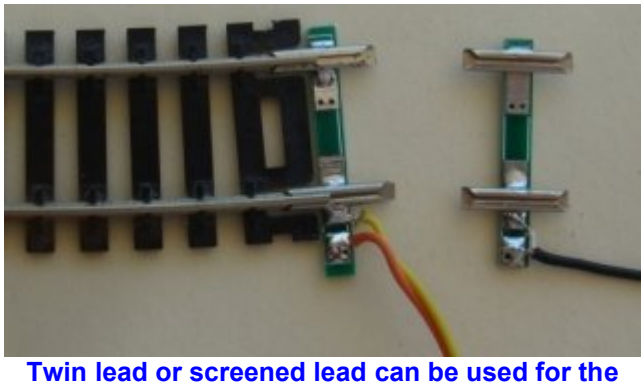
PROJECT
TRACK PICK-OFF

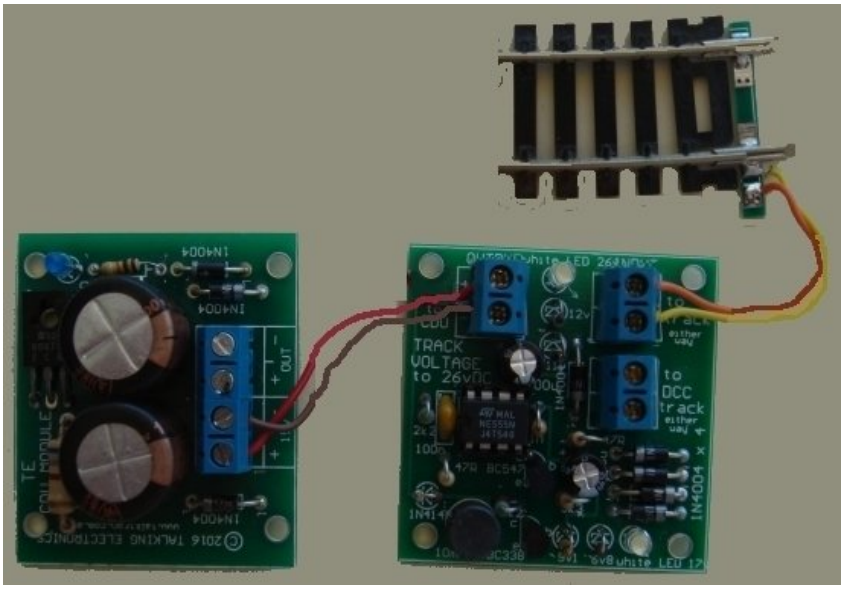
Track Pick-offs are available from Talking Electronics for $2.00 plus postage.
This Printed Circuit board is fitted between the sleepers and has contacts to touch the rails so the voltage on the track can be monitored or delivered to a project.
If the current taken from the track is very small, it will not interfere with the operation of the train(s) on the layout and is called LEACHING.
A little bit of power is taken from the track and this saves running wires all the way back to your control panel.
Talking Electronics has designed 2 of these TRACK PICK-OFF boards:

Track Pick-Off MkI has two track joiners soldered to the board and this is fitted between two sections of your layout.
The images below show this board and how it it fitted to the track:



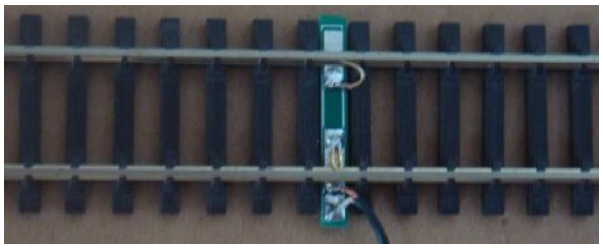
Twin lead or screened lead can be used for the Track Pick-off PC board

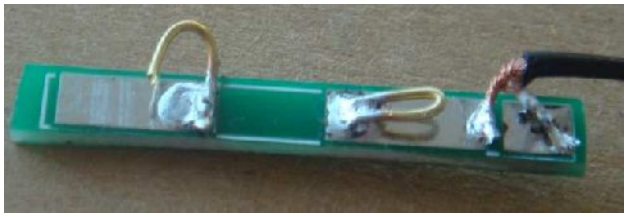
Here is the module connected to a project:



If it is not easy to connect the track joiners to your layout, we have:

Track Pick-Off MkII. It has two springy clips that touch the inner parts of the rails and make electrical contact.
The board comes with the two clips soldered in place and you need to remove the plastic from between two sleepers to allow the board to fit. Twist the board into position and give the spring clip a twist with a pair of pliers so it pushes against the rail.





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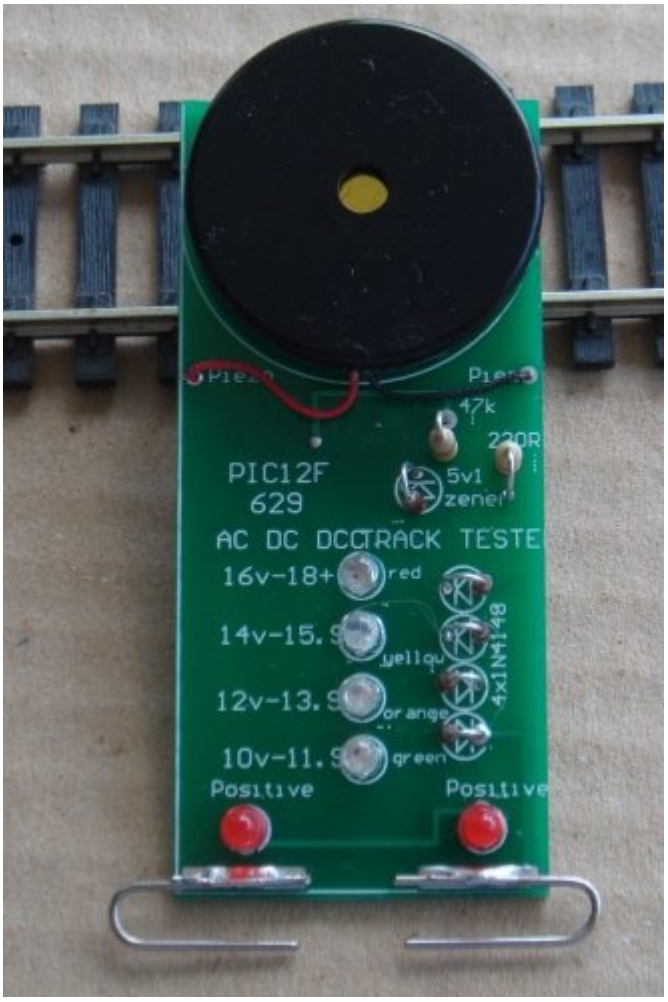
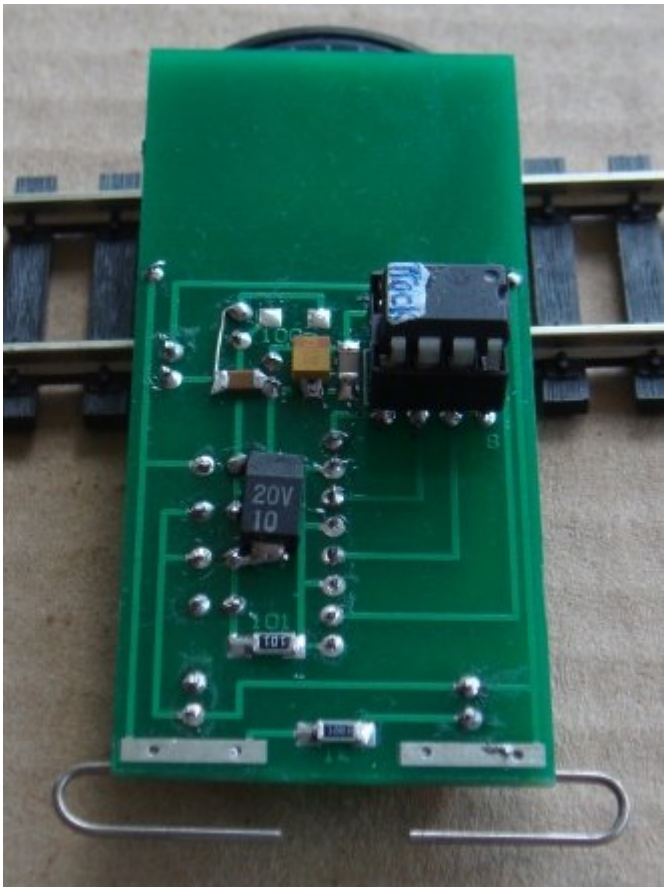
TEST EQUIPMENT

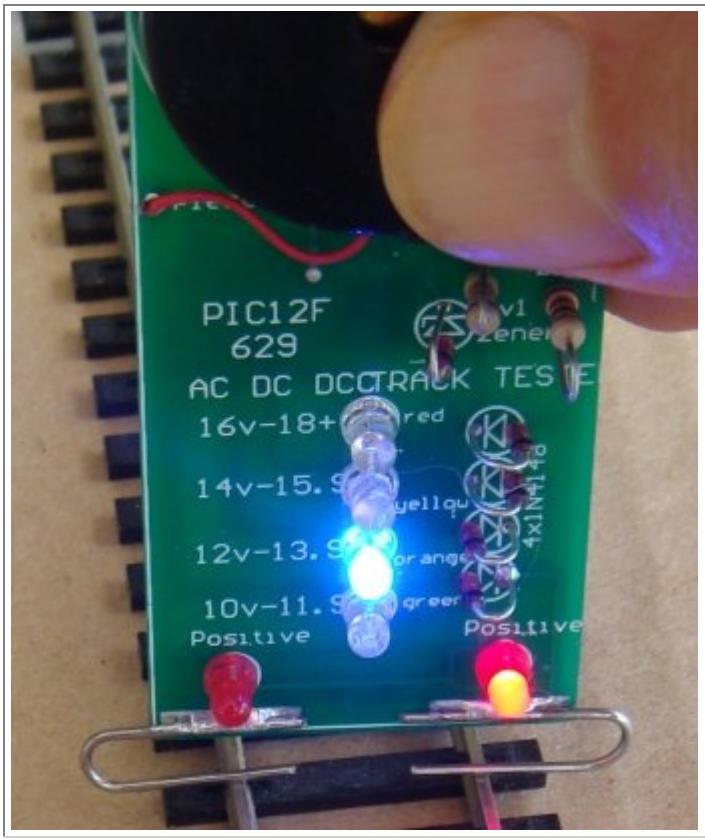
TRACK TESTER

This project tests the voltage on your track.
It's another very handy piece of test gear.
See the full project HERE
The **Track Tester** kit costs $10.00 AUD plus $4.50 AUD postage.
The **Track Tester** is also available ready-made for $16.50 USD (posted)
It alerts you to the presence of DCC via the piezo diaphragm and the voltage of your track at all parts of the layout.

Click Here to buy a Track Tester.


Piezo
Piezo
47k
220R
PIC12F
629
5v1
zener
AC DC DCCTRACK TESTE
16v-18+
red
14v-15.9
yellow
12v-13.9
orange
10v-11.9
green
4x1N4148
Positive
Positive


20V
10
10K



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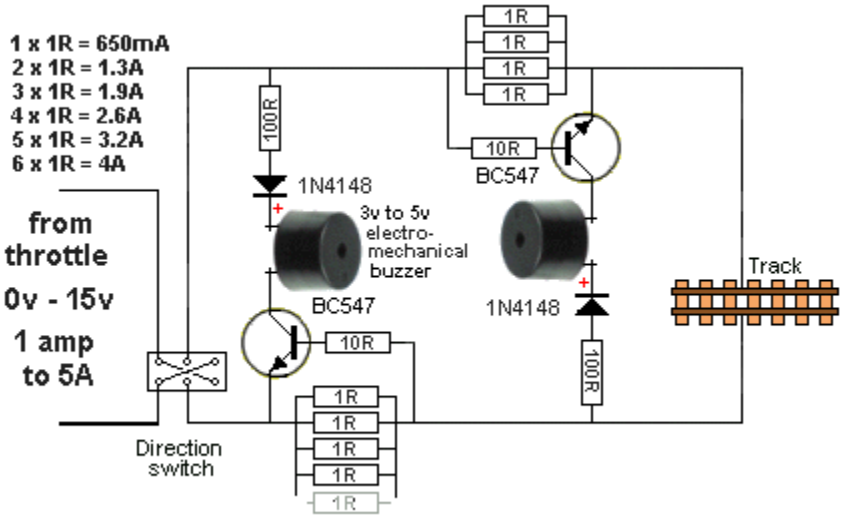
TEST EQUIPMENT

OVER CURRENT DETECTION

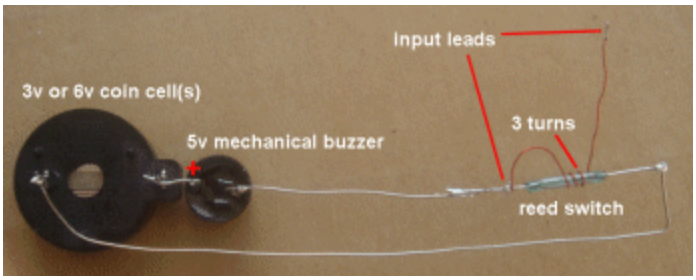
Requested by William Hicks:
This circuit detects when the tracks are overloaded by too many trains.

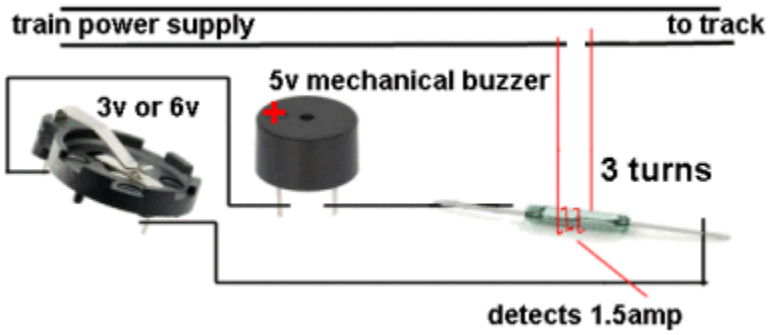


1 x R22 in parallel with 1 x 1R = 4A (R22 = red-red-silver-gold)

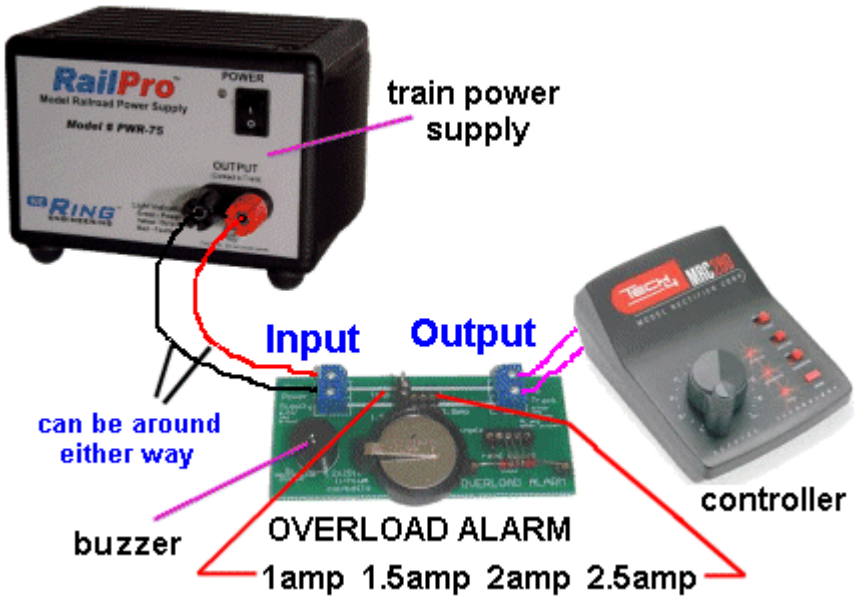
Note: Each 1R resistor needs to be 0.5watt 0R22 needs to be 5watt!!
The circuit will drop 1.4v when full detection-current is flowing.

Here is the simplest over-current circuit:





The reed switch closes when about 1.5 amps flows for 3 turns wrapped around the centre of the reed switch. 2 turns will detect about 2 amps.
Keep the reed switch at least 6cm from the mechanical buzzer as the magnet inside the buzzer will turn the circuit ON all-the-time.
The sensitivity of reed switches vary enormously and the ones we are using require 19 turns to detect 1 amp then tapped at 7 turns, 2 turns, 2 turns and the final winding is 8 turns. Nothing is linear with the turns and magnetic flux because the turns are at different locations across the reed and have differing effect.
You cannot get a simpler circuit and it only drops 22 millivolts when 2.5 amps flows.
It is ideal for detecting SHORT CIRCUITS. If something falls across the tracks, the buzzer will sound.



The Overload Alarm Module is fitted between the Train Power Supply and the Controller

Kits are available for this project from
Talking Electronics for $8.00 plus $4.50 postage.
The reed switch and coil with tappings is already fitted to the board as this has to be calibrated with a 3-amp power supply and load.

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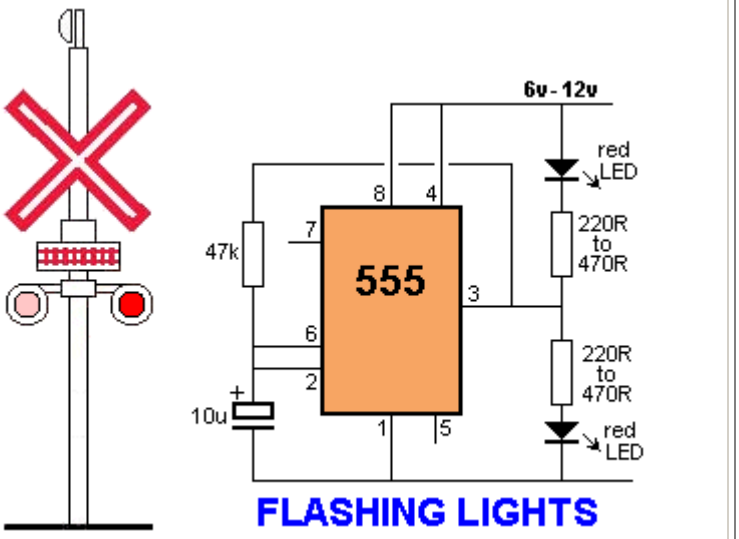
FLASHING RAILROAD LIGHTS

This circuit flashes two red LEDs for a model railway crossing.



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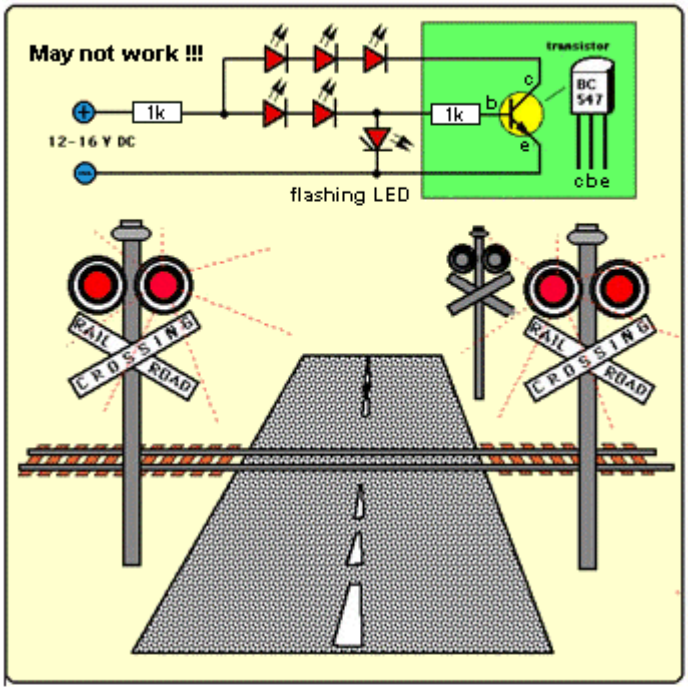
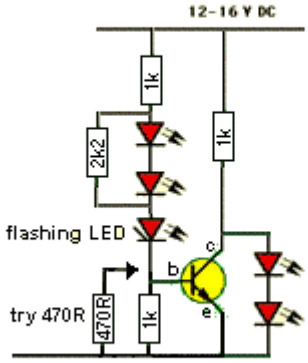
FLASHING LIGHTS FOR MODEL RAILWAY CROSSING:

A flashing LED is used to create the timing for the flash-rate and the transistor provides the alternate flash for the second set of LEDs. The first circuit comes off the web, but Colin Mitchell doesn't think it will work. See his circuit below.





This circuit has been designed by Colin Mithcell AND IT WORKS !!!

The top two 1k resistors are current-limiting resistors and can be increased if you want the LEDs to be dull.
The 2k2 makes sure the two LEDs are completely turned-off because the flashing LED draws a small current when it is off and this shows in the two LEDs. The lower 1k may need to be reduced to 470R to completely turn the transistor OFF. The other circuit does not have any of these features. The flashing LED has to be an ON-OFF flashing red OR green LED. Not a red-green flashing LED or a RED-GREEN-BLUE flashing LED. The flashing LED actually has an in-built resistor and will work on 2v to 5v. But we are using its feature of "taking a small current" when illuminated and then "taking almost zero current" when not illuminated, to "switch the transistor."
You can get the CROSSING LIGHTS plastic mouldings from Talking Electronics. They will take 3mm LEDs.
Cost: $6.00 for 2 Crossing Lights with 4 LEDs and 2 metres of fine 0.25mm enamelled wire. .
You need to "push-out" the red lens and fit the 4 x 3mm red LEDs and carefully solder wires to the LEDs.

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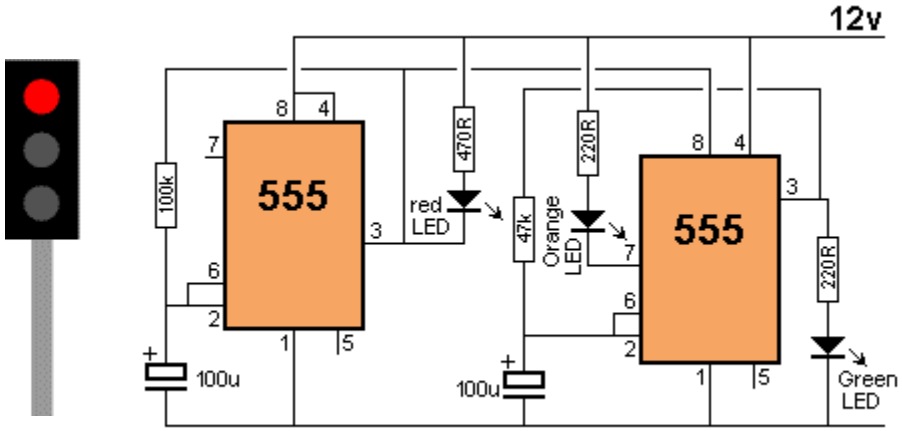
TRAFFIC LIGHTS

Here's a clever circuit using two 555's to produce a set of traffic lights for a model layout.
The animation shows the lighting sequence and this follows the Australian-standard. The red LED has an equal on-off period and when it is off, the first 555 delivers power to the second 555. This illuminates the Green LED and then the second 555 changes state to turn off the Green LED and turn on the Orange LED for a short period of time before the first 555 changes state to turn off the second 555 and turn on the red LED. A supply voltage of 9v to 12v is needed because the second 555 receives a supply of about 2v less than rail. This circuit also shows how to connect LEDs high and low to a 555 and also turn off the 555 by controlling the supply to pin 8. Connecting the LEDs high and low to pin 3 will not work and since pin 7 is in phase with pin 3, it can be used to advantage in this design.



Here is a further description of how the circuit works:
Both 555's are wired as oscillators in astable mode and will oscillate ALL THE TIME when they are turned ON. But the second 555 is not turned on all the time!
The first 555 turns on and the 100u is not charged. This makes output pin 3 HIGH and the red LED is not illuminated. However the output feeds the second 555 and it turns on.
Output pin 3 of the second 555 turns on the green LED and the second 100u charges to 2/3 rail voltage and causes the 555 to change states. The green LED goes off and the orange LED turns on.
The second 100u starts to discharge, but the first 100u is charging via a 100k and after the orange LED has been on for a short period of time, the first 555 changes state and pin 3 goes LOW.
This turns on the red LED and turns off the second 555.
The first 100u starts to discharge via the 100k and eventually it changes state to start the cycle again.
The secret of the timing is the long cycle-time of the first 555 due to the 100k and the short cycle due to the 47k on the second 555.

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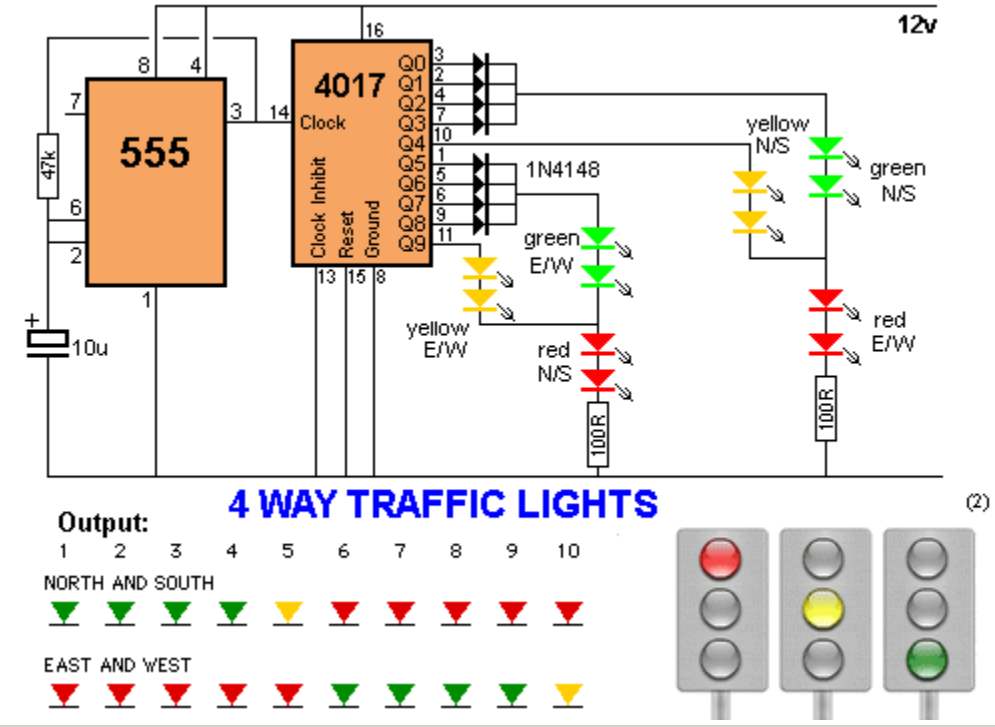
4 WAY TRAFFIC LIGHTS

This circuit produces traffic lights for a "4-way" intersection. The seemingly complex wiring to illuminate the lights is shown to be very simple.



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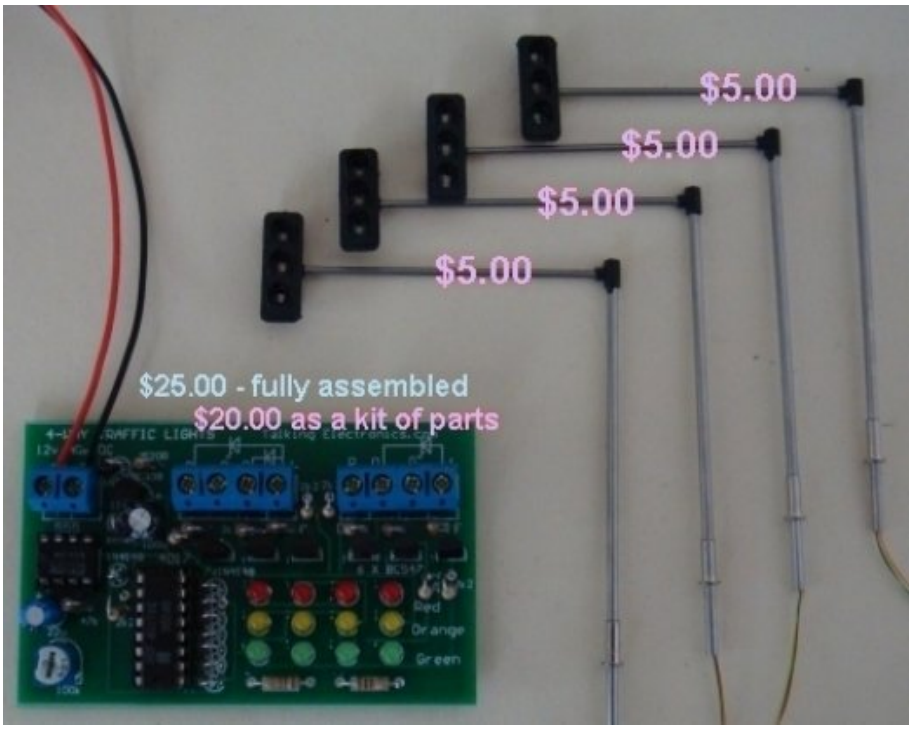
4-Way Traffic Lights

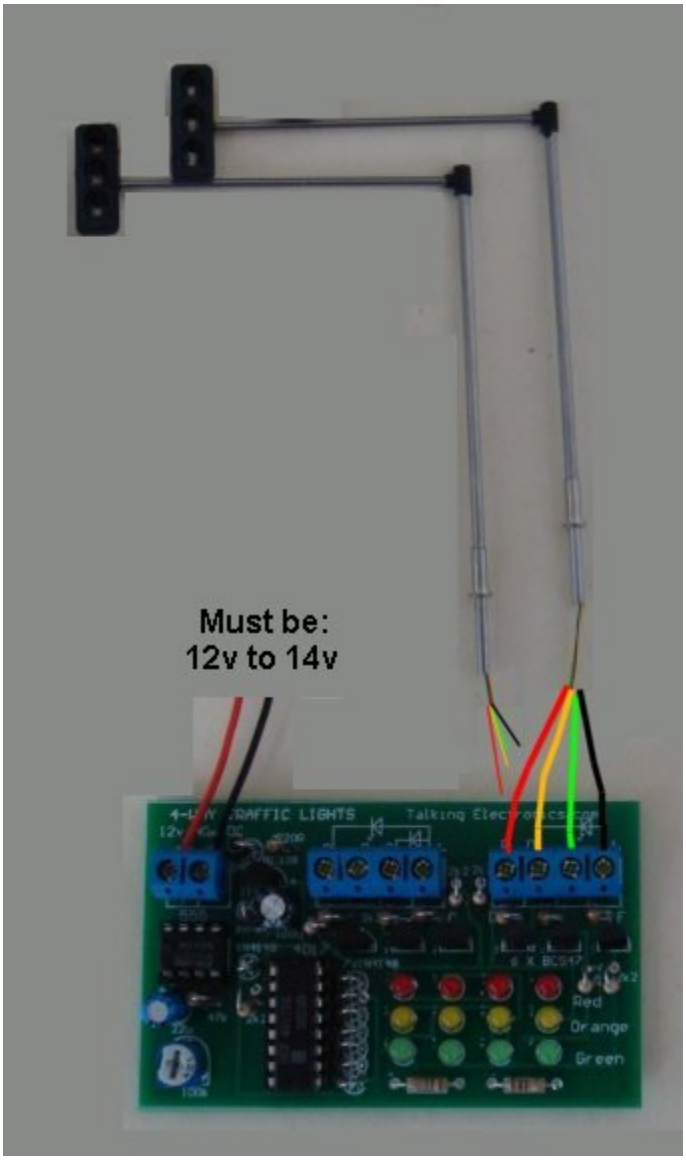
Kits are available for this project from
Talking Electronics for $20.00 for the parts and PCB plus
$5.00 for each overhead light (4 needed) plus $6.50 postage.
The project is also available fully assembled and tested for $25.00 plus postage.

This project adds realism to your layout with functioning traffic lights at an intersection.

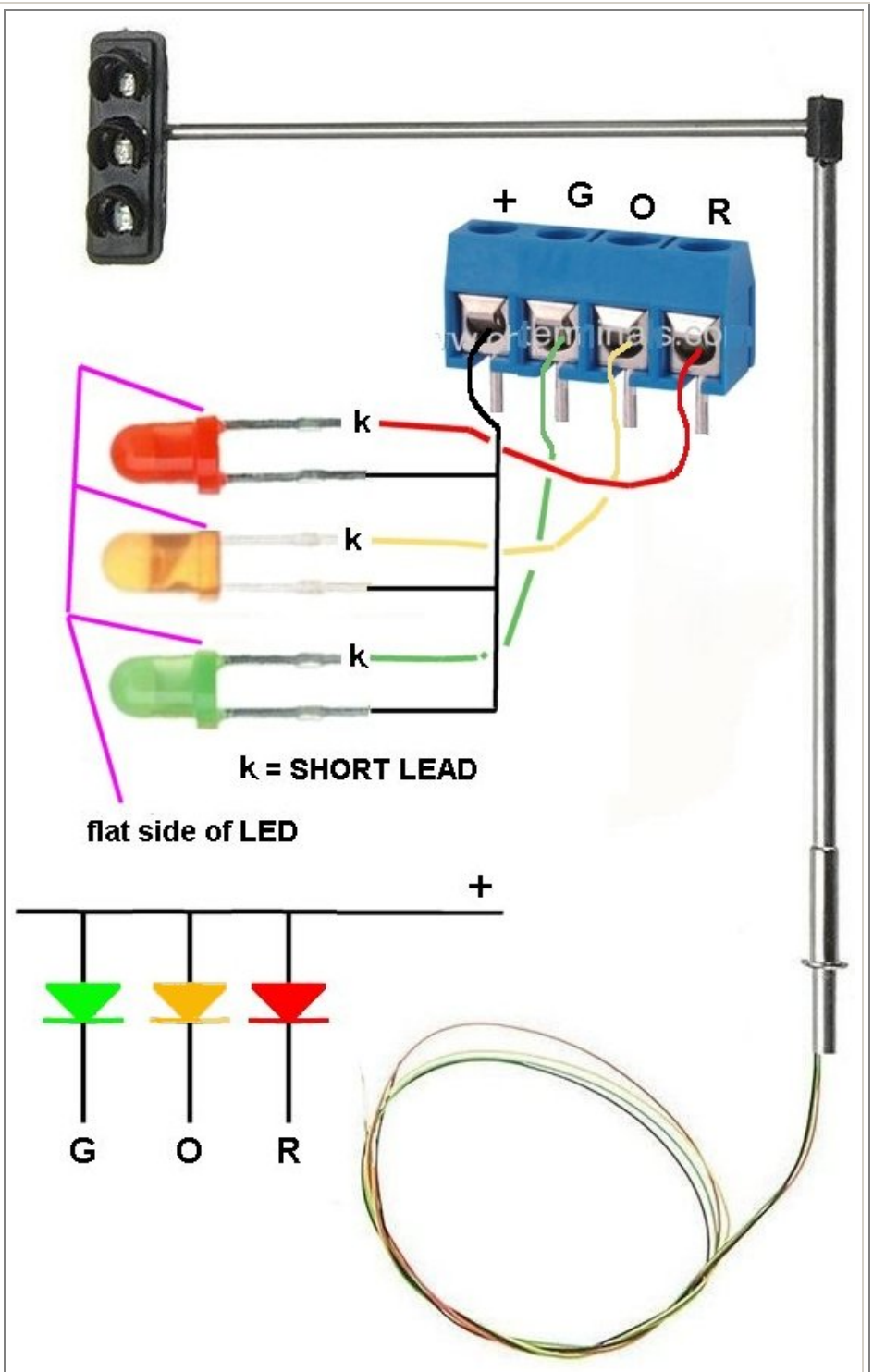
You can use column signals or overhead signals.
The PC board shows the condition of the lights and you only need to extend leads from the board to the signals, to complete the project.
The supply MUST be 12v as the voltage of the LEDs adds up to about 10v and any voltage below 12v will not allow some of the LEDS to illuminate AT ALL - and you will think the project is faulty.




$4.00
$4.00
$4.00
$4.00
$20.00 as a kit of parts
$25.00 - fully assembled
4-WAY TRAFFIC LIGHTS
Talking Electronics.com
12v AC or DC
555
4017
1N4148
7x1N4148
6 X BC547
Red
Orange
Green



This image shows how to connect the very fine wires from the end of the post to the screw terminals. The kit contains fine screened lead and two of these leads are used for each overhead signal to the terminals. Two overhead signals are joined in parallel to the first set of four screw terminals and two overhead signals are connected to the second set of four screw terminals.



This wiring diagram shows how the LEDs are connected in the over-head light. All the anodes are connected to the black wire and the cathodes emerge as Green, Orange and Red. The 4-screw terminal block is looking at the where the wires enter the terminals and this is clearly shown in the photograph above.

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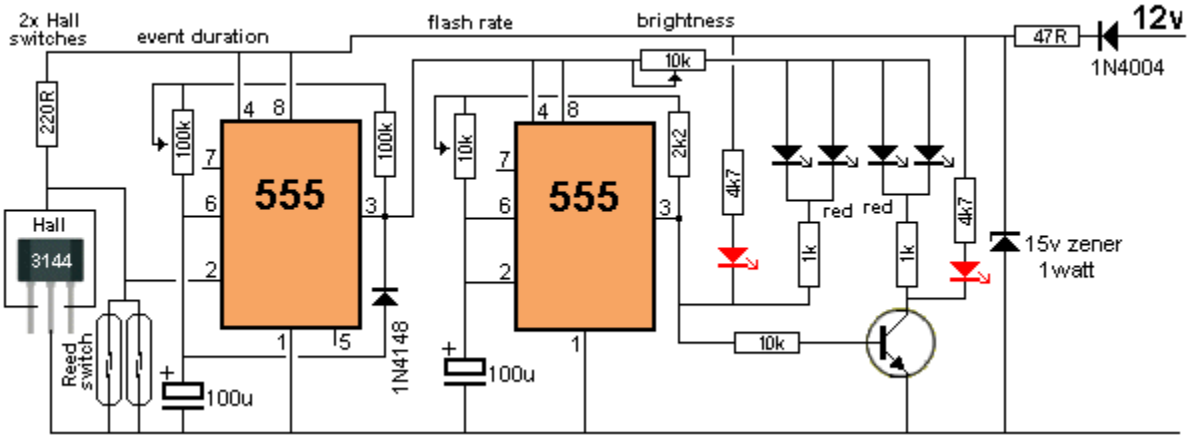
Jim's Crossing

Lights MkIV

Kits are available from
Talking Electronics for $15.00 plus $4.50 postage.
See the FULL PROJECT HERE with more details of the Hall Device

This project operates crossing lights automatically when the train enters the crossing and turns them off automatically. The flash-rate can be adjusted as well as the brightness of the lights and the overall length of time for the flashing. No other module on the web offers these features.

Two LEDs on the module indicate when the lights are flashing and the module comes with 4 extra LEDs for those who have bought crossing signals without the LEDs installed.



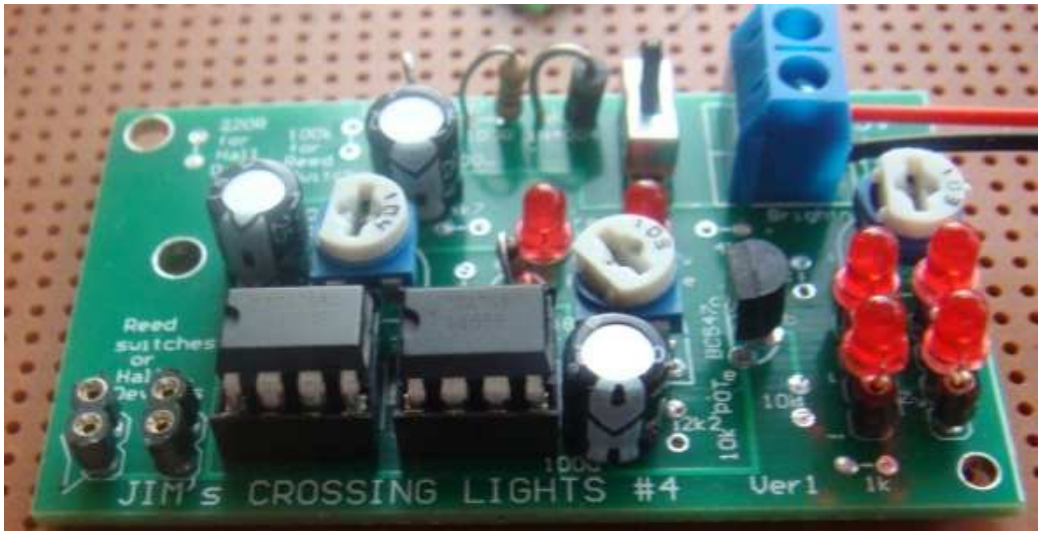
Jim's Crossing Lights MkIV circuit

The circuit has a number of very clever features. .
It is **Jim's Crossing Lights MkIV**

It uses two 555 ICs to provide all the functions. The signal diode on the first 100u discharges the 100u quickly when the circuit turns off so the timing can restart again with full duration.
The flash-rate can be adjusted because everyone says "the flash-rate is not right."
The "duration of the event" can be adjusted to suit your layout.
The brightness of the LEDs can be adjusted to suit the type you are using.
The circuit will take 12v DC as the ideal voltage. Do not go below 10v DC as the voltage drops across the various components gives the second 555 less than 5v because the power diode drops 0.7v, the 47R drops about 1.5v and the first 555 outputs a voltage and current via pins 3 to the second 555 for all the rest of the circuit. There is about another 1.5v drop in doing this.
The circuit will work perfectly up to 15v DC and when you supply a DC voltage higher than 15v, the 15v zener comes into action and any voltage above 15v, will be dropped across the 47R resistor. If you supply 16v, the voltage drop across the resistor will be 1v and the current that will flow through the 47R will be **I**=V/R = 1/47 = 20mA. This current will also flow through the 15v zener and is called the REGULATION CURRENT or wasted current and the wattage dissipated by these two components will not be noticed at the moment. But if the supply voltage is raised to 20v, the "wasted current" will be 100mA and the wattage dissipated by the 15v zener will be 15 x 0.1 = 1.5watts. The zener is 1watt and it will burn out at 1.5watts, so the limitation of input voltage is 18v.
The zener in this circuit is NOT called a zener regulator but a ZENER LIMITER. It prevents voltages higher than 15v because the 555 IC's are limited to 18v operation.
The circuit is designed to take either two reed switches **OR** two Hall effect devices (switches).
The Hall switches are connected in a very clever way. They are connected so that they sit with a load resistor of 220R and due to the small current they require, the voltage at the "pick-off" point is about 9v for a 12v supply.

When any of the input devices detects magnetic flux, the circuit switches ON and the output lead effectively goes LOW. The voltage goes to 0v for the reed switch, but the Hall device is different. This "pulls" the "pick-off" point lower and as it gets lower, the voltage to the Hall device drops too. As the voltage across the device reduces, its capability to keep the output low is reduced and thus the output does not drop to 0v, but stops at about 2-3v. At this voltage the device is still working and pulling the output as low as possible, (with the current that is available at this low voltage).
You can combine one reed and one Hall device as the 220R will cover the requirement of either/both devices.
The voltage at the "pick-off" point is detected by Pin2 of the 555. This pin only detects a LOW and when the voltage drops to 33% (or less) of the voltage on pin 8 of the chip, it starts to "time the event."
The timing of the event is done by charging a 100u via a resistor(s) and when Pin6 detects 66% of the voltage on the Pin8, the output Pin 3 goes HIGH and the project turns OFF. The only component taking current when the project is not flashing, is the first 555 and this takes up to 10mA.
To reduce the brightness of high-brightness red LEDs, it takes up to 10k via a mini trim pot. This will allow all different types of LEDs to be used.

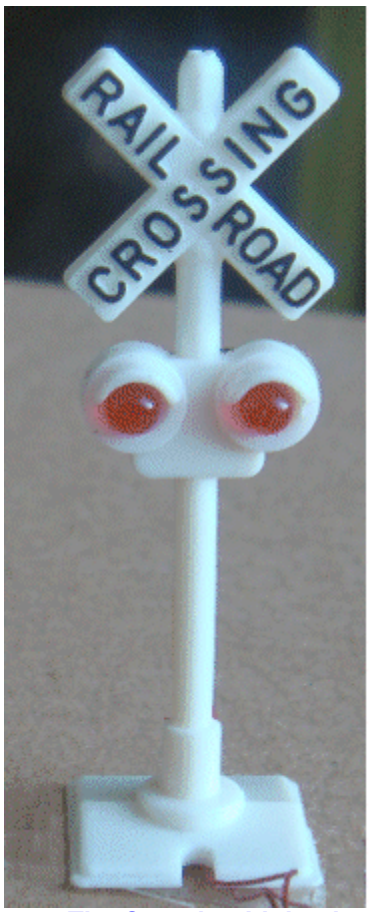
Everything is identified on the PC board

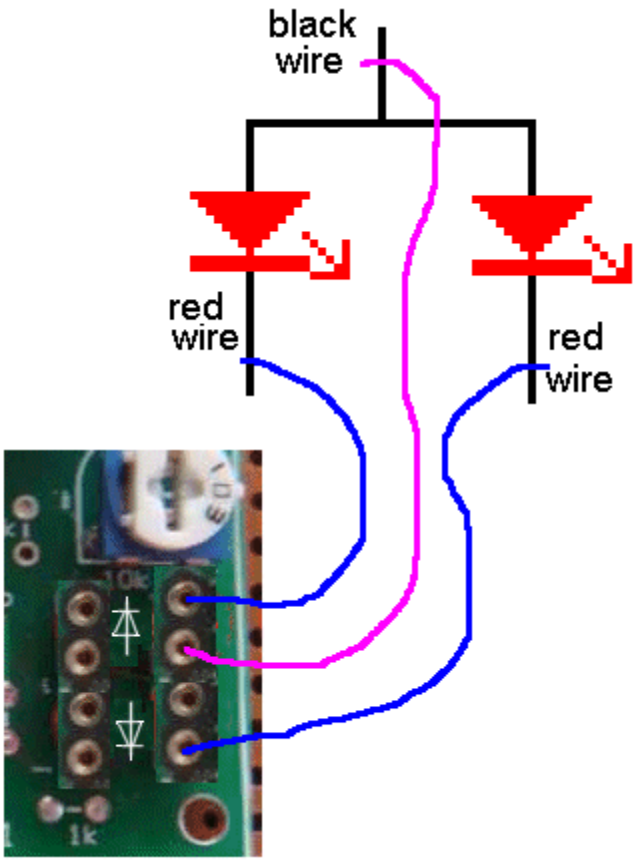


The module is available fully-built and only needs to be connected to 12v DC. Connect the reed switches or Hall devices to the input terminals and switched ON.
Bring the magnet up to the reed switch or Hall device and work out the distance at which it is detected.
The magnet must be around the correct way for the Hall device as it detects just the North or South pole, according to the way the Hall device is placed.
The detection range is about 5mm for the tiny super-magnets we supply in the kit
This will help you place the reed switch or Hall device in the centre of the track and glue the magnet under the loco, and have the gap small enough to make sure the circuit responds every time.

CROSSING LIGHTS

There are many different types of crossing lights and most of them have three wires.
The black and red wires are shown in the diagram below.





The Crossing Light above is available from Talking Electronics for $5.00
You will need 2 of these. (HO scale)

This crossing Light is on eBay

Jim's Crossing Lights

$15.00

plus $4.50 postage

Kits are available1 - 47R all 0.25watt
1 - 220R
2 - 1k
1 - 2k2
2 - 4k7
1 - 10k
1 - 100k
2 - 10k mini trim pots
1 - 100k mini trim pot

3 - 100u electrolytic

1 - 1N4148 diode
1 - 1N4004 diode
1 - 15v 1watt zener diode
6 - 3mm red LED

2 - 555 ICs
2 - 8 pin IC socket
1 - BC547 transistor

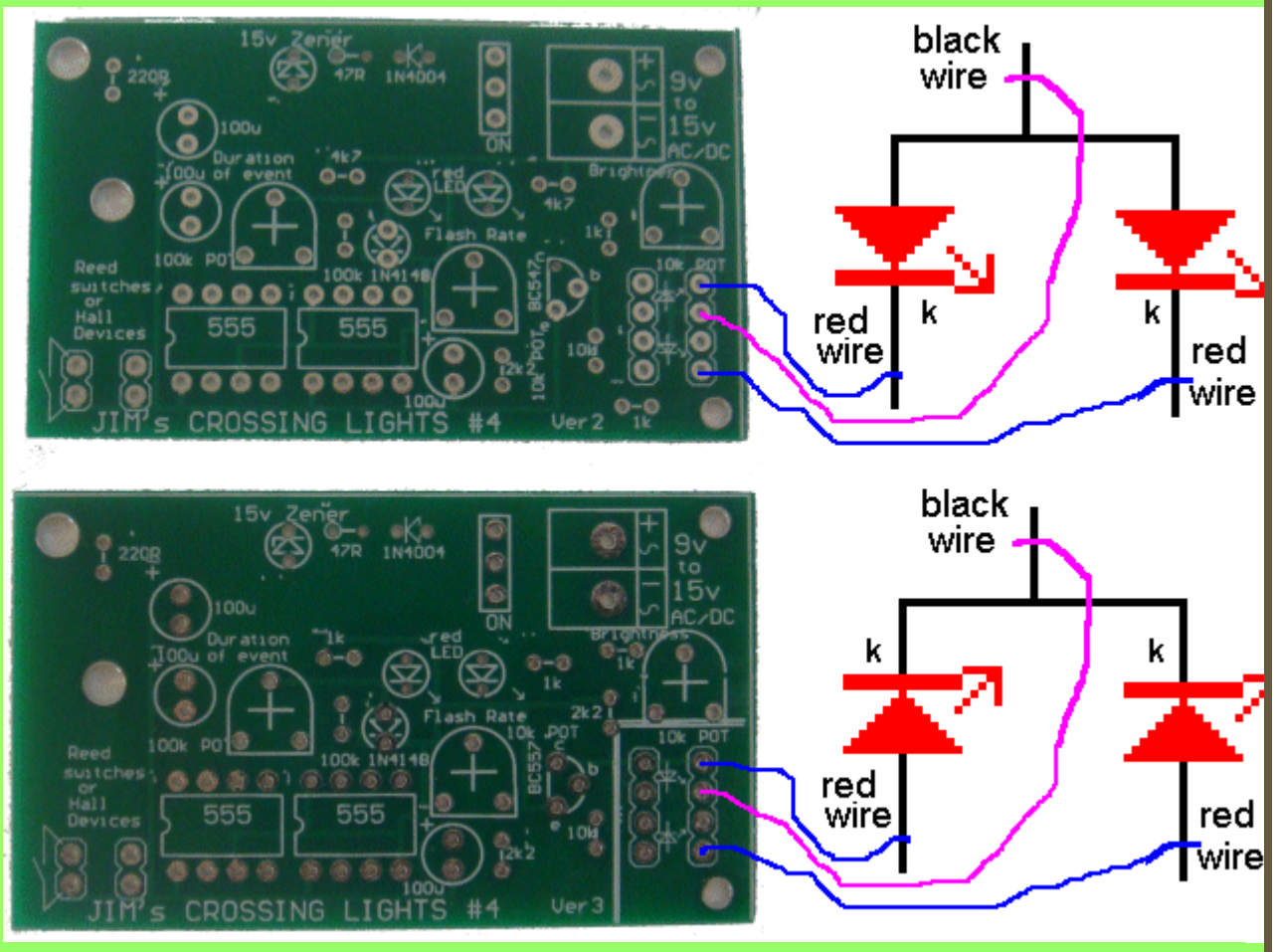
2m - 2-core cable for input devices
2 - mini reed switches **or**
2 -- Hall effect devices
2 - 10mm x 1mm super-magnets
1 - 2-way terminal block
2 - 2 pin sockets - round pins
2 - 4 pin sockets - round pins (called machine pins)
1 - mini slide switch
1 - 20cm very fine solder

1 - Jim's Crossing Lights MkIV PCB

You will need 2 x Crossing Lights as shown in the images above

TWO VERSIONS

TWO versions of this project are now available because some 2-aspect lights have a black wire that goes to the anode of each LED via a resistor and some are wired with the black lead to the cathode of the two LEDs.
The difference between the two PC boards can be clearly seen by the white frame around the output pins.



The wrong type of Crossing Light will NOT work with the wrong module.
You can test each Crossing Light with a 6v battery and 1k resistor or use the LED Tester project.

With the ver2 PC board, the LEDs must illuminate when the positive of the 6v battery is connected to the black wire and the red wire is connected to the 0v of the battery. You will need a 1k resistor to prevent the LEDs burning out, just in case the Crossing Light does not have an internal resistor.
But when the Crossing Lights are fitted to either module, the PC board has current limiting resistors under the board and a 10k pot to reduce the brightness to any level.

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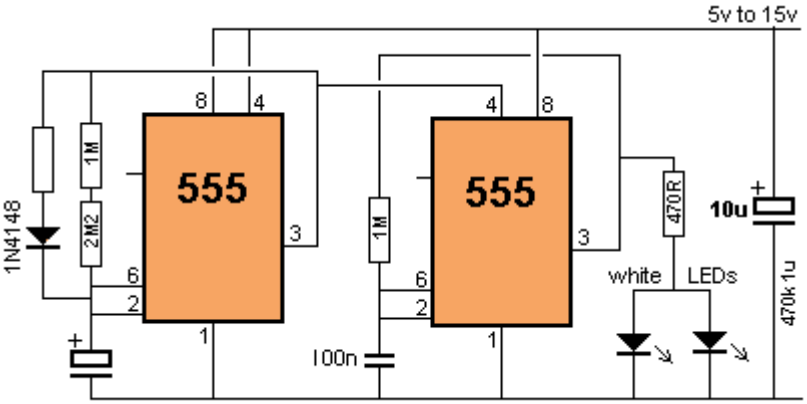
PROJECT

AIRCRAFT NAVIGATION BEACON



This project is available from Talking Electronics for $5.00 plus $4.00 post.
Buy A Kit It uses surface mount parts on a double-sided board 15mm x 15mm. Two very bright LEDs are mounted on the tips of the wings of your model aeroplane and the LEDs flash twice then delay 2 seconds before the next double flash.

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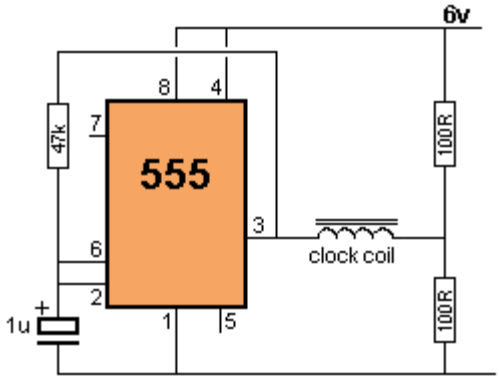
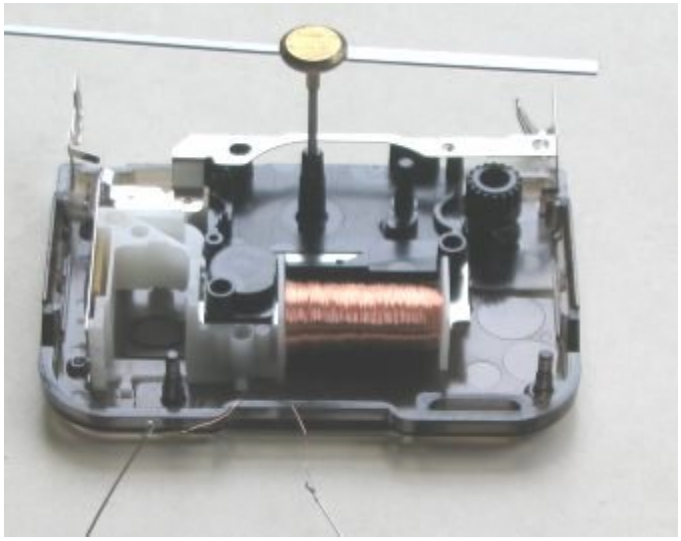
MODEL RAILWAY TIME

Here is a circuit that will convert any clock mechanism into Model Railway Time.
For those who enjoy model railways, the ultimate is to have a fast clock to match the scale of the layout. This circuit will appear to "make time fly" by turning the seconds hand once every 6 seconds. The timing can be adjusted by changing the 47k. The electronics in the clock is disconnected from the coil and the circuit drives the coil directly. The circuit takes a lot more current than the original clock (1,000 times more) but this is one way to do the job without a sophisticated chip.



MODEL RAILWAY TIME



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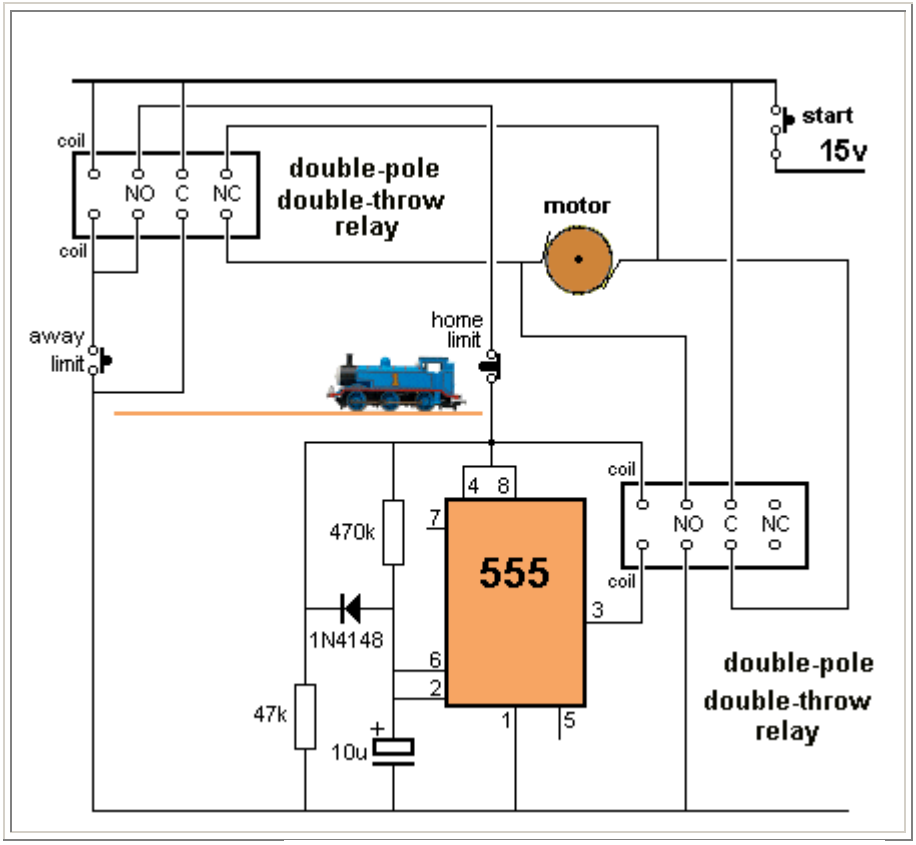
THEORY

REVERSING A MOTOR-4 **(see 1, 2, 3 in 200 Transistor Circuits)**

In this example the power is applied via the start switch and the train moves to the away limit switch and stops. The 555 creates a delay of 1 minute and the train moves to the home limit and stops. Turn the power on-off to restart the action.



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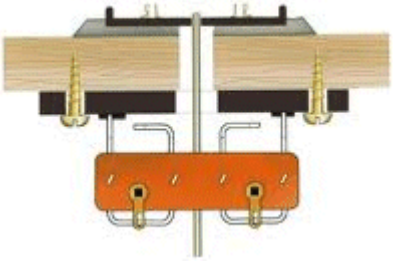
THEORY

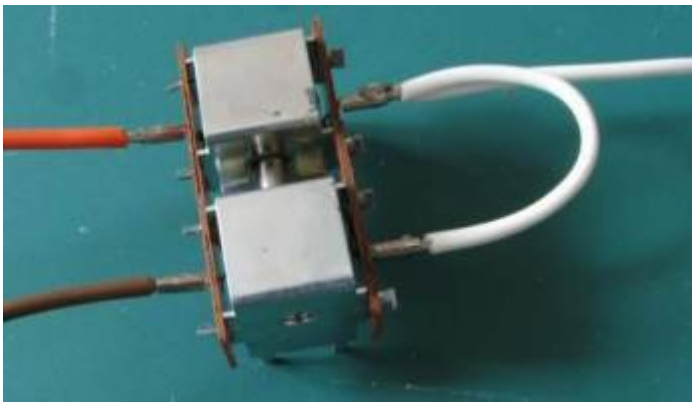
POINT MOTOR DRIVER

One of the first things (you will want) when expanding a model railway is a second loop or siding.
This needs a set of points and if they are distant from the operator, they will have to be electrically operated. There are a number of controllers on the market to change the points and some of them take a very high current. (You can get a low-current Point Motor).
The high current is needed because the actuating mechanism is very inefficient, but it must be applied for a very short period of time to prevent the point motor getting too hot.
Sometimes a normal switch is used to change the points and if the operator forgets use it correctly, the Point Motor will "burn-out" after a few seconds.
To prevent this from happening we have designed the following circuit. It operates the Point Motor for 5mS to 10mS (a very short time) and prevents any damage.
You can use a Peco switch (PL23 - about $10.00!!) or an ordinary toggle switch (change-over switch - SPDT - single-pole double-throw).
You can connect to either side of the Point Motor and both contacts of the other side go to 14v to 22v rail.

Point Motor mounted under the track.



The Point-Motor shaft moves left-right to change the points.



Wiring a Point Motor

The white wire is the "common" because it goes to the start of the two windings.
The red wire move the point to the left and the brown wire moves the point to the right.

Point Motor connected to track

Here is a video showing a point motor connected to a set of points, from the Rail Video Channel::
http://www.youtube.com/watch?v=aW67CFSWGzU&feature=related

to Index

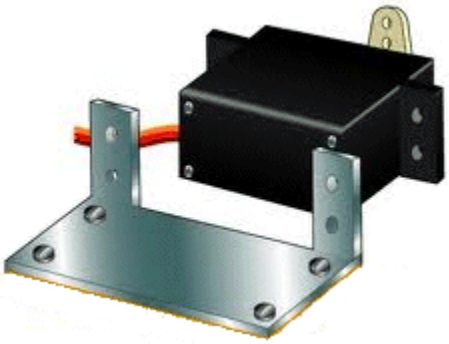
THEORY

MAKE YOUR OWN POINT MOTOR using a SERVO

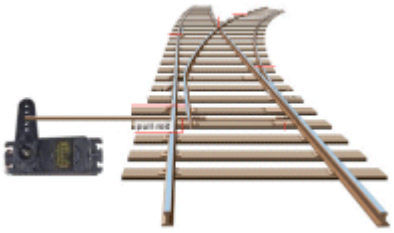
Point Motors can be expensive. You can save over 75% by making your own.
Point Motors (or switches) are also known as Turnouts or Points.
A point Motor can be made from an RC Servo (Radio Control Servo).

Servo and Horns

Connecting the push-rod



Mounting the Servo on a bracket



Fitting the Servo to the track

All servos come with a variety of attachments for the output shaft. These are called "Servo Horns" or "Servo Arms" and are "single leg horn, (or servo arm), double servo horn, circular horn (wheel) and others.
They convert circular motion into straight-line motion with the aid of a push-rod.
That's exactly what we want, to move the track-rails. Any of the horns can be used for this project as you only need a very short travel. The push-red needs to be spring-steel and you can unwind a small spring to get this item.
Servos have 3 leads. Positive, Negative and Signal. The Signal wire is connected to a PC board containing a chip that detects pulses to activate the motor. We do not need this feature. The PC board needs to be removed. Open the servo and remove the PC board and signal wire. The pot can be left in position but the wires need to be removed.
The two remaining leads are connected directly to the motor.
Our circuit drives the motor and gearbox with a short pulse of energy to provide clockwise or anticlockwise movement.
No limit switches are needed because the railway track provides the limits-of-travel and the motor effectively stalls when the end-of-travel is reached. The gearing produces adequate torque (or effort) to move the rails and a current of about 50mA is sufficient to operate the motor to provide this effort.

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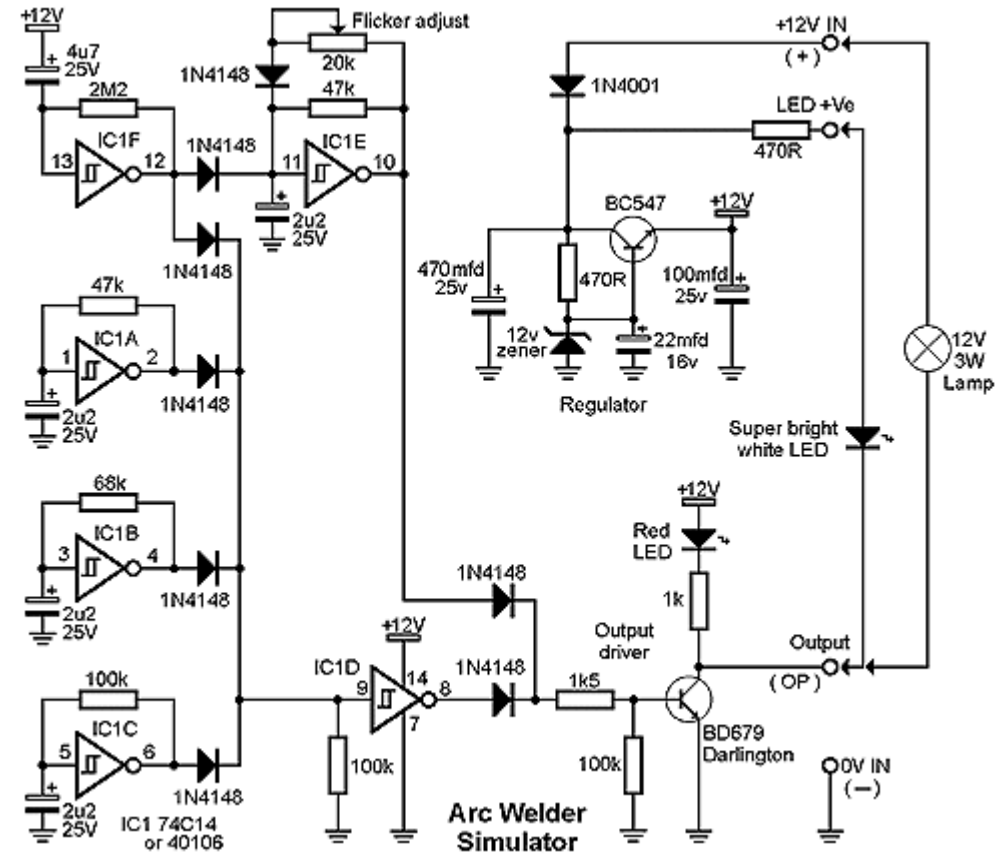
PROJECT

Arc Welder Simulator

This project adds reality to a work-site. It produces realistic flickering from an arc-welder.
The full project can be viewed HERE. A full kit is available from Talking Electronics for $21.50 plus postage.



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PROJECT
27MHz link for about $10.00

These two modules are available from Talking Electronics for about $10.00 plus post.
They produce 2-channel transmission and can be used for all sorts of communication on your layout.
You may want to control something at the far-end and running cables may be practically impossible.
Or you may want to control something that moves around the layout.
This is an ideal way to solve the problem.
The range is about 10 metres.
The modules come with whip antennas.
See more of this project: HERE


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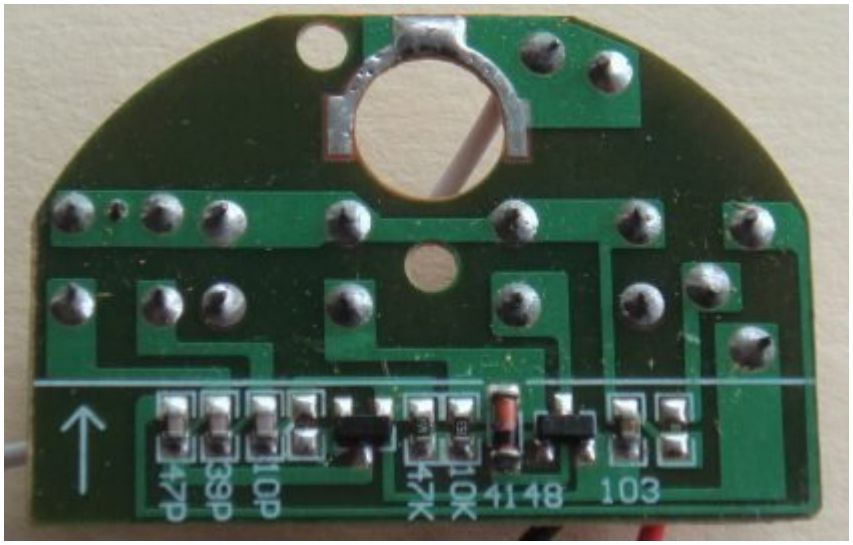
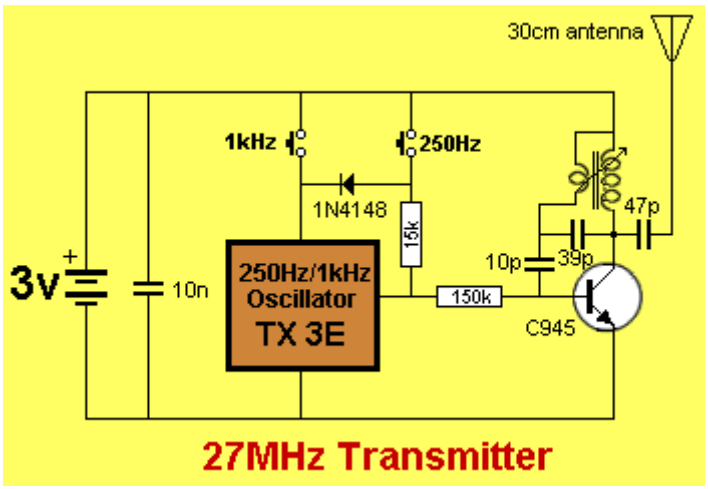
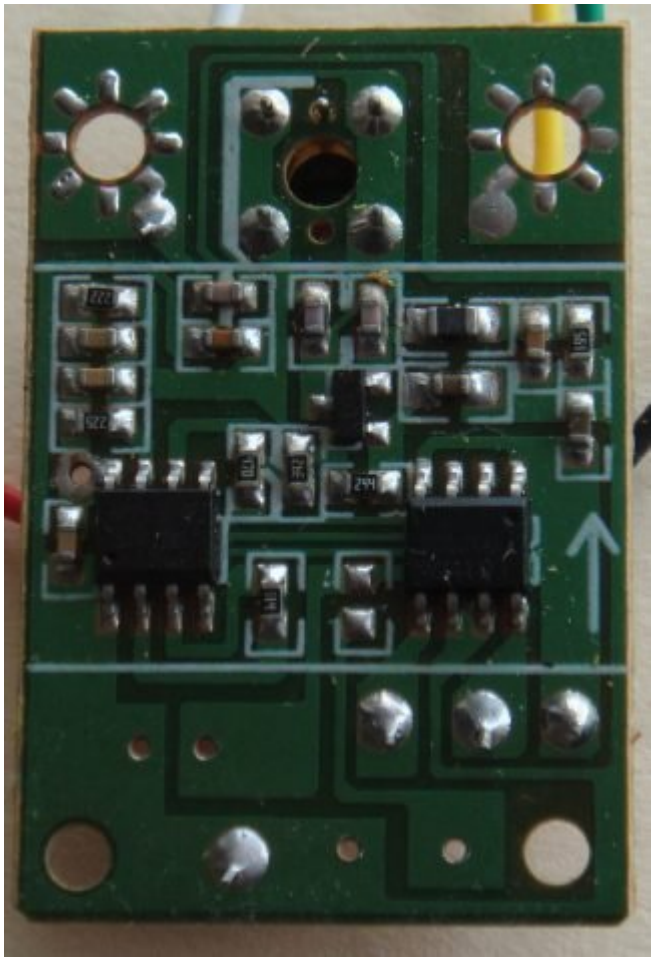
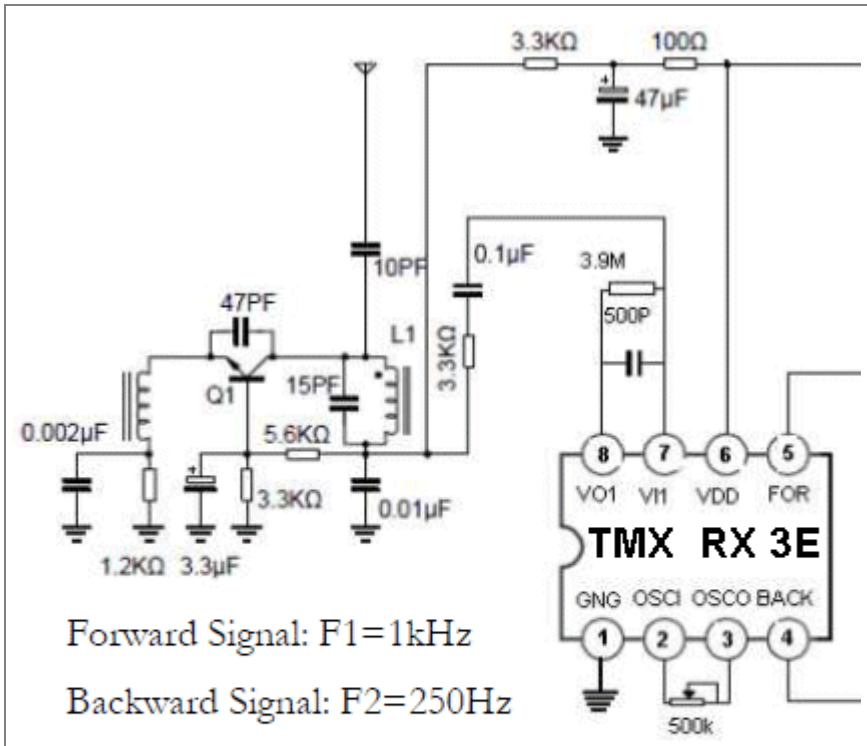

47P
39P
10P
47K
4148
103


30cm antenna
1kHz
250Hz
1N4148
15k
47p
10p
39p
3v
10n
250Hz/1kHz
Oscillator
TX 3E
150k
C945
27MHz Transmitter


ANT
ANT
QF-1692R
2015.4.01
+8
R
L
-8

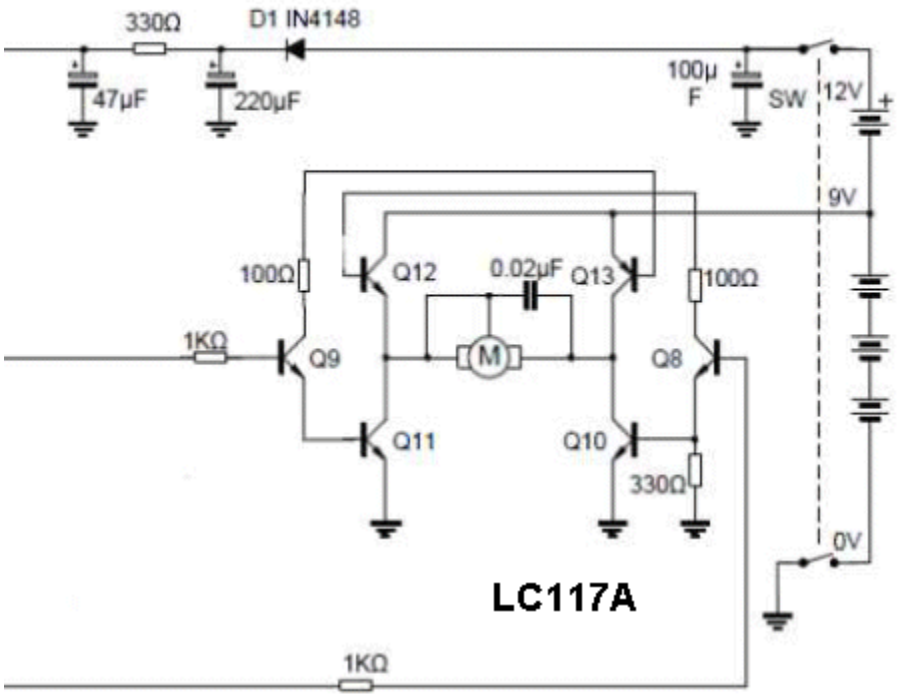




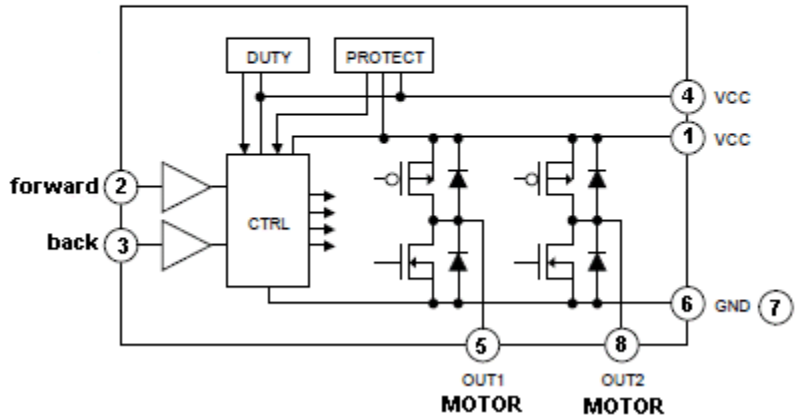
Forward Signal: F1=1kHz

Backward Signal: F2=250Hz

This is the approximate circuit for the 27MHz receiver



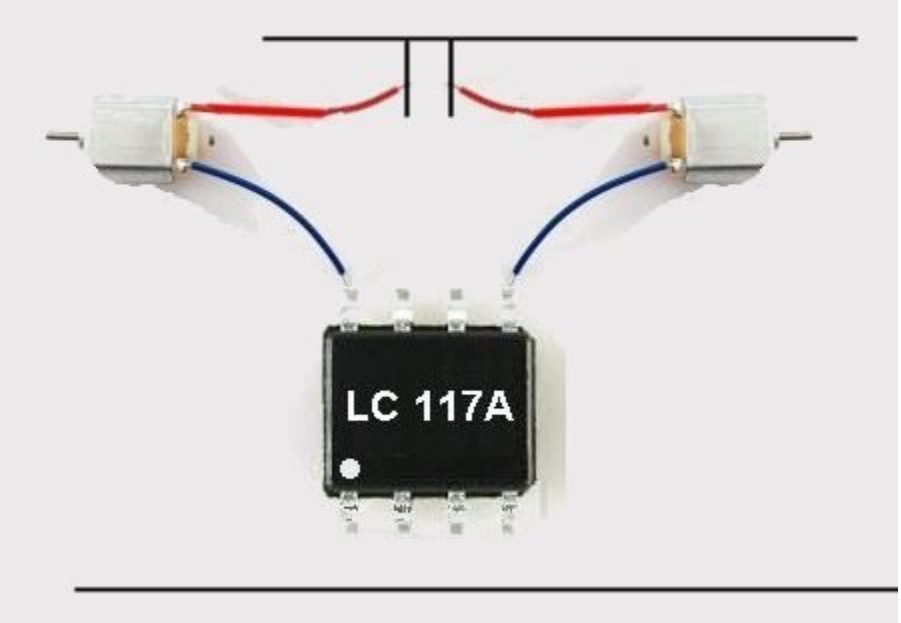
LC117A



Note: Only **one** motor is connected to the chip.

The two outputs can be used to reverse a motor or each output can be used to turn on a device.
When there is no transmission (reception) both outputs have zero volts.
For Forward, one output goes high and the other goes low.
The voltage lost across the output FETs is only a few millivolts (about 3 to 5mV).

The output FETs can handle about 200mA to 300mA.
Each output can be used to turn on a separate motor:



You don't have to buy these modules. You can use the transmitter/receiver from a toy car that no-one wants any-more. (some of them are 4 channel).
You can operate sound modules, lights, gates, points and anything up to 6v and 200mA.
Every module is different with different circuitry and chips. This article is just to give an approximate idea of how to use the modules.