Save 75 Model Railway Projects: .doc (9MB) or .pdf (8MB)
27-8-2020   27-8-2020

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

Talking Electronics has produced two books on Model Railway Electronics.
They are Electronics for Model Railways-1 (pdf) and Electronics for Model Railways-2 (pdf)
**These books have completely sold out so we have provided them in .doc format (Word) and .pdf**
All the kits from the two books are still available and we get lots of orders, but you must make sure
**you are good at soldering and see what the module does, before ordering.**
Some of the modules are available fully assembled and tested and some have been improved or simplified
and you need to contact us before ordering anything.   email Colin Mitchell: talking@tpg.com.au
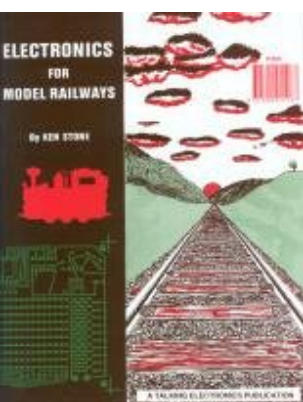
Electronics for Model Railways-1 **.pdf** (35MB) free to download
Electronics for Model Railways-1 **.doc** (13MB) free to download
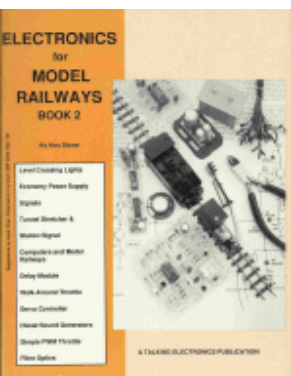
Electronics for Model Railways-2 .pdf (56MB) free
Electronics for Model Railways-2 .doc (13MB) free

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

More than 24 CIRCUITS as of 20-8-2020 Talking Electronics website has the remaining 50 projects as kits and the instructions are available in the two books shown above. As well as more projects on the website.

CONTENTS

INTRODUCTION

This e-book presents a lot of 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
Electronics for Model Railways-2

Since releasing these two books, we have designed lots of extra projects and more are being released all the time.

There is a very large group of Model Railway enthusiasts around the world and nearly everyone's layout includes more and more electronic devices, modules and controllers.
But a lot of enthusiasts are not electronically adept and have either not studied electronics or had the good-fortune to have built electronic projects.
That's why many of the projects we have designed recently are available as a kit or already built and tested.
Even to put a kit together you have to be able to identify each part and fit it correctly as well as owning a fine tipped soldering iron and knowing how to solder quickly and cleanly to prevent overheating the component.
Most Model Railway magazines don't have circuits and projects you can build, mainly because they don't have the back-up of component suppliers, reliable kit suppliers or the staff needed to answer questions on fixing kits that don't work.
We have all these features at TALKING ELECTRONICS and everything is backed by emails and service.
Most emails from us are very short as we have hundreds of emails to attend to each week but you must reply with one question at a time and eventually your problem will be solved.

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.
But there are more than 3 different manufacturers of systems
that are called "DCC" and each has a different set of "code-
signals" to perform a particular operation.
The system (coding) we use is the USA: NMRA National Model
Railroad Association
https://www.nmra.org/sites/default/files/standards/sandrp/pdf/s-
9.1_electrical_standards_2006.pdf
And the hand-held COMMAND CONTROL, we use for testing
all the modules is: **NCE Power CAB**.
HORNBY DCC has completely different DCC signals and is
NOT the same as NRMA signals.

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 45 years and about 100,000 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.

Here are some wonderful layouts and videos taken from the front and back of the trains on the layouts
. . . .   from **MODEL RAILWAY LAYOUTS PLANS.com**

http://modelrailwaylayoutsplans.com/dave-tidies-up-his-
layout/?inf_contact_key=93a9574ff8f6930e95fe40eaba006a971b0a3f0fd3ee5d9b43fb34c6613498d7"
Video:
https://youtu.be/MnBfqBCWNp4
You must join: **MODEL RAILWAY LAYOUTS PLANS.com** because they send a new layout every
day with videos.
This link show the enormous amount of wiring required for a layout with points and signals.

This is the latest: http://modelrailwaylayoutsplans.com/john-shows-us-more-of-his-stunning-
layout/?inf_contact_key=d02020000d3e42e28f99cc8a315cea07d18a532c4142cb79caf2b269de1401fa

Here are 2 of the latest images:
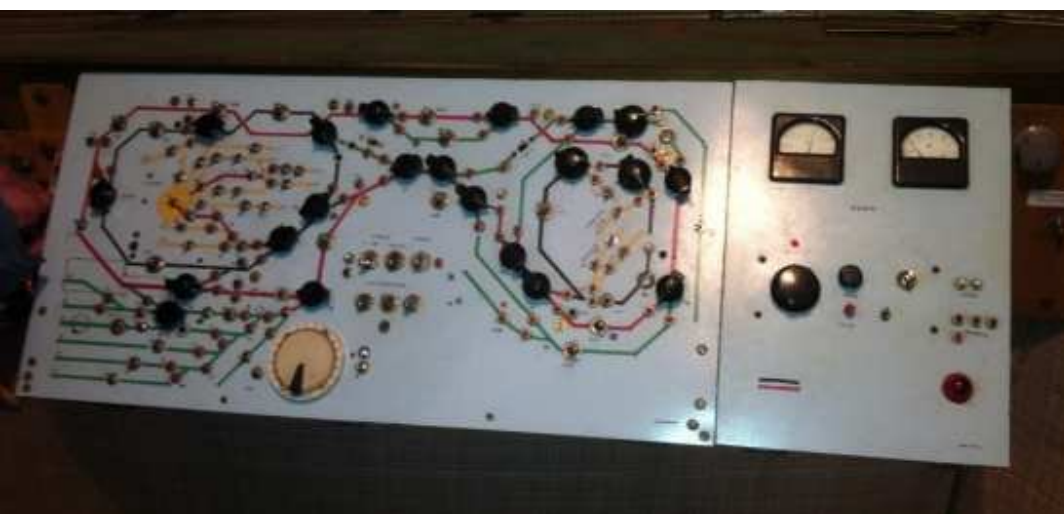
There are 200 more photos of layouts on the website:
MODEL RAILWAY LAYOUTS PLANS.com and by joining them via email you will get an email each day with more wonderful layouts.

These layouts show the enthusiasm and skill and interest and dedication and endless amounts of money invested in this hobby.

Talking Electronics is only able to help with the electronics side-of-things and you will find most of the layouts in **MODEL RAILWAY LAYOUTS PLANS.com** have very little in the way of street lighting, billboard signs, crossing lights, boom gates etc because few people know about our range of products.   Now you know, your layout can include lots more. So, don't think you have "gone too far" until you see all the layouts and spent all your spare money for the next 5 years. Your layout can always be "passed-on" or sold, so nothing is wasted. The biggest electronics hobby is model railways. And the greatest joy is squatting-down and watching a train come "head-on." The first time Edison presented a train like this on the "big screen," women fainted. You will just be over-joyed with the realism it produces. And we have a To-Fro project to do this for you automatically.

Many hobbyists wonder how to start a track layout.
Rather than use the back of an old door with a single loop, you can get more track on an "L-shaped" table and start with a single track:
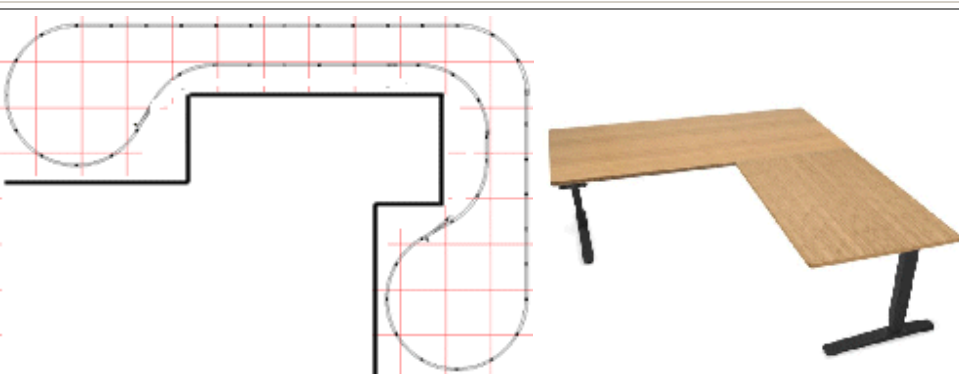
The next stage is to add points (turn-outs) or cross-overs:
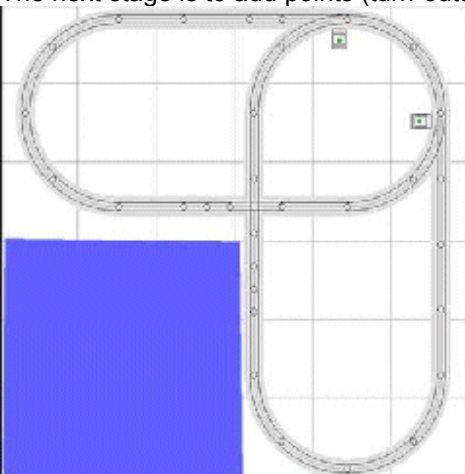
Or you can add reverse-loops:
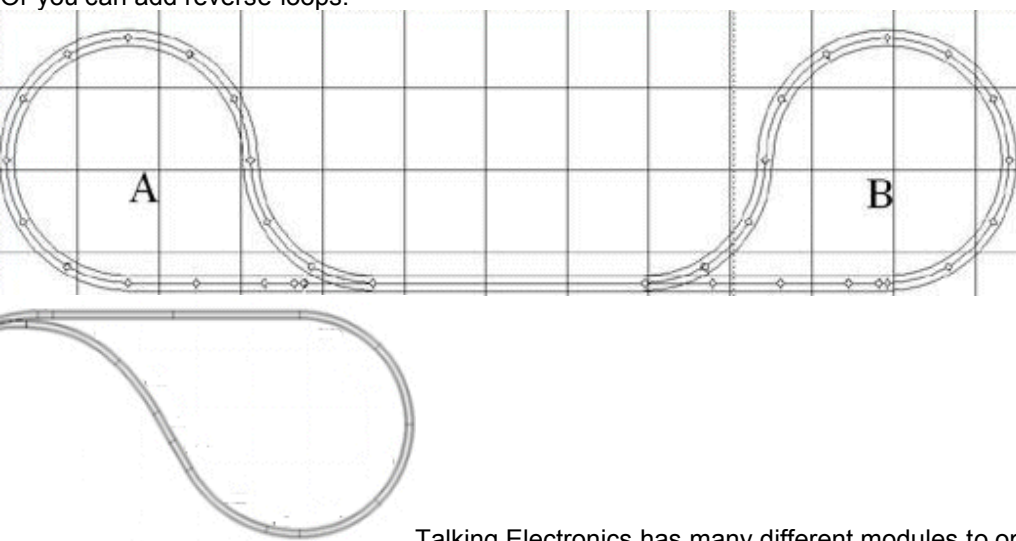
Talking Electronics has many different modules to operate points remotely and you will find them all here, in this article, on the page you are now viewing. Here are some layouts from readers:
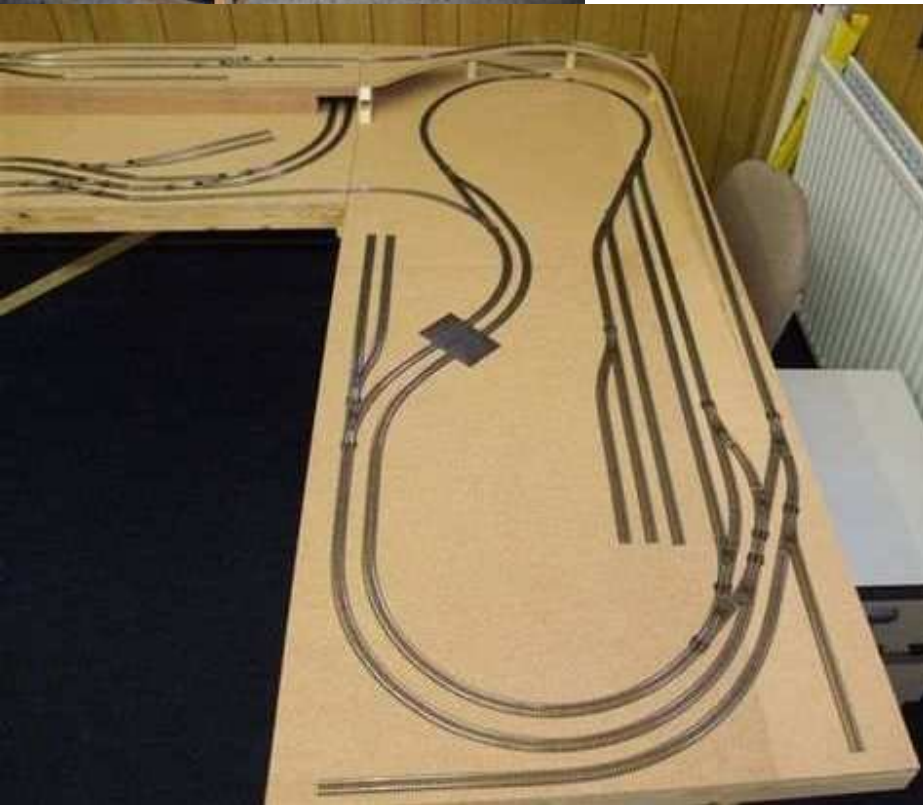
THE POWER SUPPLY

Every project needs POWER. Power is ENERGY (actually: Power over a period of TIME 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" or "reversing" 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 when 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, a 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 two 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 will 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 covered in Chapter 4 - halfway down). This is the module that connects 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 current and voltage was fairly low when you measured across the two output wires. But when you measured between either wire and the frame of a toaster, the voltage was 315 volts !!!

Throw out anything that you are not absolutely sure is safe.

I had one customer blowing up one my modules because he has two plug packs and one was leaking. It put a high voltage on the module and damaged the microcontroller 5 times. I asked him to put the module on batteries to prove the problem was the plug packs. He changed the plug packs and fixed the problem.

Suppose you 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 by 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 electrolytics.

So, almost any power supply can be used and it is the voltage that is needed so the electrolytics charge 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.

USING DC ADAPTORS IN PARALLEL
You can also connect adaptors in PARALLEL - DC adapters. This involves connecting the negative output of one to 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**. Otherwise the output voltage will be 17v on no-load and gradually drop to 12v as the current flowing to the load increases to 1 amp. And the current-sharing will change from 0:100 % to something nearing 50:50 %
It is pointless placing a 12v and 5v adaptor in parallel as the 5v adapter will never deliver any current.

THE SOLUTION:
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 if **each adapter has a diode on the output** that prevents one adapter passing any current to the other. You will lose about 0.7v and the output voltage will be 0.7v lower than previously, but it will allow two adaptors to be placed in parallel.
What will happen is this: The adapter with the higher voltage will deliver ALL the current. As you increase the velocity of the loco, the increased current will cause the output voltage to reduce and when it matches the output voltage of the second plug-pack, the two will share the current. In reality the second plug-pack will simply "start-delivering" and the voltage will not reduce much further.
If you want to see if each adaptor is supplying equal current, replace the diodes with two small "one ohm" resistors (one in each line) and operate your loco. Feel each resistor and see if they are getting "equally-hot."
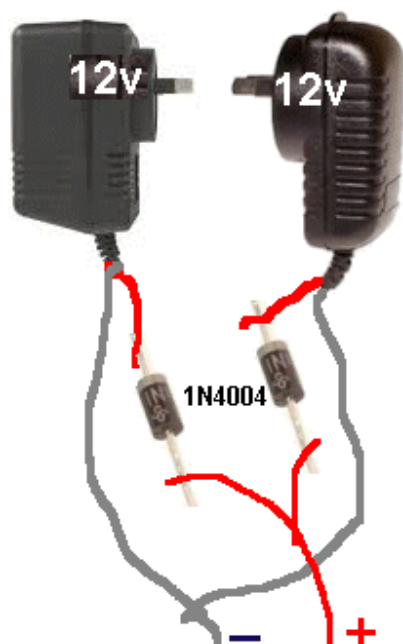
Here is a typical 18v power supply for a model railway. This is the ideal supply, but it is expensive and our aim is to show how to produce the same output voltage by using much cheaper items (Plug Packs etc.)

18v Power Supply

USING AC ADAPTORS IN PARALLEL

You can connect AC adapters in parallel, providing they produce the same output.
The only way to check this is to connect them together at one end and flick the other two leads to make them spark. If they produce a large spark, you need to change the leads from one adapter.
If you flick the leads and a small spark is created, they do not match perfectly and one or both will get hotter than normal as current will flow through the secondary windings.
It is very difficult to make any other tests without using a multimeter.
When you connect one end of each together and connect a multimeter (set to low AC voltage) to the other two leads, the meter should NOT SHOW any voltage. This means the output of each adapter is rising and falling at the same time and with the same amplitude.

USING DC ADAPTORS IN SERIES

Here are two Plug Packs connected in series:
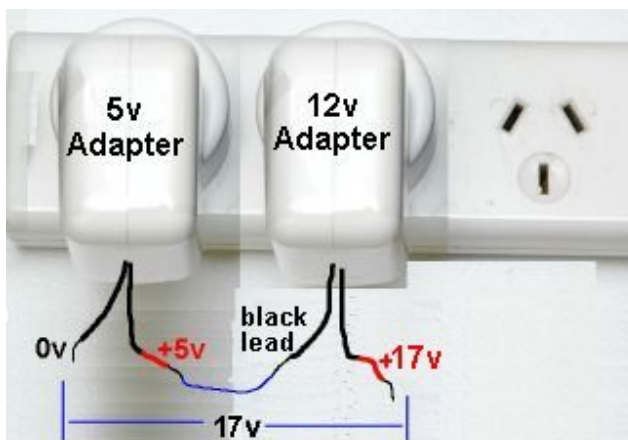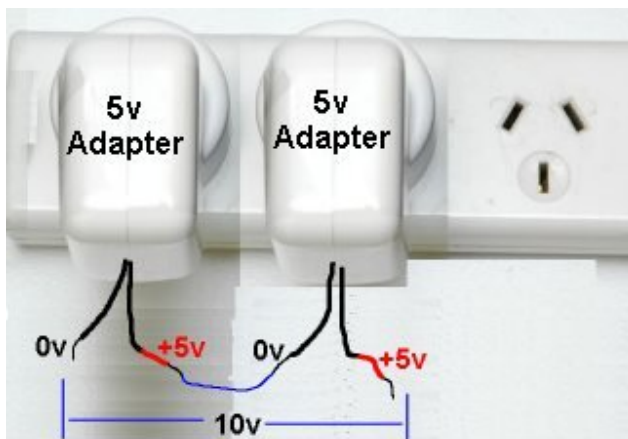
You can connect any TWO or THREE together and the output voltage will be the sum of all the voltages and the current will be determined by the lowest current of the 3 adapters.

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:

10v @ 1amp $5.00

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.

NOTE: Sometimes you will use a charger (wall wort) (or two in series) to charge a Capacitor Discharge Unit and the inrush current will be more than 1 amp and one of the chargers will "close-down" and fail to deliver its voltage. The solution is to add a 12 ohm resistor for 12v, 18 ohm for 18v or 24 ohm for 24v that is soldered to the positive lead. This will limit the current to 1 amp on turn-on.

The $2.50 plug Pack above was purchased as 12v @ 1 amp. It was easily opened-up via a screw and clip, to reveal the PC board shown below.
The output voltage is determined by the zener diode at the front of the board. The 12v zener was replaced with 15v and now the output is 15v DC. I would limit the current to 800mA, but a 15v supply can be connected to many of the throttle circuits covered later in this article to give 0v to 12v DC output. The zener diode is "sitting high" to show the diode in this discussion and also to allow test chips to measure the voltage across it. It was then resoldered close to the board and the cover replaced. This module is LIVE when out of the case, so don't touch anything.
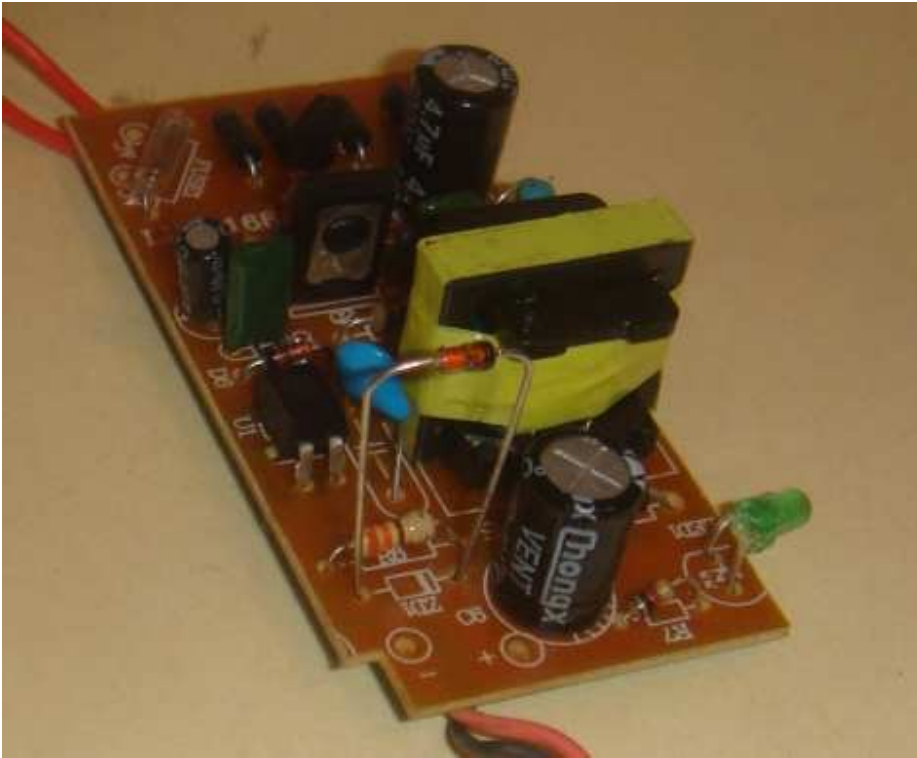
The new 15v zener converts this power adapter to 15v output.
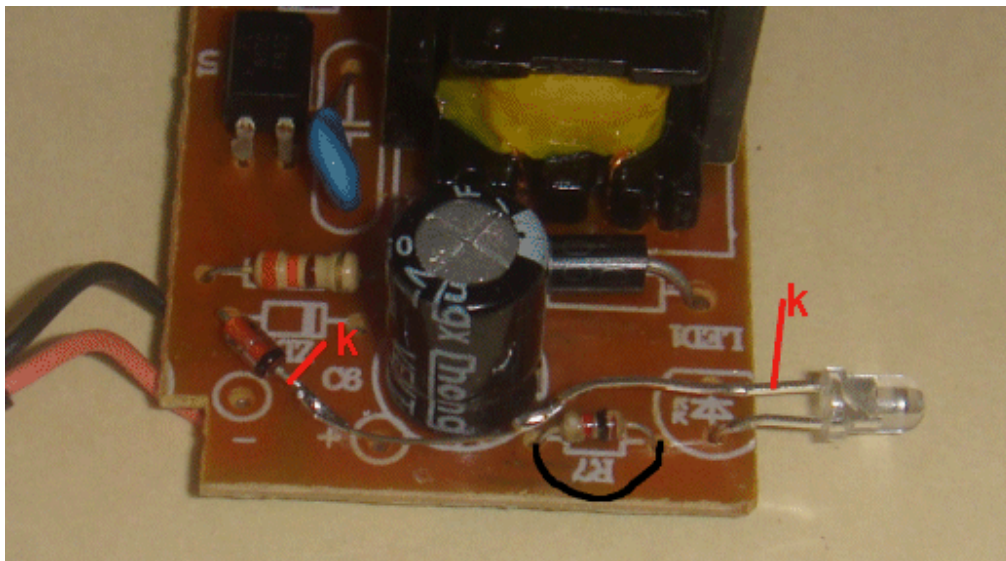
You can also use a white LED in series with the
12v zener diode to get 15v output. Note the cathode of the zener is connected
to the cathode of the LED and the 1k current-limiting resistor is
linked with a jumper (it is not used).
Thus the 15v output drives the LED (3v drop) and the 12v
zener drops 12v. The anode of the zener is connected to 0v.
The result is 15v output.

36V !!

Some of the CDU projects can be supplied with 30v to 36v DC to fully charge the electrolytic(s).
You can make a 36v supply very cheaply by using 24v and 12v plug packs and these are available on eBay for less than $10.00 (for both) including postage.
Simply connect the leads as shown in the following diagram to get 36v.
Some of these plug packs have a current detecting overload circuit and "shut-down" if the current is more than 1 amp (even for a millisecond).
To prevent this we add a 47 ohm resistor.
This "trick" only applies when you are using the plug packs for our CDU modules as the high current is only required for a few seconds and then falls to a very low value and the resistor will not get warm when used for this particular application.
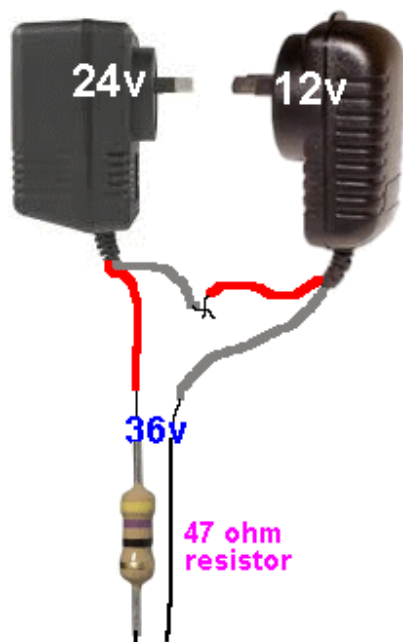
THE ALTERNATIVE TO A WALL WORT

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 push-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.

Power Supply MkII

0-12v DC(voltage adjustable)   0-1Amp(current adjustable)

Power Supply MkII kit from
Talking Electronics for $20.00 plus $7.50 postage.
Click HERE for details.
(see the full article HERE)

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.

This is the cheapest, safest **Power Supply** you can get.
It will deliver 0-12v at 1amp and you can limit the current to a few milliamp so you will not damage a project you are designing.
It has 14v at 5 amp - called an AUXILIARY OUTPUT - that connects directly to 4 cells and you need to be careful as the Li-ion cells are capable of delivering up to 50 amps if the wires are shorted.
This project is called a **BENCH POWER SUPPLY** as it is a handy piece of **TEST EQUIPMENT** that is designed to deliver a controlled voltage for a project you are developing.
It is not a continuous power supply as the cells need to be charged (when the indicator LED does not illuminate).
The Li-ion cells are available on eBay for a few dollars each and you can buy a single-cell charger for a few dollars. These chargers are microcontroller based and they stop charging when the cell is fully charged. You cannot charge the cells from a "battery charger."
You can also get a single-cell charger PCB that connects to your laptop USB socket and it will charge a cell very quickly. But you will only be able to charge one cell at a time.
All these things are covered later in the article.
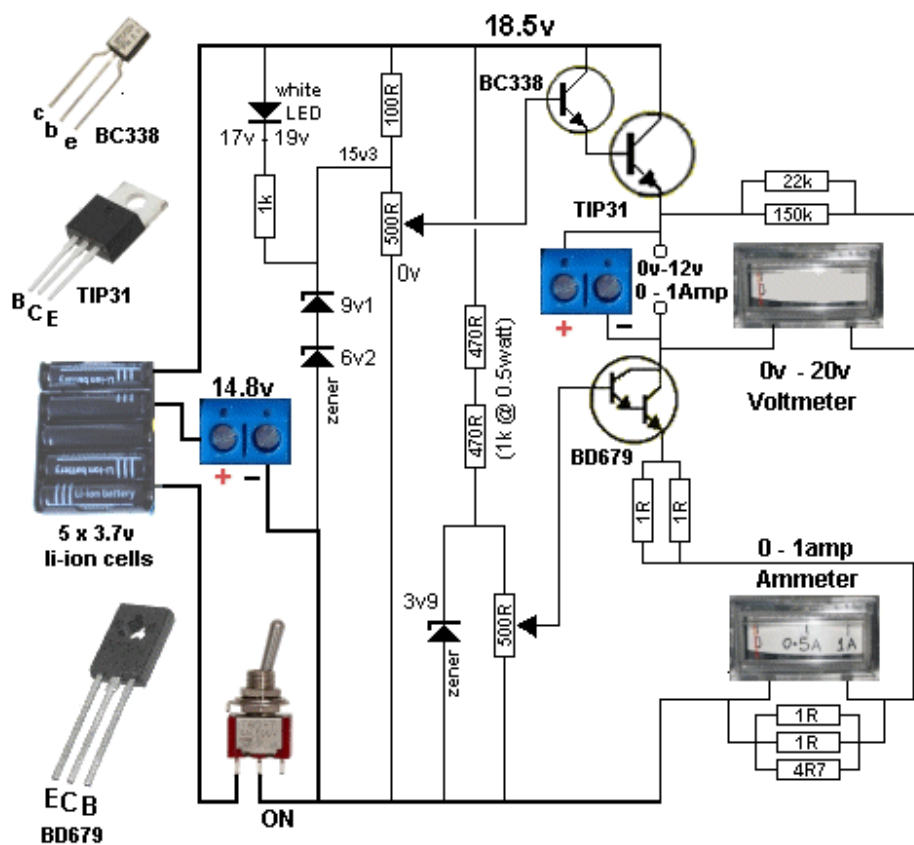
POWER SUPPLY MkII Circuit
You can use 2 x 470R @ 0.25watt or 1 x 1k @ 0.5watt
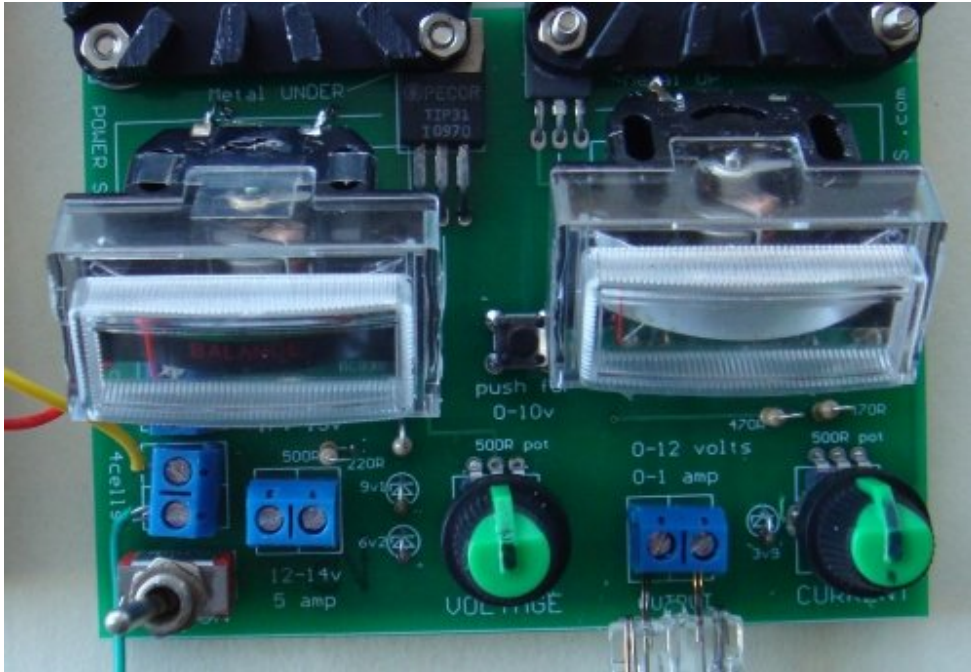
The new PC board uses 1k (in place of 220R shown above as the current limiting resistor for the white LED) to keep the brightness low to stop blinding you.

PARTS LIST
Power Supply MkII
$20.00 plus $7.50 postage.
Click HERE for details

4 - 1R   0.25 watt resistors
1 - 4R7
1 - 100R
1 - 220R to be replaced with 1k
(the old board shows 220R - new board uses 1k)
2 - 470R (or use 1k @ 0.5watt resistor)
1 - 1k (as shown in circuit above)
1 - 22k
1 - 150k

2 - 500R trim pots
2 - knobs to suit

1 - 3v9 zener
1 - 6v2 zener
1 - 9v zener
1 - BC338 transistor
1 - TIP31 transistor
1 - BD679 transistor
1 - 3mm white LED
4 - 2-screw terminal blocks
2 - heat fins

4 - sets of nuts and bolts and 5 washers
4 - hook-up wire for battery boxes (to replace
     the rubbish on the battery boxes)
2 - side-view panel meters and 2 stickers and
     foam tape to hold them in position

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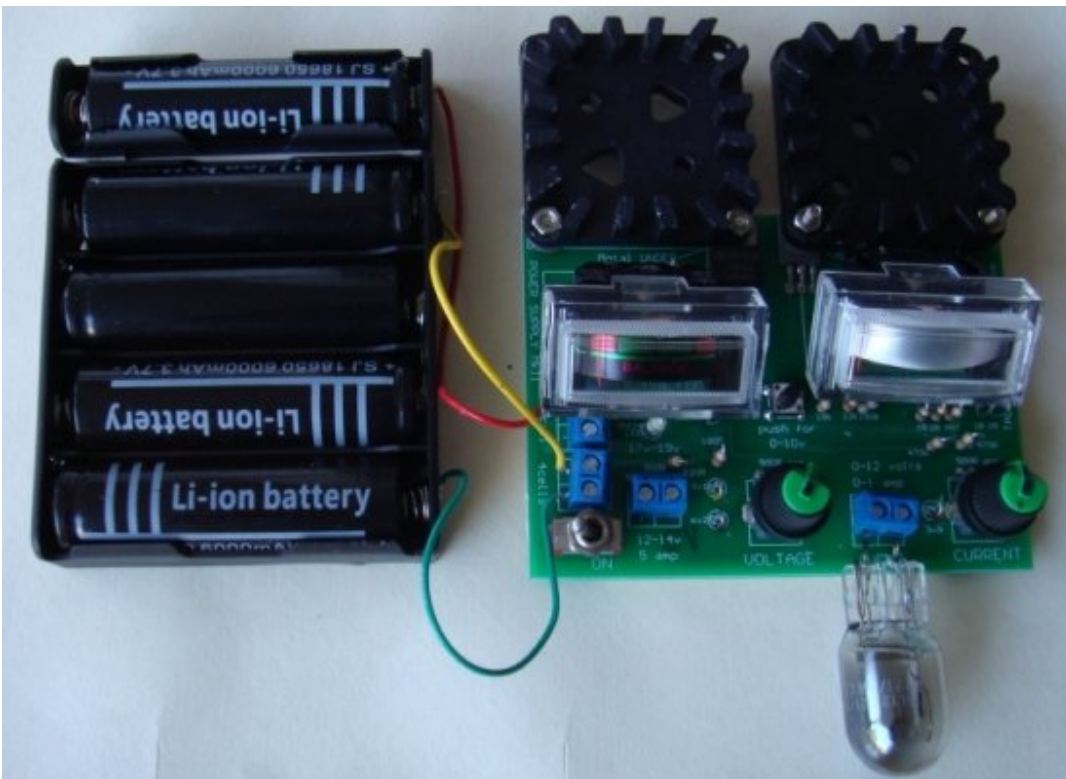
You can buy Li-ion cells for about $2.50 each on eBay. They have a capacity of about 2 Amp-hour to 3 amp-hour.

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.
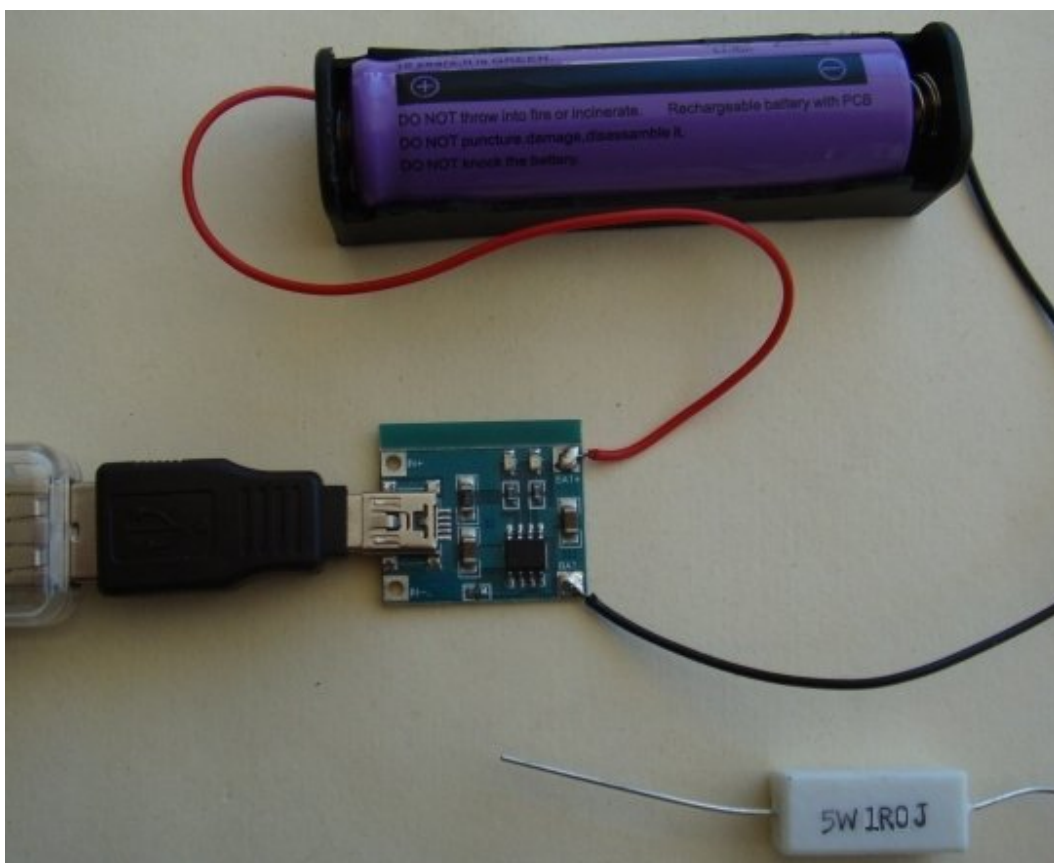
The 1 ohm resistor will discharge the cell quickly. The cell voltage must not go below a minimum voltage of 2.8v. You need to place a voltmeter across the resistor while discharging to make sure you do not discharge the cell below its recommended minimum. The module in the photo charges the cell quite 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 (when the same motor is connected). 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) and lots more current when the motor is "loaded."

AC TO DC
Before we finish, there is a bit of theory that needs to be understood.
We have mentioned the AC voltage and DC voltage on (or for) many of the projects.
The two values are a little bit different and you may be wondering why.
The technical reason is this: When you deliver 10v AC to a circuit that has diodes and capacitors (electrolytics) that convert the voltage to DC, the output is 40% higher than "10" because the 10v AC is actually 14v at the instant when the voltage is rising to a maximum and the capacitors get charged to this value.
There is a loss of about 1.5v across the diodes in the circuit and the output becomes 12.5v
Quite often the manufacturer of the 10v AC transformer will add a few extra turns and the voltage will be 13v AC (under no load). This is done because the output drops when full current is delivered (because the transformer is very poor quality) and this will ensure the output never goes below 10v AC. It drops from 13v to 10v - under full load.
However the 13v AC will produce 18.2v AC minus 1.5v = 16.7v DC when unloaded and if you deliver more than 13v AC, the resulting unloaded voltage may be too high for some of the electronic components - especially IC's.

CONCLUSION
You need to buy or make 2 POWER SUPPLIES:
15v 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 bare joints or bare 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 an earth lead. It also infers they do not have a metal case and this makes them extremely safe.

CAPACITOR-INPUT POWER SUPPLIES
You may find instructions or a circuit on the web for a CAPACITOR-INPUT POWER SUPPLY. This is a power supply with just a single or even 2 capacitors connected to the mains, followed by a bridge and an electrolytic. There is no transformer in this type of power supply and although you think the capacitor separates the mains from the 12v output, IT DOES NOT.
It does reduce the voltage of the mains to say 12v DC after the bridge, but if you touch either of the output wires and a water tap or kettle or toaster, you will get a jolt of 240v AC and although the current may be less than 100mA, you only need 15mA to kill you. It's the duration of the electric shock that is finally fatal and if you are under a railway layout and cannot remove your

hand fast enough, you will get fried.
Another point to remember. This has NEVER been mentioned before. The output of a cap-fed power supply is only 12v when the diode bridge and 12v zener is connected. If any of these wires are cut, the "12v section" becomes **336 volts** !! The 12v zener is called the LOAD and when you connect your project to this power supply, the current passing through the zener is now diverted from the zener and to your project. But if the zener "blows up" and then your project "blows up" you will have 336volts on your project.
This type of power supply is illegal in many countries and hopefully you will never see one. BUT this comment is to inform you: NOT TO BUILD A CAPACITOR-INPUT POWER SUPPLY.

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BOOST CONVERTER
Finally we have a module that will answer a lot of your problems.
It is a **DC to DC converter** that converts a low voltage DC to a higher voltage DC. Commonly called a BOOST CONVERTER. (A converter that converts a high voltage DC to a low voltage DC is called a BUCK CONVERTER).
All our Capacitor Discharge Units now come with a Boost Converter module connected to the input terminals of the CDU module.

Here is an example:
The input wires (on the right) will accept a DC voltage from 5v to 20v DC (from a plug pack or wall wort) and produce an output voltage that has been adjusted by the 10-turn pot. We set the output voltage to 26.5v so the electrolytics on the CDU module see a voltage of 25v (after the input diodes). This has now solved all our problems of getting the right voltage for the CDU modules so they produce the full output.
The boost module can deliver up to 2 amps and this means the CDU module will charge very quickly (if required). However any plug pack can be used and even a 200mA plug pack @ 5v will charge the module in less than a few seconds. The speed of charge (recovery) will depend on the voltage and current capability of the plug pack and the number of electrolytics on the module and the microfarad value of each electrolytic.

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 a 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 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.
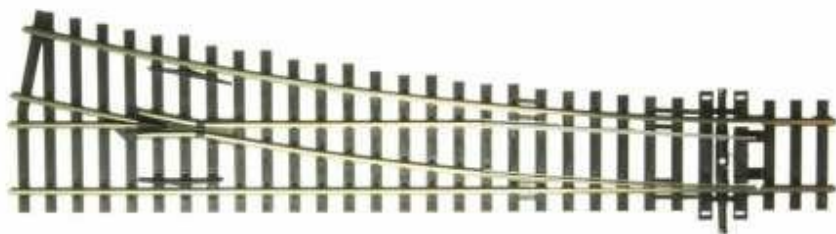
This is a MANUAL POINT

If you have a solenoid operated point, we will cover it later:
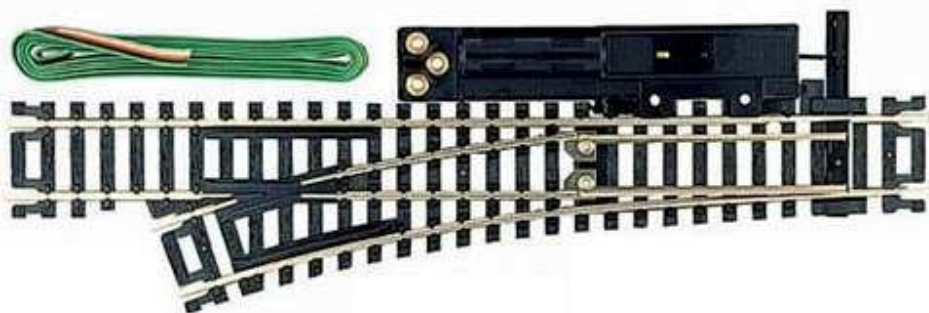
This is a point with a solenoid actuator to move the rails. We will cover this later in the article. We will firstly cover a MOTOR to activate the point.

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:
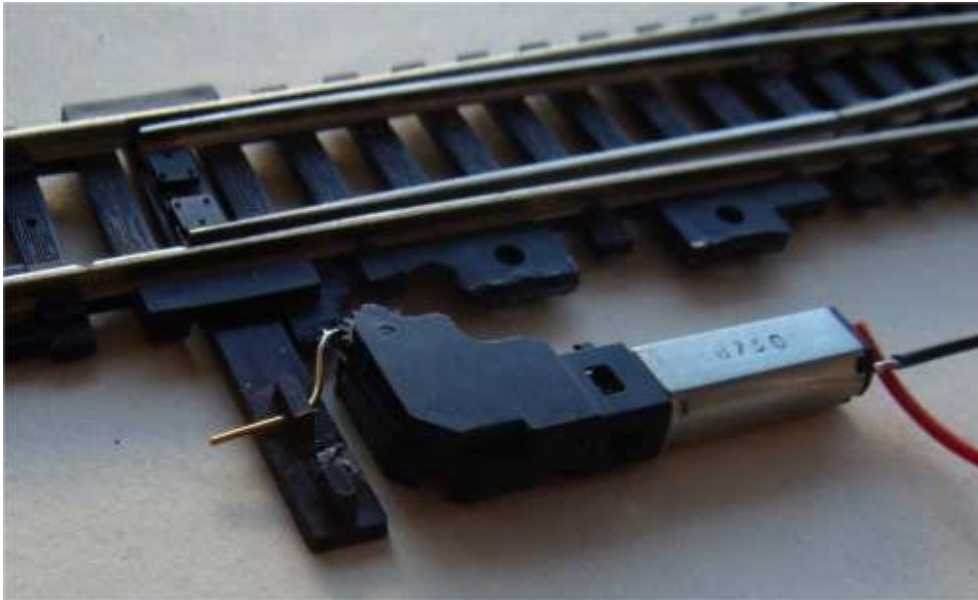
**Image shows the control rod on the gearbox is
bent to fit the push-bar of the point.
The movement of the control rod will activate the point.
You have to provide some "springyness" to the push-bar so that a train coming
in the wrong direction will (from the right) will separate the
rails and not be derailed.**

The arm (lever) on the output of the gearbox
is activated about 90° but will move less than this when
restricted by the "throw" of the lever connected to the point.
Cut the arm to length and bend it carefully by using a pair
of pliers to hold the arm and don't let it move where it is held
by the plastic output gear.
Mount the motor and gearbox with double-sided tape when
adjusting its position and finally use glue to hold it in place.
The two 500R pots on the latest PC board (not shown) allow you to adjust the
strength of the "throw" of the arm.

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/gearbox is available from Talking Electronics for $25.00 including postage.
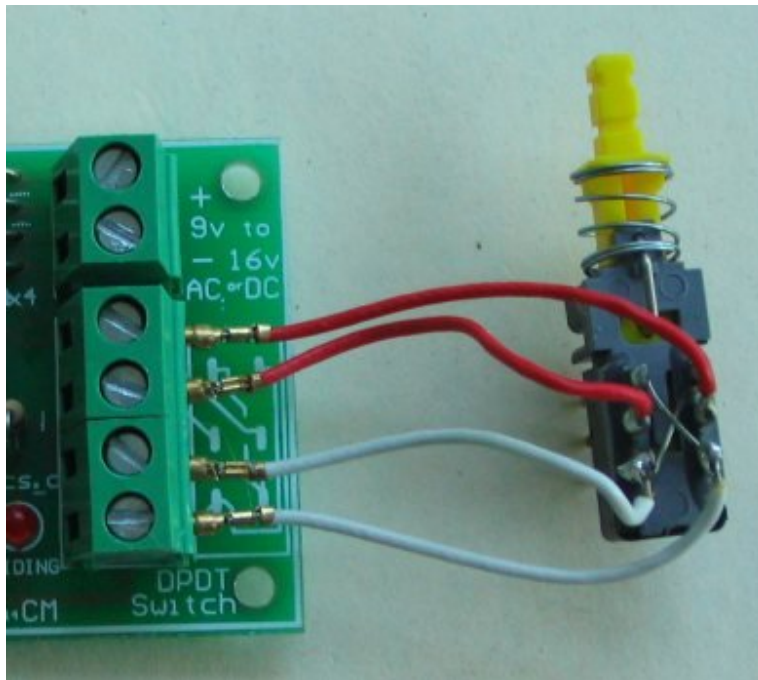
You get a micro motor with worm gearbox and module and DPDT push-push switch and the position of the point is shown on the red and green LEDs on the module. The movement of the point is fairly rapid. There are other modules with slow movement.

Controller using 3v motor and worm gearbox

The circuit above uses a 3v micro motor with worm gearbox. The latest PC board has a number of improvements with two 500R pots to adjust the strength of the throw of the arm.

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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 this has two mini trim pots to adjust the amount of travel of the arm on the servo..
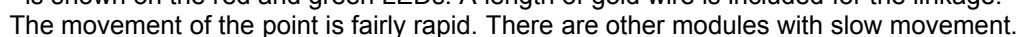
This choice is: **POINT CONTROLLER using converted SERVO ver 4 for $21.50**.
Click Here to order.

Controller using converted SERVO

The Printed Circuit Board has 2 x 500R mini trim pots to adjust the amount of travel of the output arm.
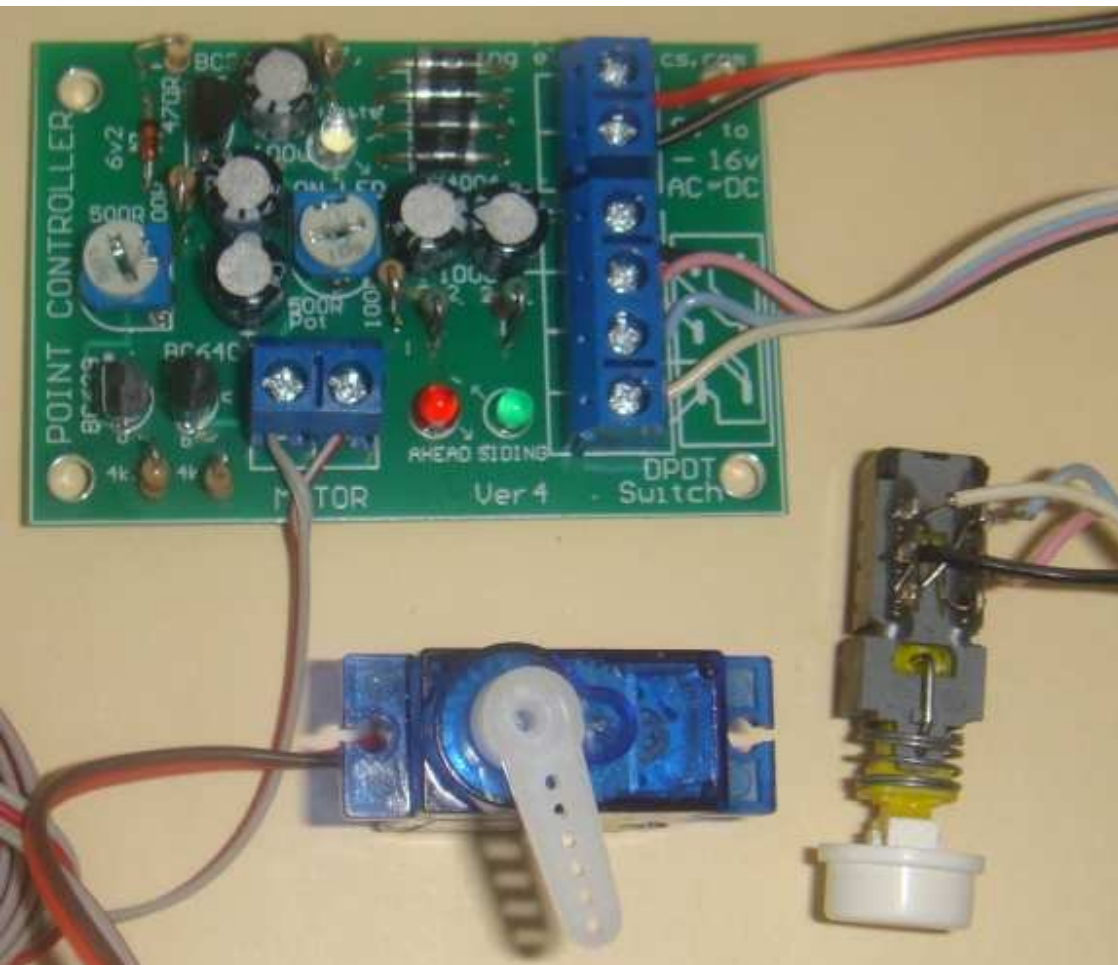
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CHOICE NUMBER 4:

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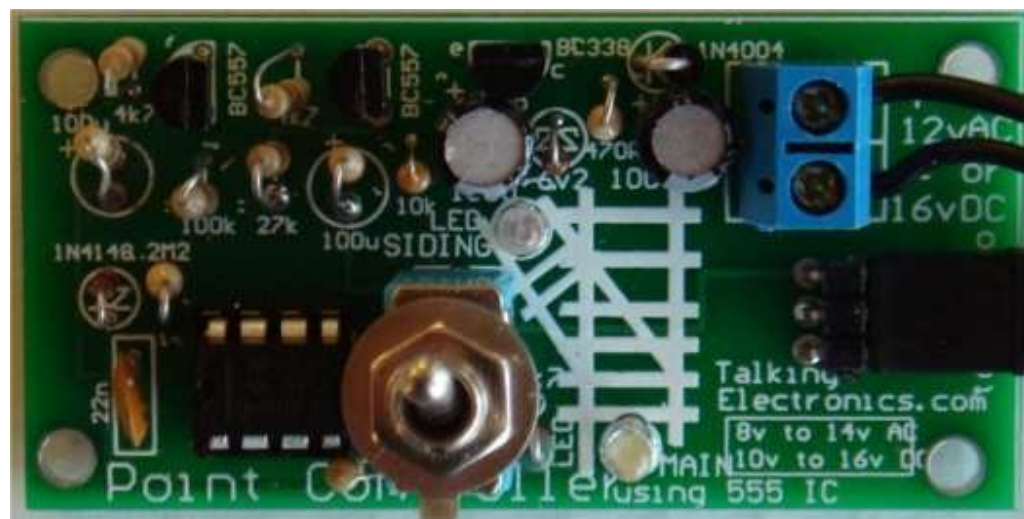
The on-board LEDs show the position of the point.

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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.

CHAPTER THREE

THE POINT
Controlling a SOLENOID point
using a CDU module

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."
You must read all of this discussion as some modules can be wired to operate many points (one after the other) while some modules can only be connected to ONE POINT.

[Here is the module to operate a KATO point motor.]

(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:

Side Mounted
Turnout 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.**
They are called PULL SOLENOIDS because the core is not a magnet.

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. (When the core is a magnet, you can get push-pull action with a single winding)
But because the core in the solenoid point motor is classified as a SOFT IRON CORE, 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 some of the solenoid point motors DIRECTLY 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.
So, it's: POWER SUPPLY, CDU MODULE, PASSING SWITCH, POINT.

PRE-VOLTAGE MODULE
After 20 years of selling CDU modules, we found a pre-voltage module in the form of a BOOST MODULE that will convert any voltage from 3v DC to an output of 27v DC.
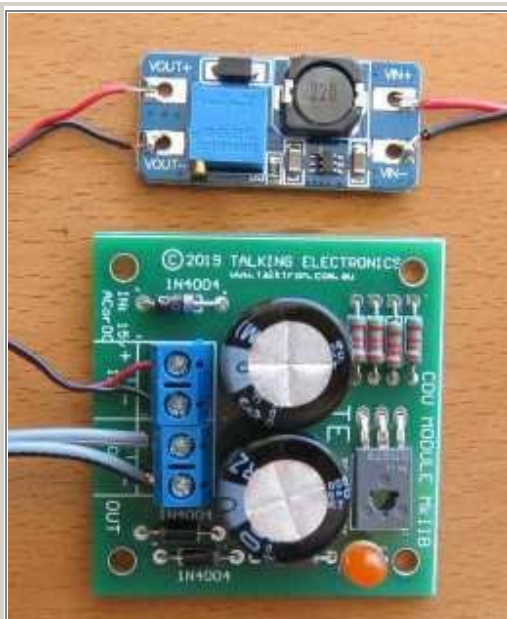
This has changed our range of CDU modules enormously. The photo shows the pre-voltage module connected to CDU Module MkIIB however it can be connected to ALL our modules to make them operate at full output, no matter what voltage power supply you are using.

Previously it was very difficult to get 16v to 24v supplies but now the problem is solved.

You can ask for the pre-voltage module for any of the CDU modules you have already purchased.

The output voltage of the pre-voltage module is increased when the screw of the 10-turn put is rotated **ANTICLOCKWISE** and and you have to keep turning and turning and turning the screw as the voltage only increases when the wiper inside the case is very very near the end of its travel.

You need to monitor the output voltage as it will increase to 40v from some modules and this is too high for the electrolytics in the CDU module.

STRENGTH OF A CDU

Here's a way to understand the "strength" of a CDU.
It's only an approximate comparison, but it will help you.
We take the simplest CDU with 2 x 1,000u electrolytics and charge them to 25v. We say this will operate ONE POINT.
If we have 2 x 1,000u electrolytics and charge them to 35v, we can operate TWO POINTS at the same time. This is because the voltage has increased from 25v to 35v and the voltage plays a BIG part in producing the energy.
If we have 2 x 2,200u and charge them to 25v, we can operate TWO POINTS at the same time.
If we have 2 x 2,200u and charge them to 35v, we can operate FOUR POINTS at the same time.
If we have 1 x 4,700u and charge it to 25v, we can operate FOUR POINTS at the same time.
If you have an old-style point, it can require more energy than a new style.
And N-gauge points may require less energy than HO-points.
It is not wise to operate 3 or more points at the same time from a single supply-line (from a CDU) as there is nothing in the system to share the energy equally. It may work, simply because you are over-supplying the energy.

REDUCING THE ENERGY

If the point "bangs too hard," the energy from the CDU can be decreased by reducing the voltage.
You can use a lower voltage supply. If you are using AC, the voltage on the capacitors will be about 40% more than the AC reading of the supply you are using. This is because the AC voltage is rising and falling and the CDU detects the "top of the wave" whereas the multimeter reading is a value below the top of the wave. And the CDU charges the capacitors to to peak voltage produced by the AC.
If you add a diode between the wire going to the positive terminal of the CDU and the actual positive terminal of the CDU, the voltage will be reduced by 0.7v. The cathode of the diode must be connected to the positive of the CDU. Keep adding diodes in series and after about 5 diodes it will start to have an effect. If the voltage is AC, the voltage will reduce by about 1v per diode.

OVER-VOLTAGE

Capacitor Discharge Units (CDU's) contain electrolytics with a high capacitance and it is important NOT to charge them to a voltage higher than the VOLTAGE RATING on the component. For instance, a 4,700u 25v electrolytic should not be charged to a voltage higher than 27v. And a 1,000u 35v electrolytic should not be charged to a voltage higher than 38v. A customer charged a 1,000u 25v to 42v and it got very hot !!!!   I had to replace it as it started to leak internally and continued to get hot, even at 25v. So, it was permanently damaged.
When you connect a CDU to a power supply, take a reading of the output voltage as this will be the voltage across the electrolytics and do not exceed the voltages I have suggested above. If the end-cap is bulging and not FLAT, is has been overheated and may leak or explode at any time. If it gets hot, even if the rated voltage is across it, the electrolytic is leaking internally and may explode. An electrolytic in our modules should remain cold at all times.
Using a DC supply (such as from a wall wort or plug pack) is the easiest way to deliver the right voltage.

You can get 24v 1 amp wall worts on eBay for less than $5.00 delivered and this will give you 23v to 24v on the electrolytics.
Some CDU's have voltage doubling on the AC input terminals and a voltage as low as 12v AC will produce up to 40v DC on the electrolytics because the 12v AC can be 15vAC on no load and when this is doubled and converted to DC it will become as high as 40vDC. This is too high for any of our electrolytics. That's why the CDU specifies 8v to 12v AC as this will produce 22vDC to 34vDC.
Our CDU's put virtually no load on a power supply and this definitely occurs when the CDU is fully charged and thus the power supply will deliver it no-load voltage and the electrolytics will be charged to a maximum.

THE SIZE OF WIRE

The size of the conductors in the wring to a point-motor is not very critical. You can buy light-duty, medium-duty and heavy duty hook-up wire. The resistance of these will be different but it will not affect the operation of a point. A point motor may be 3-4 ohms resistance and the wiring may be 2 ohms and the point motor will get less energy. But this loss can be overcome by increasing the voltage to the CDU.
The reason why we have three different gauges of hook-up wire is this:
The thickness of any type of wire and wiring is worked out when a constant current is flowing for a long period of time. This current will gradually increase the temperature of the wire and it must not get too hot. A point motor may take 3 amps and when delivered via a 1 amp light-duty cable, the operation will be so short that the wire will not have time to heat-up.
Thick wires and leads are only needed when supplying current to the track as you may be driving a train for a few minutes.

TYPES OF CDU's

We have designed more than 15 different CDU modules to cater for hobbyists requiring to operate new or old points and also KATO points.
Every new model is cheaper to keep the customers happy and offer different mounting features.
They also cover AC and DC supply-lines and a whole range of voltages.
They all do exactly the same job when you compare the total capacitance and the operating voltage of 25v or 35v.

HOW THE 'ENERGY' WORKS

A CDU delivers ENERGY to a point motor. A Point Motor is a SOLENOID and it can be called an ELECTROMAGNET and is similar to the crane that picks up scrap metal via an electromagnet and delivers it to a ship at the dock to take overseas for re-manufacture.
But an electrolytic is not like a battery. A battery delivers a high voltage and a high current for a considerable period of time at the beginning, when it is full charged.
An electrolytic delivers a high voltage and high current for a very short period of time in our CDU projects.
That's because it stores 1/1,000th the energy of a battery.
So we have to take this into consideration.
A point motor takes time to move from one position to the other. During this time the voltage will fall and the current will decrease.
If the voltage drops too much before the point reaches the other position, it will no travel the full distance.
This can be fixed by increasing the voltage to the maximum of the electrolytics or adding more electros.
You need to listen to the "click" "click" of the point before fitting the CDU and maintain the same sound.
The aim is to get the point to "click" and stay in the position via what we call a "toggle mechanism" or "over-centre cam" where the armature of the solenoid keeps a very small amount of pressure on the point so the loco is not derailed.
Too much capacitance can cause the armature to bounce away from the end position and too little capacitance can prevent the armature reaching the end of its travel.
That's why you have to match up the CDU with the point.

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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 (BM means built and tested - made up)
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:
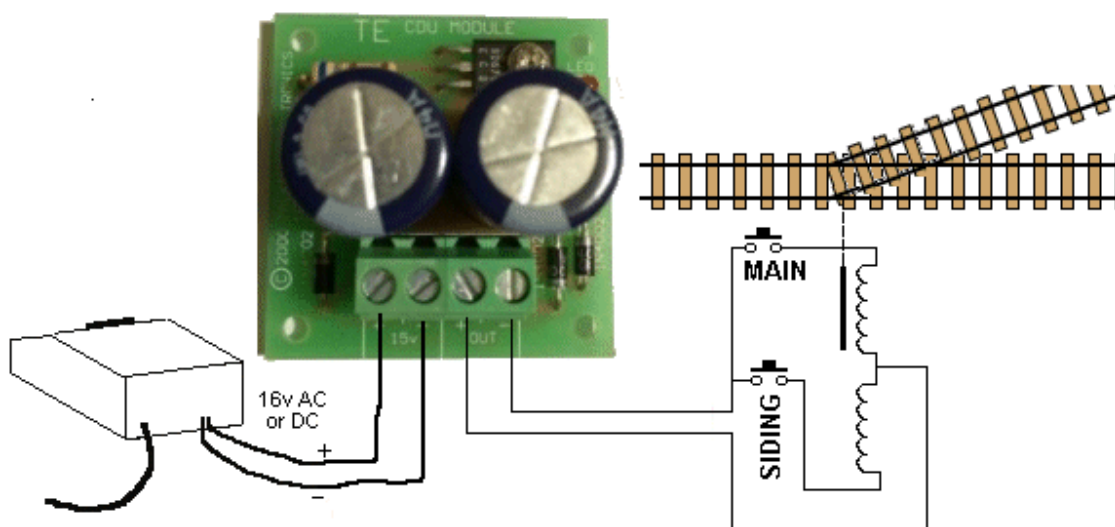
The two push switches in the wiring diagram above are also shown in the two following diagrams:

2 Push-switches

Output of CDU

PECO Passing switch

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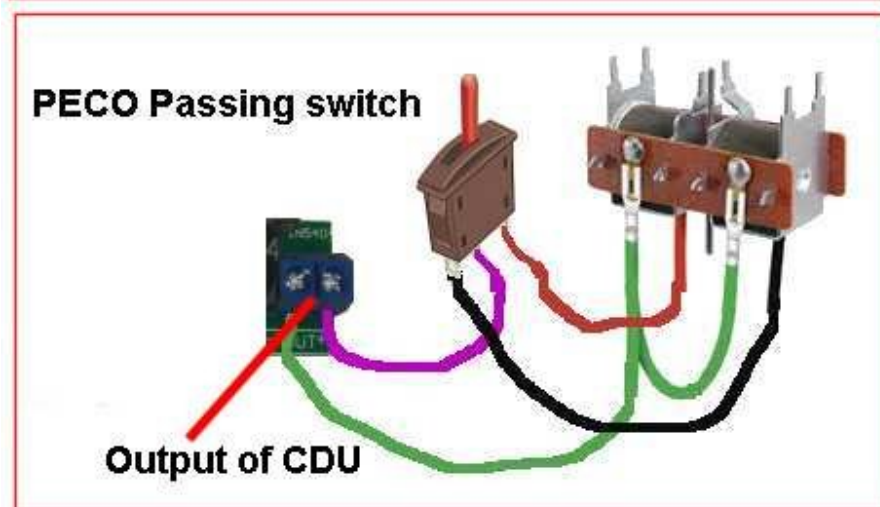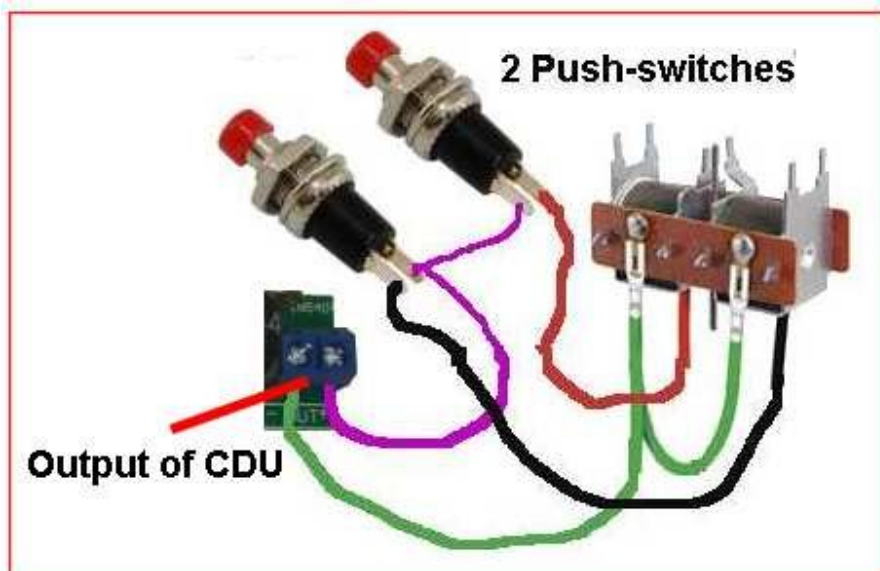
The **PECO Passing switch** only makes contact when the red lever touches and pushes the contact. This occurs when the lever is in the "12 O'Clock" position and you must move it past this position to prevent the point motor "burning-out."

2 Push-switches

Output of CDU

PECO Passing switch

Output of CDU
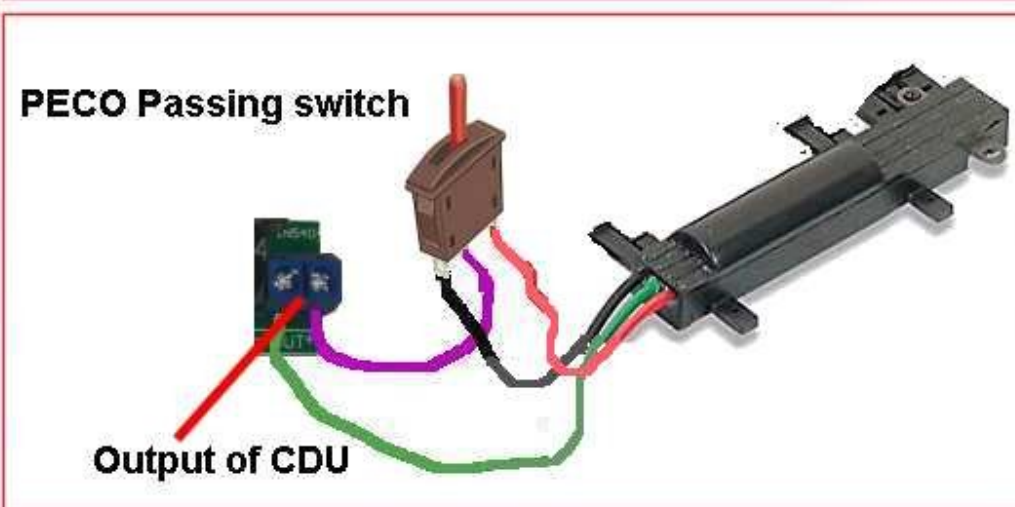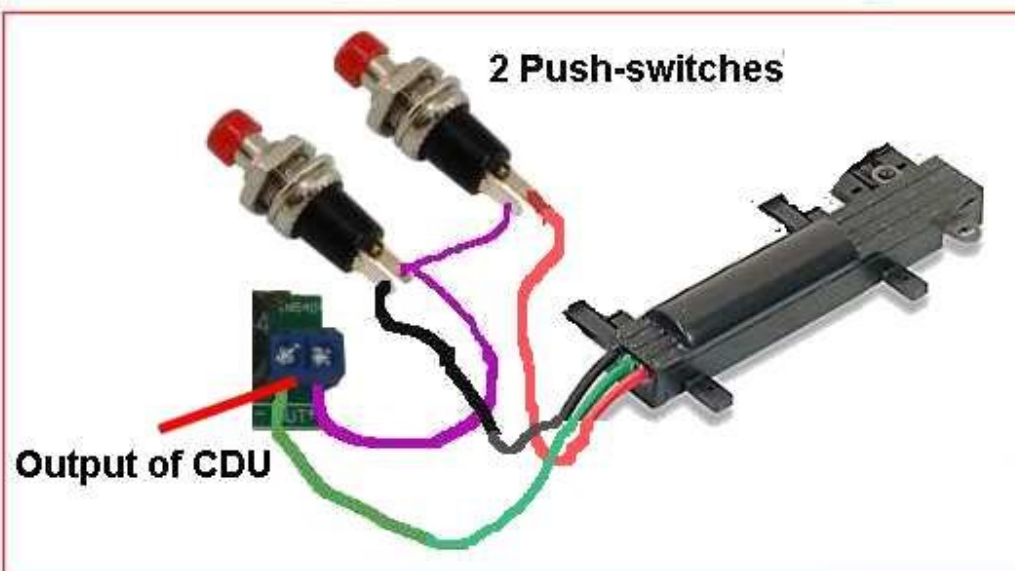
The green wire is called the COMMON
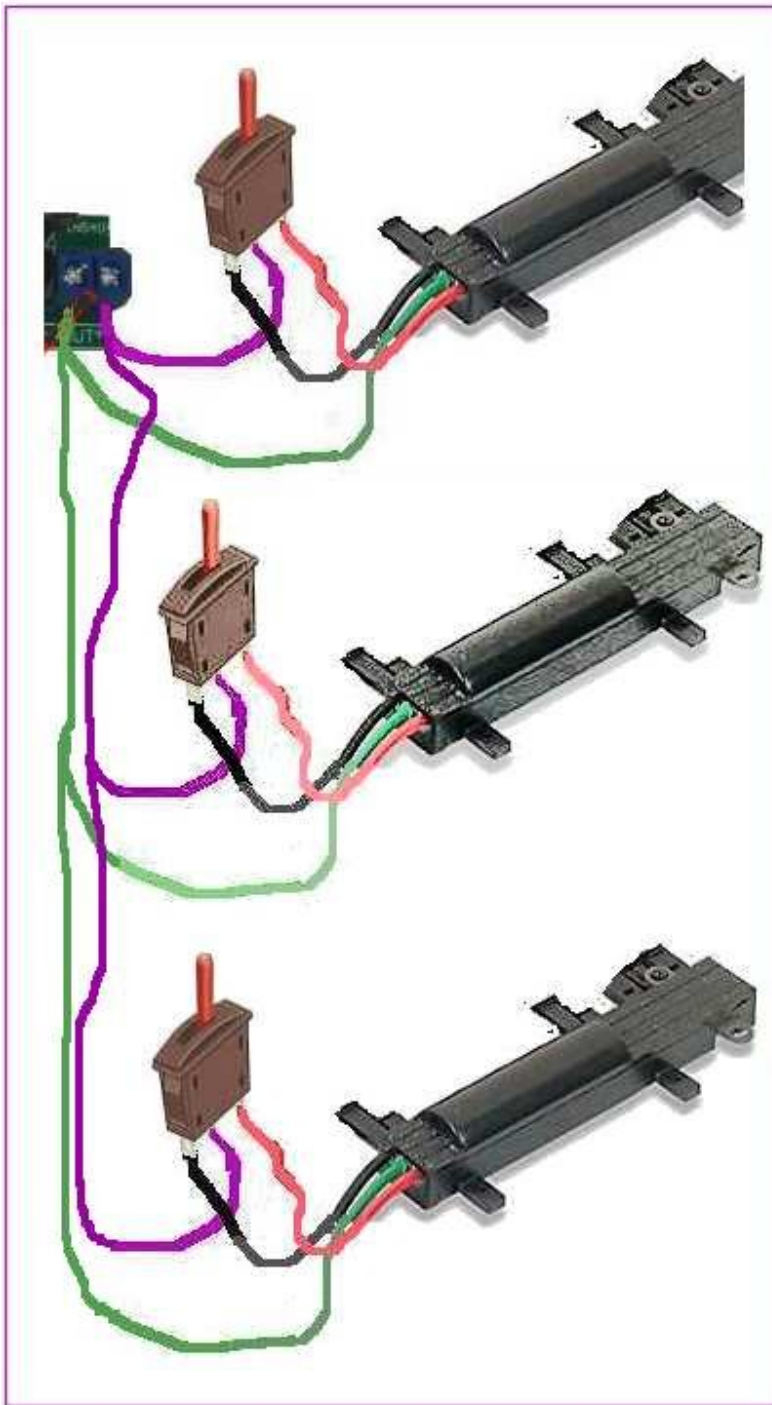
A single CDU can be used to operate 2 or more point motors provided you allow a few seconds been each activation, for the CDU to re-charge.

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 !!**

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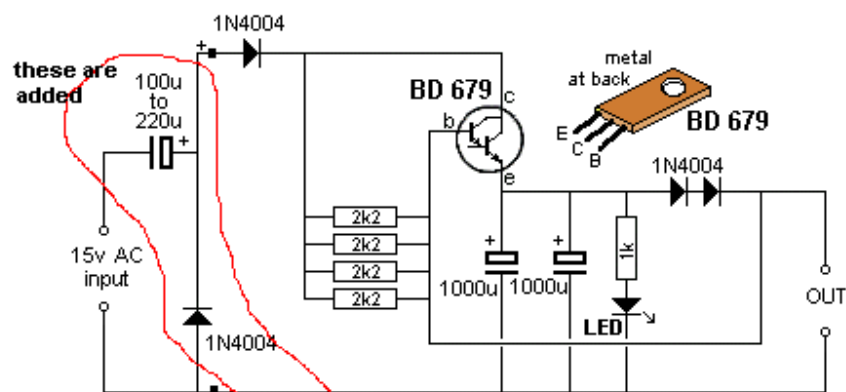
CAPACITOR DISCHARGE UNIT MkII
MODIFICATION
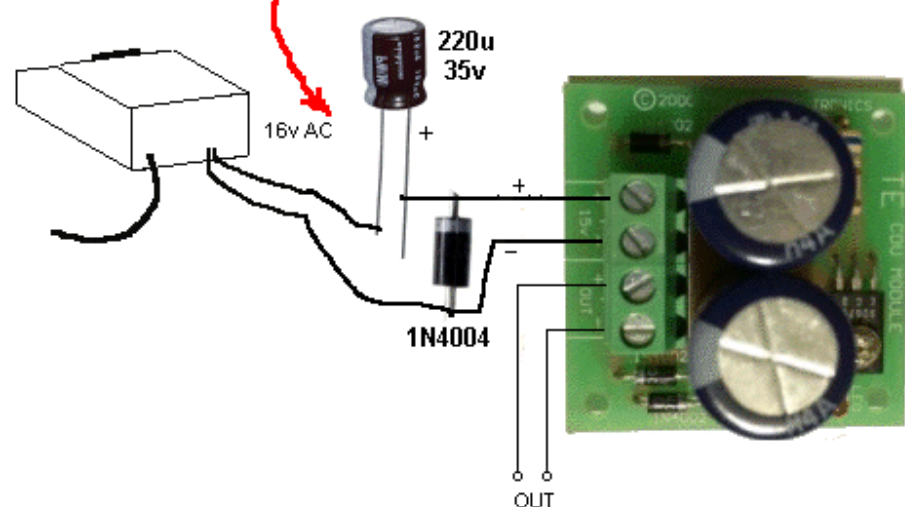
By adding one power diode and 220u electrolytic, the 16v AC input will be "doubled." You need to ask for 35v electrolytics before you do this as the final voltage on them will be very close to 30v to 35v DC

If you ask for 35v electrolytics, you can supply the module with 35v from one or two plug packs.
You cannot get a single 35v plug pack but you can get 12v and 24v or use 3 x 12v plug packs.
Here is the authors solution to providing 36v:

https://www.aliexpress.com/item/33019625426.html?spm=a2g0s.12269583.0.0.20bf3cb13mMIx6

Universal EU US Plug Switching Adapter AC 220V-240V To 5 V 12 V 24V Volt Power Supply DC 5V
12V 24V 1A 2A 3A 5A Power Adapter Output Voltage 12v   Current 1A $2.30

Universal EU US Plug Switching Adapter AC 220V-240V To 5 V 12 V 24V Volt Power Supply DC 5V
12V 24V 1A 2A 3A 5A Power Adapter   Output Voltage 24v US Plug Current 1A $3.60

The adapter costs less than $1.00 (you need 2) and you need to order the type to suit your wall
socket:

https://www.aliexpress.com/item/32842341038.html?spm=a2g0s.9042311.0.0.27424c4d2OjUuW

This gives you a 36v supply for less than $10.00 You just need to wire the outputs in series.
If one of the plug packs does not turn on when connected to a Capacitor Discharge Unit, it will be due
to the high in-rush current being detected by the over-load section.
The answer is to add a 22 ohm or 27 ohm resistor in series. This will limit the current to 1 amp and the
resistor will not get warm because the current reduces to a very small value within 5 seconds.

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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.
You can also buy the module fully built and tested with toggle switch on an extension lead for

$20.50 plus $6.50 postage.

230v AC — 16v AC

4 x 1N4004

16v AC or DC

330R

14v to 22v DC

1,000u + 1,000u

100R

PECO - PL23

metal at back

E C B

BD 679

2k2

10u

1k

4k7

100u +

LED

BD 679

2k2

10u

1k

4k7

POINT MOTOR CONTROLLER
using a SPDT switch

LED

talking electronics.com

100R

POINT MOTOR CONTROLLER
using SPDT SWITCH

330R

ONLED 1N4004
x4

+ 12v to — 16v AC or DC

link

100u +

10u

10u

2k2

2k2

e c b
BD679

e c b
BD679

COM

Siding

Ahead

4k7 1k SPDT Switch 1k 4k7

SIDING LED

AHEAD

1,000u 1,000u

LED

SIDING   AHEAD

CM

Connecting switch, point motor and power to PC board

Note: The common to the solenoid is fitted to the top screw terminal.

The amount of energy delivered to the solenoid depends on the voltage delivered to the module. For 12v DC supply, the solenoid will work very delicately and will be suitable for small solenoids used in "Z-scale." Supplying 16v AC will deliver FOUR times more energy and will be suitable for larger scales and can operate 2 points.
The 100R resistor determines the amount of energy delivered. Increasing the 100R to 150R or 220R increasing the timing and thus the amount of energy delivered.

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

12v Adapter   12v Adapter

0v   +12v   0v   +12v
24v

IN4004

© 2017   TALKING ELECTRONICS
www.talkingelectronics.com

VENT   VENT

CDU MODULE MkIII

2 x push switches

Turnout Motor

Train transformer "accessories"

must be 14v AC to 16v AC

POWER

IN4004

© 2017   TALKING ELECTRONICS
www.talkingelectronics.com

VENT   VENT

CDU MODULE MkIII

2 x push switches

(Not less than 13v AC and not more than 18v AC - input voltage)

The output will be 17v DC to 24v DC

Turnout Motor

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.
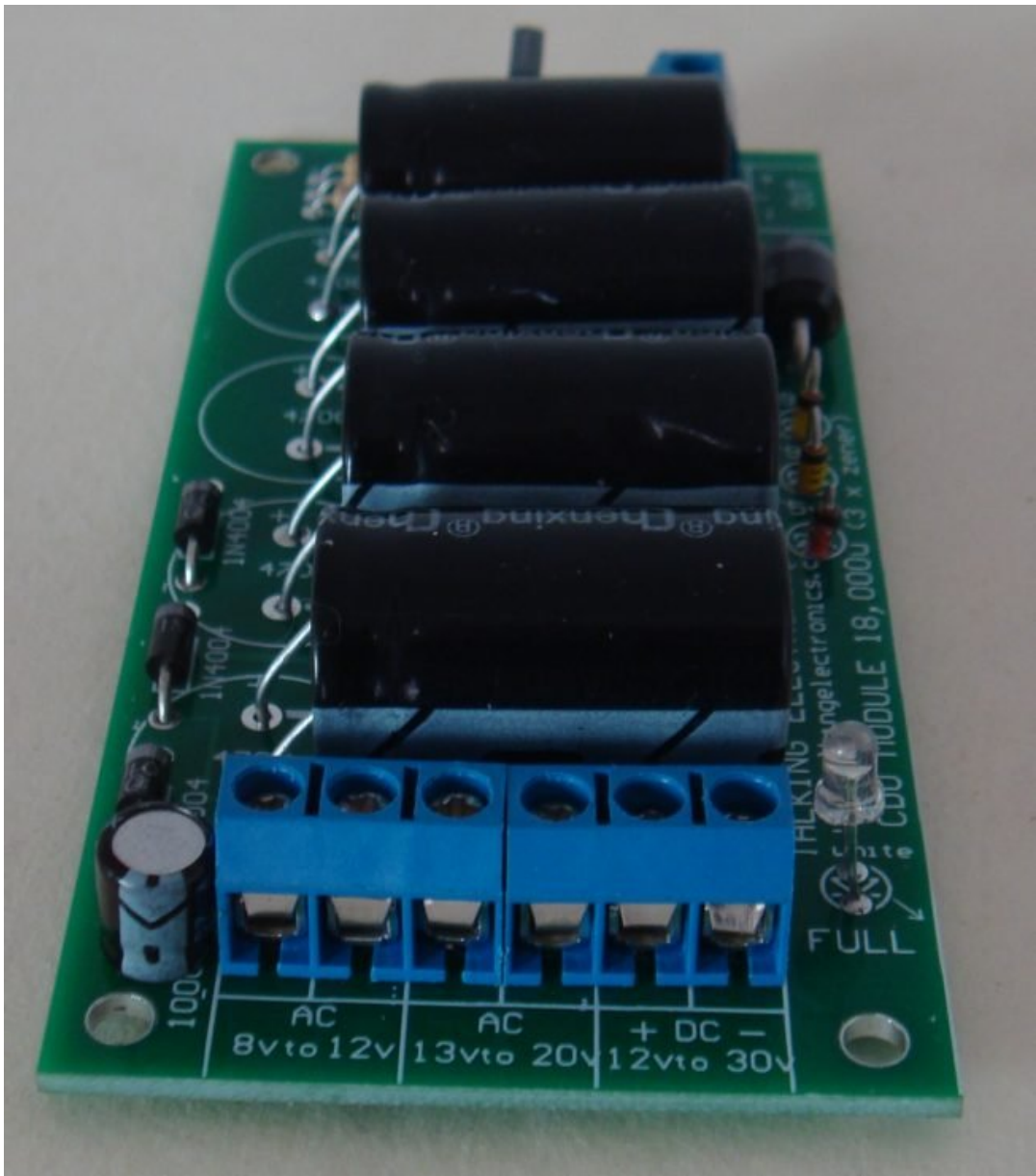
If you use a 24v plug pack and 12v Plug pack, the voltage to the module will be too high and the zeners will get HOT.
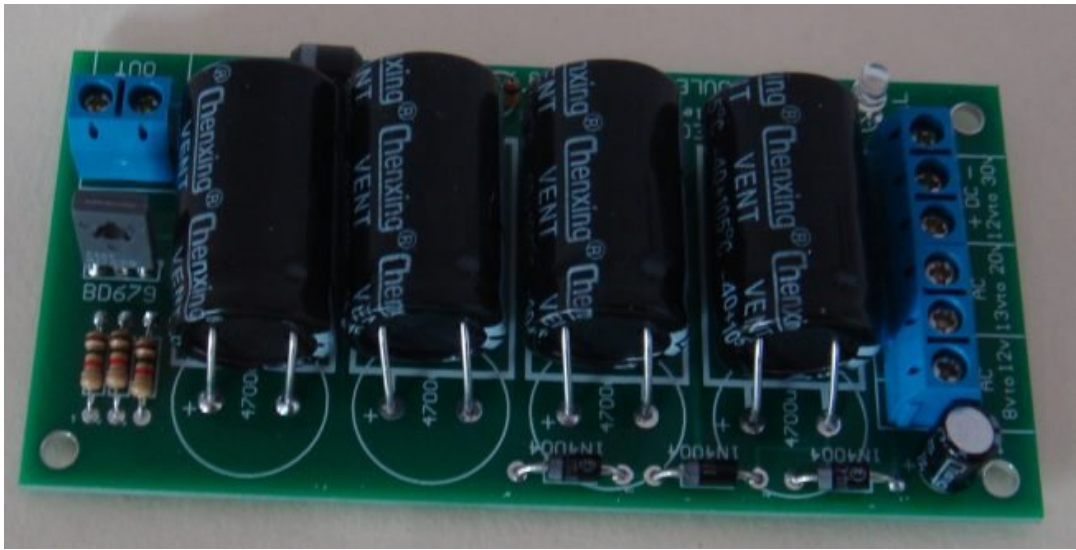Here is a solution from Steve Galka:

This principle applies to all CDU's but it does limit the "inrush current" and you can email me if you are adding a VOLTAGE DIVIDER to another project to see if any reduction in operation will occur.

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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 (built and tested)** and costs **$18.50 plus $6.50 postage.** It is shown in the following image:
Click Here to order.   Click Here to order Module and switch module.

CDU Module 18,000 fully built and tested $18.50 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.

If you supply a DC voltage above 25v, this voltage is called "OVERHEAD." It is voltage that is not needed by the module and will be "lost" in the resistors. However it will allow the module to charge quicker as it will supply current right up to the time when the electros are 99% charged. And then they will charge to a full 100% very quickly. If you supply 32v, for example, the electros will charge to 26.5v and the remaining 5.5v (slightly less than this) will be dropped across the 330R combination of 1k resistors to allow a "bleed current" of 16mA to flow. This will also flow through the zeners but nothing will get hot.

However it will protect the electros from seeing a voltage of 32v as this will leak through the dielectric of the electros and they will heat up and explode.

A Switch Module can be fitted to this CDU to activate the solenoid point and also show the position of the point via two LEDs:
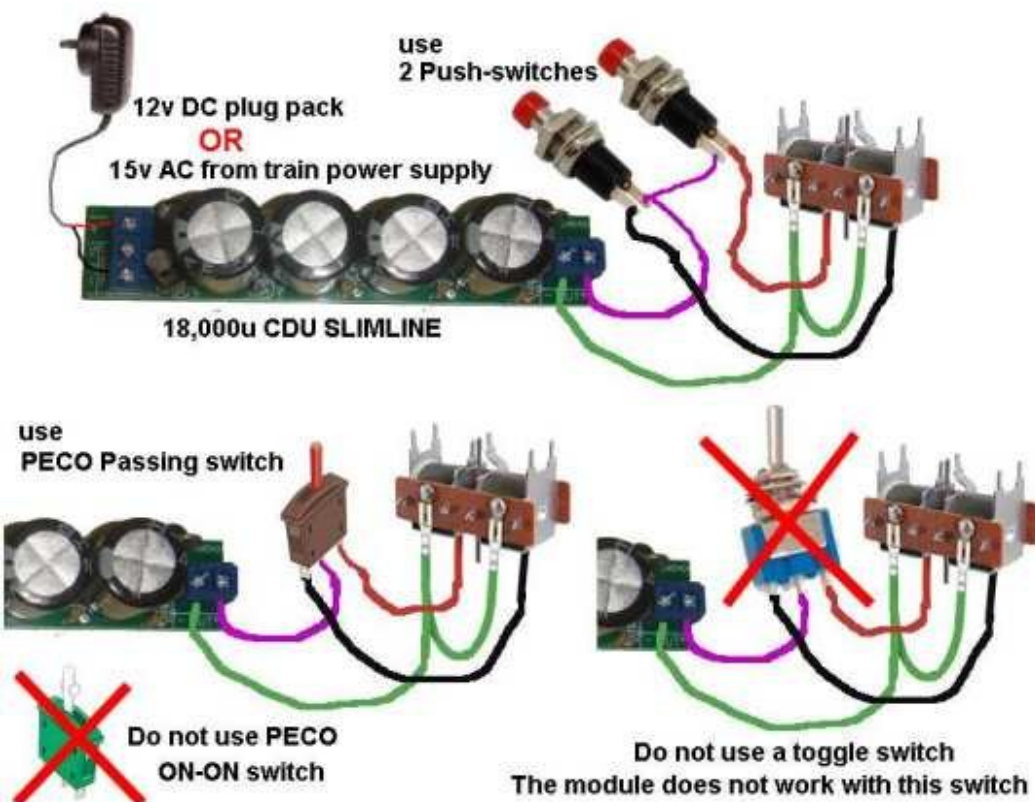
The SWITCH MODULE (shown in the images above) connects to 18,000u CDU for $7.00 extra.
This switch module shows the position of the point via two high bright LEDs and it controls (limits) the energy to a point to prevent the rails "bouncing back" due to too much energy being supplied.

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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. Click **Here** to order Module and switch module.

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CHOICE NUMBER 14:

A NEW version off **CDU 18,000u Slimline MkII** 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 MkII 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 MkII** **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
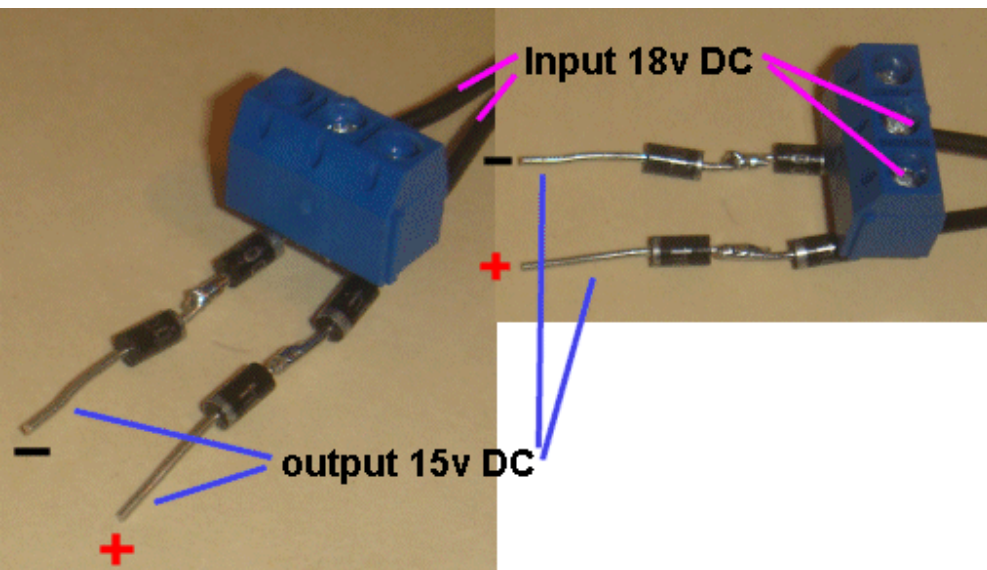
The **VOLTAGE REDUCER** MODULE consists of a 3-terminal block and 4 power diodes and screws into the 3-terminal block on the module.
This is how the Voltage Reducer Module works: Each diode reduces the incoming voltage by 0.75v, making a total of 3v.
When you get **CDU 18,000u Slimline - MkII,** check 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 - MkII** 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:

2v is "lost" across the 3 diodes !!!
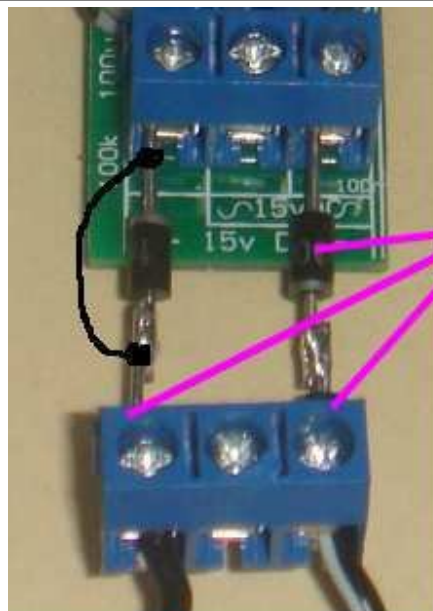
DC input 17v

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 - MkII** with two plug packs, here is the circuit:

DC adapter

5v Adapter

12v Adapter

CDU "sees" 15v !!!

black lead

0v   +5v   +17v

diode 1

positive lead

17v DC going in . . .

negative lead (also called the 0v lead)

VOLTAGE REDUCER MODULE

diode 2   diode 3
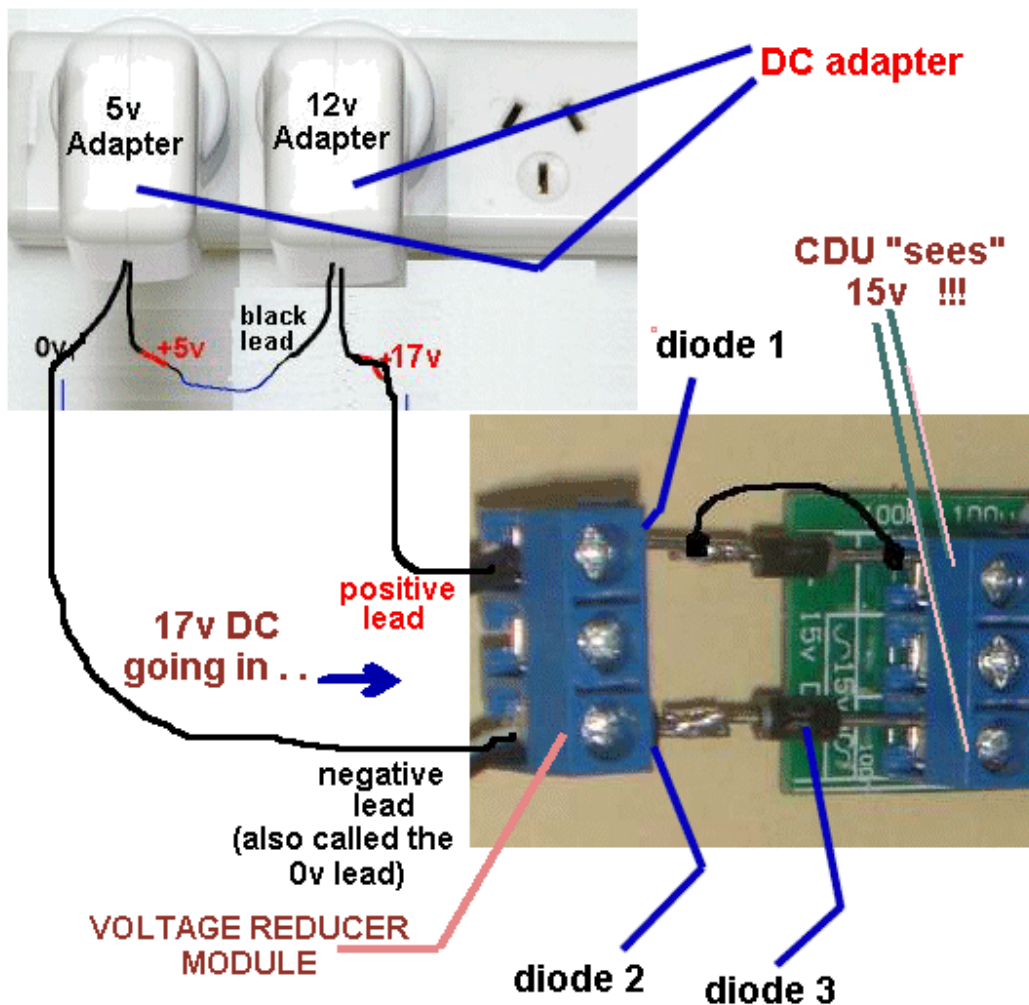
**An easy way to get 15.5v for CDU 18,000u Slimline - MkII
is with two plug packs - 5v and 12v.
You can also use three 5v plug packs and you will find many of these
in your parts-bin from old mobile phones !!!!**

A Switch Module can be fitted to this CDU to activate the solenoid point and also show the position of the point via two LEDs:

The SWITCH MODULE (shown in the images above) connects to 18,000u SLIMLINE CDU for $7.00 extra.
This switch module shows the position of the point via two high bright LEDs and it controls (limits) the energy to a point to prevent the rails "bouncing back" due to too much energy being supplied.

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CHOICE NUMBER 15:

1,000u Capacitor Discharge Unit

with SPDT Switch SLIM
Click HERE to buy.
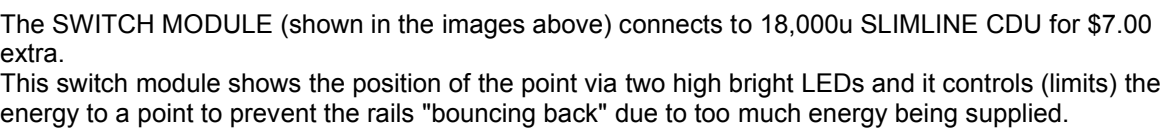
Fully built and tested for $10.60 plus $6.50 postage.

We are constantly updating and improving and adding to our range of modules and this one combines three features at a LOWER COST - amazing !!

The name: **Capacitor Discharge Unit with SPDT Switch - SLIM** has been chosen to identify it from all the other CDU modules made by Talking Electronics.
It combines a number of features with a clever circuit to allow a single 1,000u to be charged to 35v and produce sufficient energy to operate a point. It also has an on-board **mini toggle switch** and two indicator LEDs - this reduces your wiring.
The circuit also includes a voltage doubling arrangement for 12vAC to 15v AC - (from a train power supply) and two indicator LEDs to show the position of the point.
The mini toggle switch can be easily fitted to your console and small holes on each side of the switch used for the LEDs to shine through the console.
All these features are in this narrow PC board so that a row of these modules can be aligned on a panel to show the position of the points.
This module reduces your wiring considerably as only 3 wires are needed for each point and a common "bus" of positive and negative to the modules.
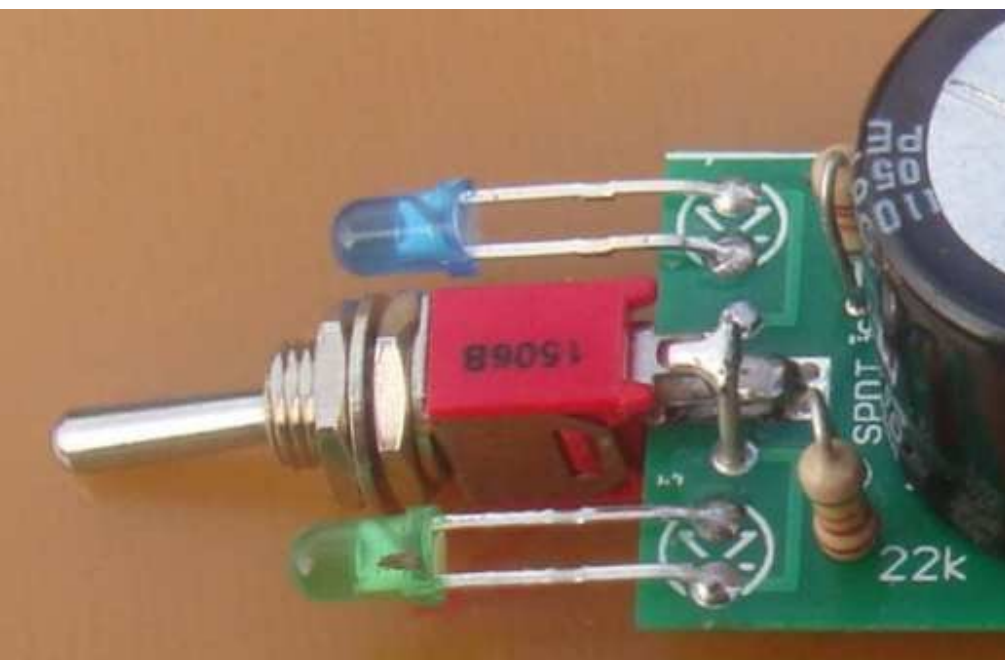
A close-up of the switch, showing the leads soldered to the tabs on the switch
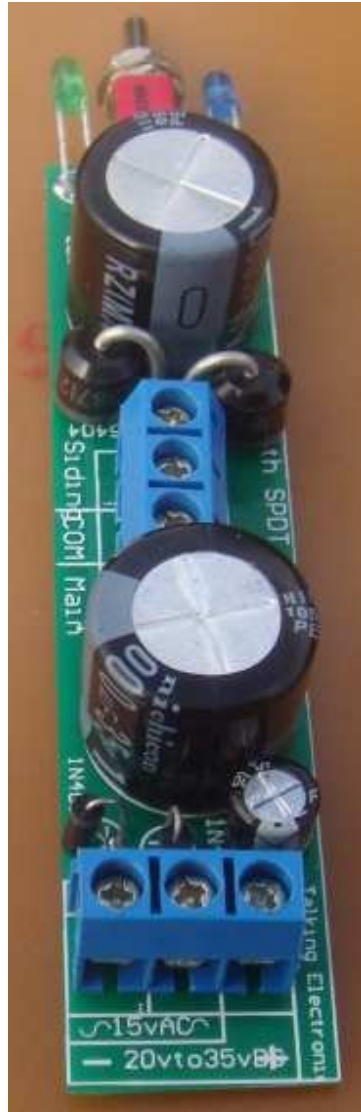
All the components fit on the PC board and the module comes with 2 x 1,000u electrolytics. The input can be 12vAC to 15vAC or 20vDC to 35vDC.

You can make a 12v 24v or 36v supply very cheaply by using 24v and 12v plug packs. These are available on eBay for less than $10.00 (combined) including postage.
If you are making 36v, simply connect the leads as shown in the following diagram.
Some of these plug packs have a current detecting overload circuit and "shut-down" if the current is more than 1 amp (even for a millisecond).
To prevent this we add a 47 ohm resistor.
This only applies when you are using the plug packs for our CDU modules (like this project) as the high current is only required for less than a second and then falls to a very small value.   The resistor will not get warm when used in this particular application.
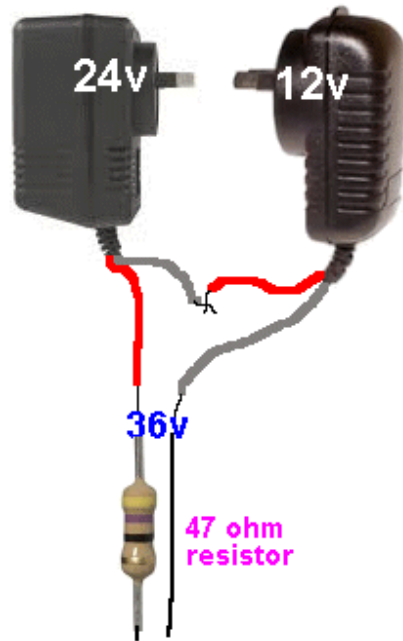
Using an old Printer Power Supply

You can use a discarded Printer Power supply for many of the CDU modules. Make sure the electros are 35v. I have highlighted the voltage and the current capability (625mA) of this printer supply and it is ideal. You cannot use it on any of the throttle modules as the current is not very high but it is ideal for a CDU module as the current requirement is less than 100mA to charge the electros.

There are lots of other power supplies from discarded electronic equipment and you just have check everything before you throw it out.

CHOICE NUMBER 15A:

2 MODULES

This CDU now comes as 2-modules with a face place and 5 modules with a face plate.
This module requires 25v supply and to get the required energy to change a point, the electrolytics are 2,200u.
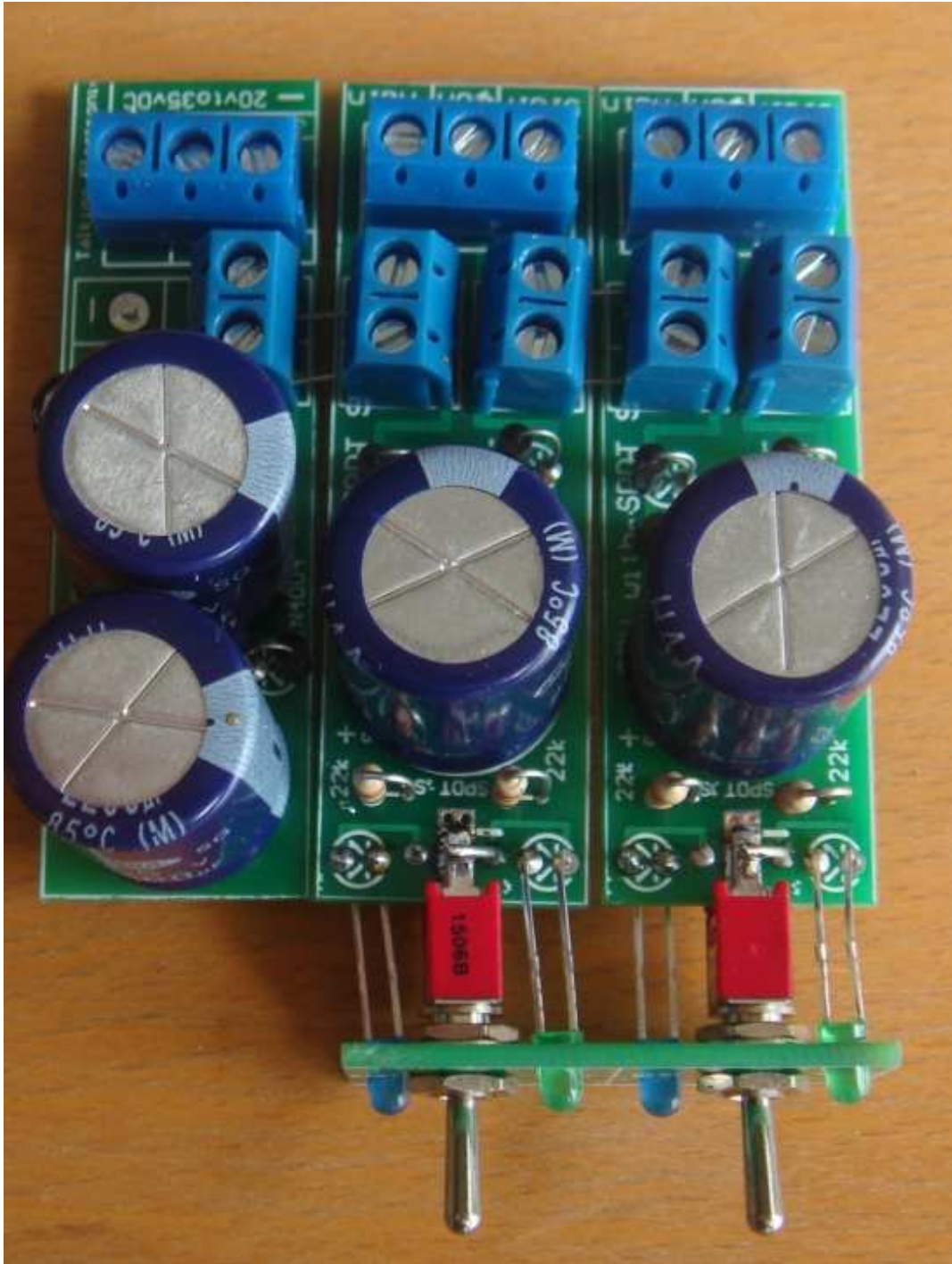
2 MODULES
1 - faceplate $2.00
1 - power supply module $5.50
first switch module $5.00
second switch module $5.00
Click HERE to buy

2 MODULES
fully built and tested:

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5 MODULES

You can mount 2 or 5 modules "side-by-side" and use the face-plate shown in the photo below to connect them together and fit them to your console.
Here's what you need:
1 - faceplate $2.00 for 2 modules $3.50 for 5 modules
1 - power supply module $5.50
1 - switch module $5.00
1 - switch module $5.00
1 - switch module $5.00
1 - switch module $5.00
1 - switch module $5.00
You can operate 5 points for a total of $34.00 and that is less than $7 per point.

The face-plate means there is no drilling needed and a simple cut-out in your console will allow the face plate to be added.
A new face-plate with track ID has been introduced:
The 2-module face-plate costs $2.00
or 5-module face-plate $3.50
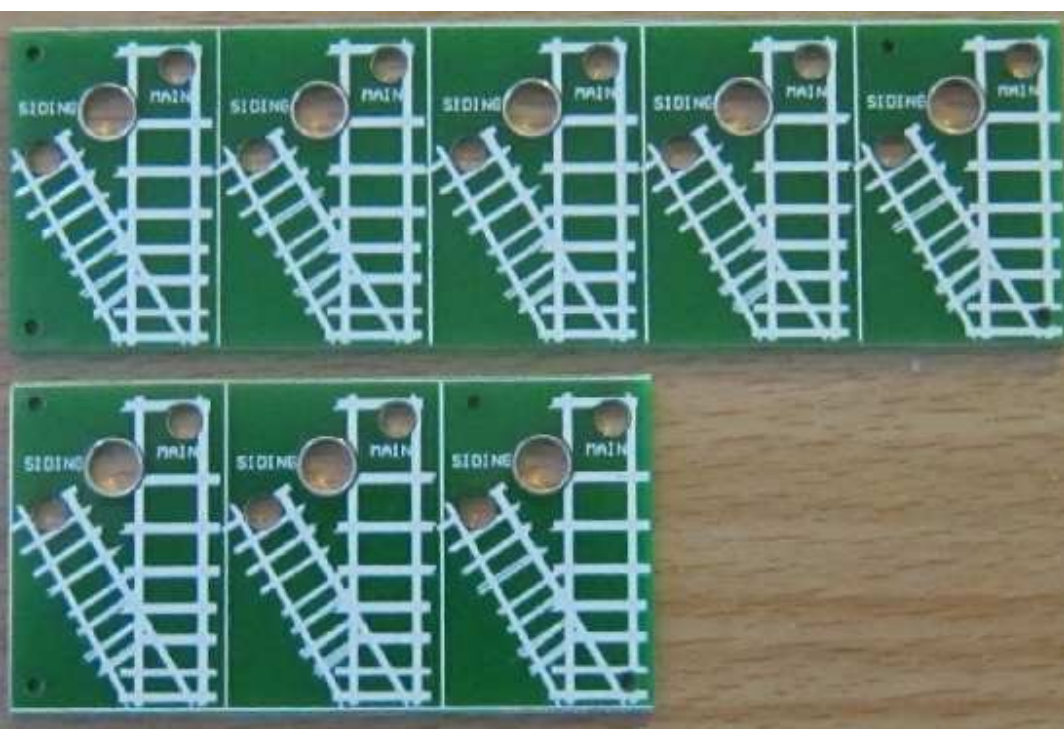
The circuit for the 5-Modules version has 2 x 2,200u electrolytics in the power supply section because the charging of the 2,200u (in the second part of the circuit shown above), when the switch is in the "MAIN" position, will take a lot of energy from the 2,200u in the power supply and the voltage across it will dip 50% (theoretically). When 5 modules are connected to the power supply, this will be passed to the other modules and affect the operation of the other points at a time when they should not be affected.
To prevent this we have used two 2,200u electrolytics in the power supply. The voltage will theoretically drop 30% but the other points are not affected.

USING ATLAS #56 SWITCH
At first inspection, this switch may not appear to be suitable. **But here is the secret of its operation.**
When you slide the switch to the left or right **NOTHING HAPPENS**.

You need to **push** the switch for 0.5seconds for it to **make contact** and the energy from the CDU changes the point.
If you push the switch for more than 1 second, all the energy from the CDU will pass to the point in less than 1 second and the extended time of pressing will not damage anything.
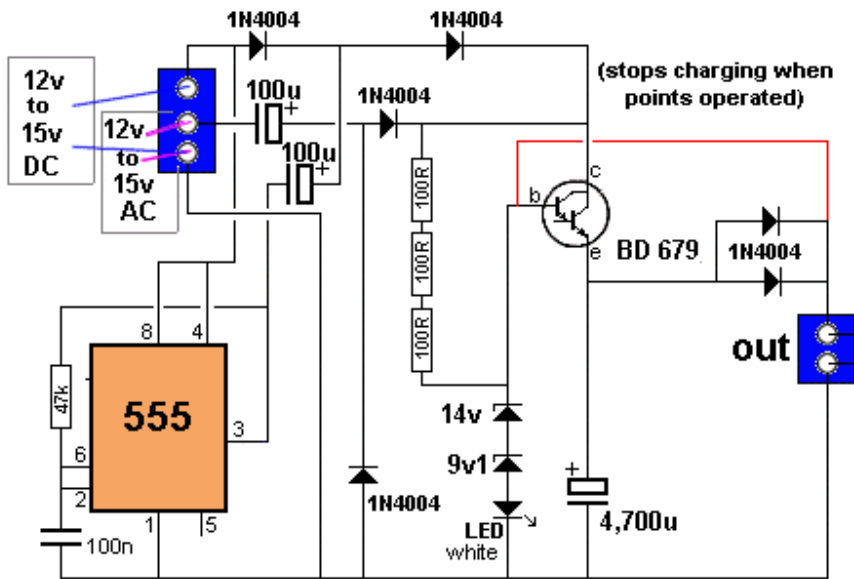

slide switch left ot right then press for 0.5 seconds
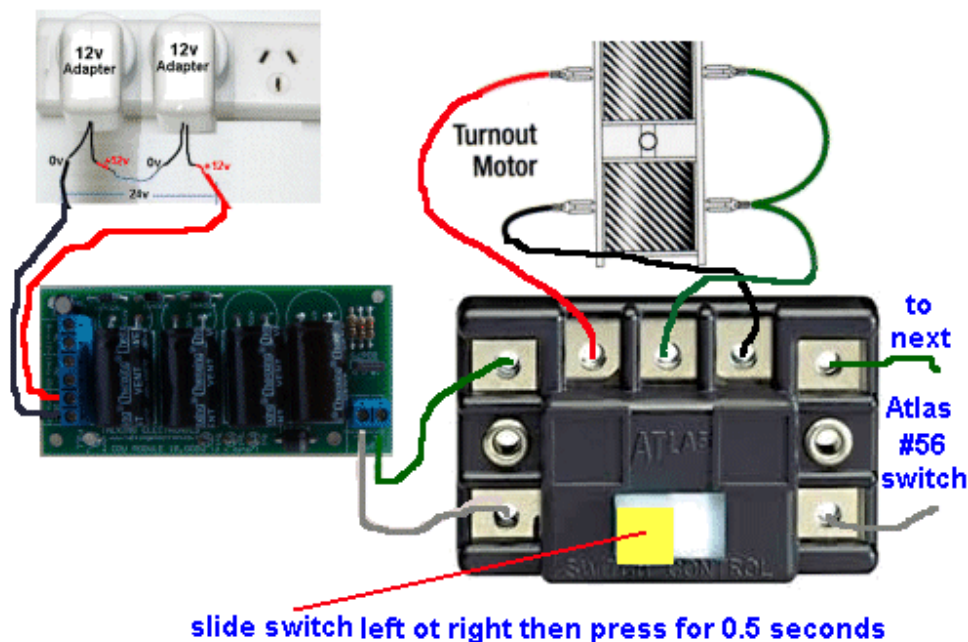
CHOICE NUMBER 16:

CDU 4700u Slimline

Buy a kit: **CDU 4700u Slimline** **$10.50** plus $5.50 post
Fully assembled and tested

This CDU (Capacitor Discharge Unit) module has been designed with voltage-doubling components so you can use the 12v DC or 15v AC terminals of your train power supply. It also has voltage regulating to prevent over-charging the electrolytic and an indicator LED to show when the electrolytic is fully charged.
The 4,700u electrolytic is adequate for a single point and can be connected to two points at the same time, if needed.
You just need two push-buttons (switches) and twin flex (wire) to activate your solenoid point (point motor).

CDU 4700u Slimline

1N4004   1N4004

12v to 15v DC

12v to 15v AC

(stops charging when points operated)

100u   1N4004

100u

100R   100R   100R   100R

b   c   BD 679   1N4004

e

47k

555

8   4

6   3

2   5   1

100n

14v

9v1   +

4,700u

1N4004   LED white

out

CDU 4700u Slimline

out
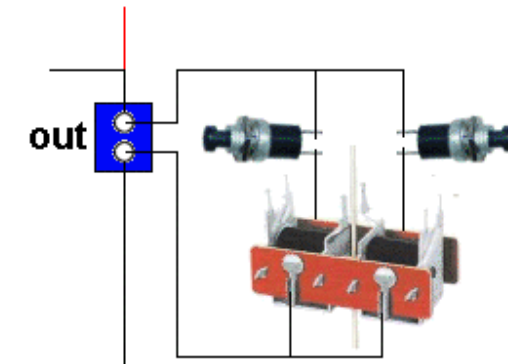
25-9-2020

**The advantage of this module is the input voltage.
It can be 12v to 16v DC or up to 15v AC
and the circuitry will double the voltage**

CHOICE NUMBER 17:

Jim's CDU MkII

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 40v. 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.
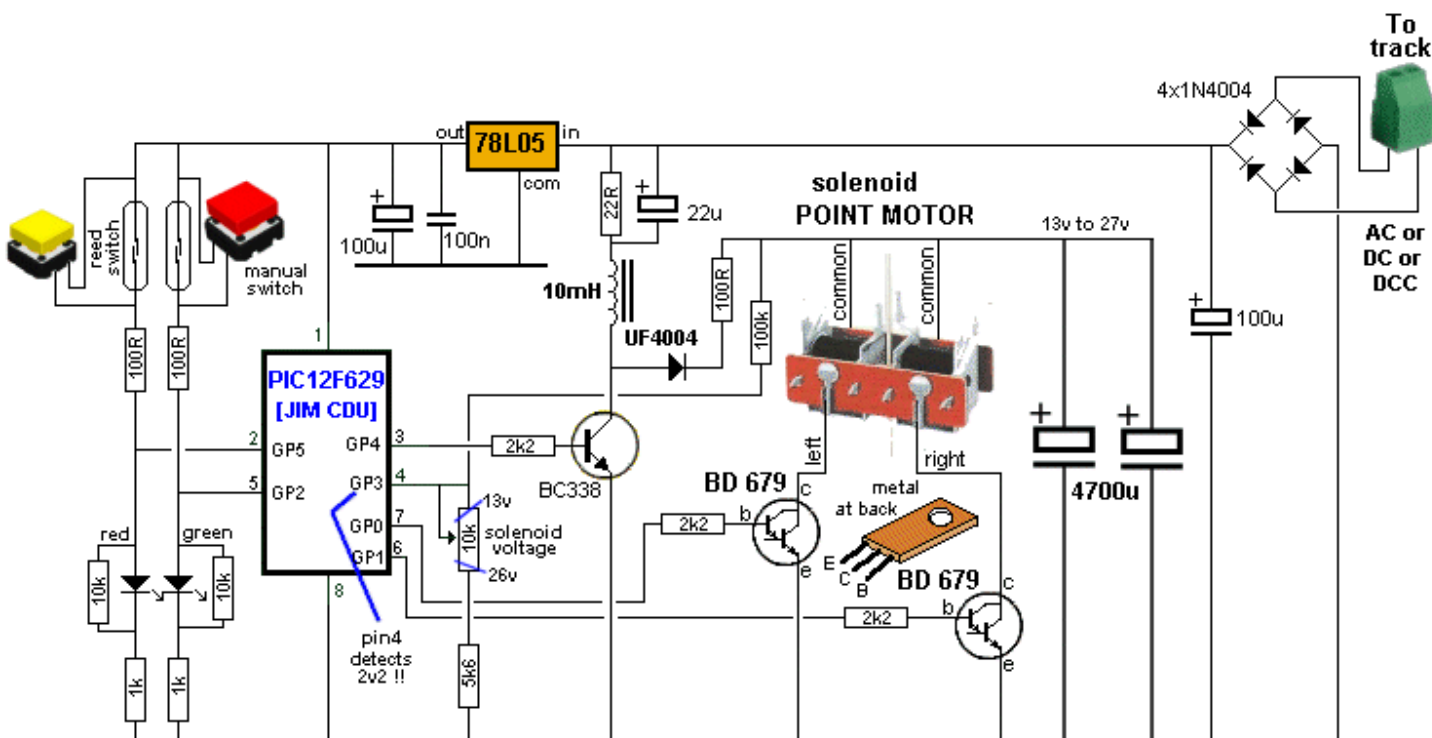
JIM's CDU MkII circuit

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. It did not work for me and I threw it in the trash. The frustration of trying to get a shiny joint was enormous.

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. Watch the solder "click" onto the resistor and it will look a little bit like a skateboard ramp.

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 when they are upright.

The mini trim pot can be adjusted from 13v to 27v so the electros hold the right amount of energy for the point you are using. This is the first module on the market to provide this adjustment as some points bounce too much if the voltage is too high.

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.

This track pick-off is called BETWEEN SLEEPERS

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

Alternatively, you can ask for **Track Pick-off** "using Rail Joiners." You will need to get to the track, remove the rail joiners that presently connect the rails, and fit the track jointers as shown in the following image:
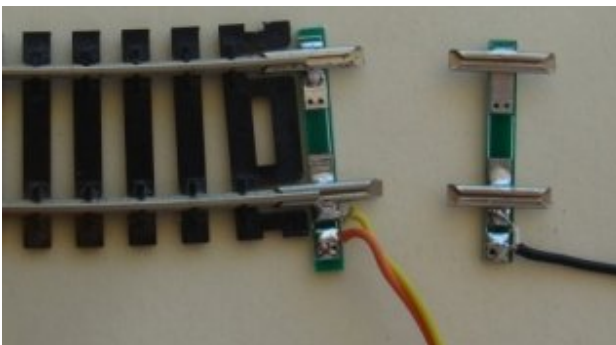
This track pick-off is called "using Rail Joiners"

**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 LED
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 called "Between Sleepers"
or
1- **Track Pick-off** called "Between Sleepers"
(tell us the one you want)
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.

ooooooooooooo00000000000000000000ooooooooooooooo

CHOICE NUMBER 18:

This module operates a SERVO very slowly. All the other modules operate the servo fairly quickly.

SLOW SERVO

Buy **Jim's Slow Servo** **$31.50** plus $6.50 post
Fully assembled and tested with servo and leads
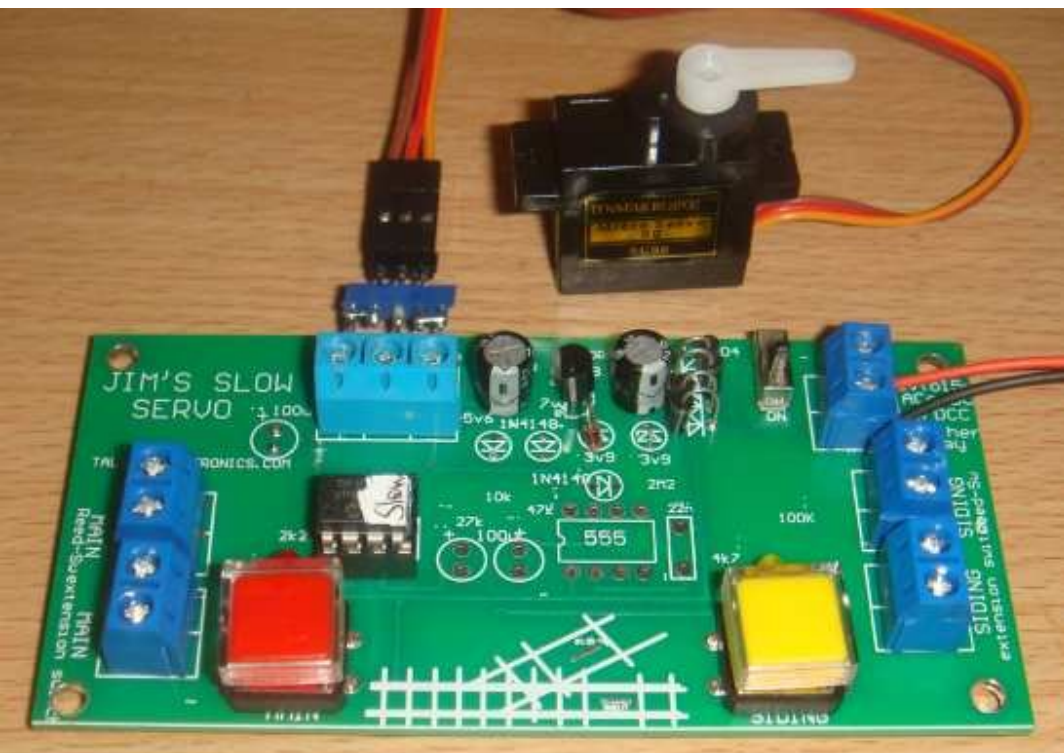
The original circuit used two 555 IC's. The new and improved circuit uses a microcontroller and 15 fewer components !! That's why some of the components are no longer required.
The top terminal block on the left connects to a reed switch and this activates the servo slowly to change the position of the point to allow the train to come back into a point with the rails in the correct position.
The other terminal block on the left connects to a switch on your control panel to activates the point manually so you can send the loco to the siding.
The top terminal block on the right connects to a reed switch to allow the train to come to a point with the rails in the correct position.
The other terminal block connects to your control panel.
The module comes with a servo, extension lead for the servo, gold push-rod for servo, leads to your panel for the Main and Siding switches, 2 reed switches on 1200mm leads and two very strong rare-earth magnets: 10mm diameter x 1mm thick.
There are many ways to mount the servo and one customer asked about "N Scale code 55 track." Here is the solution:
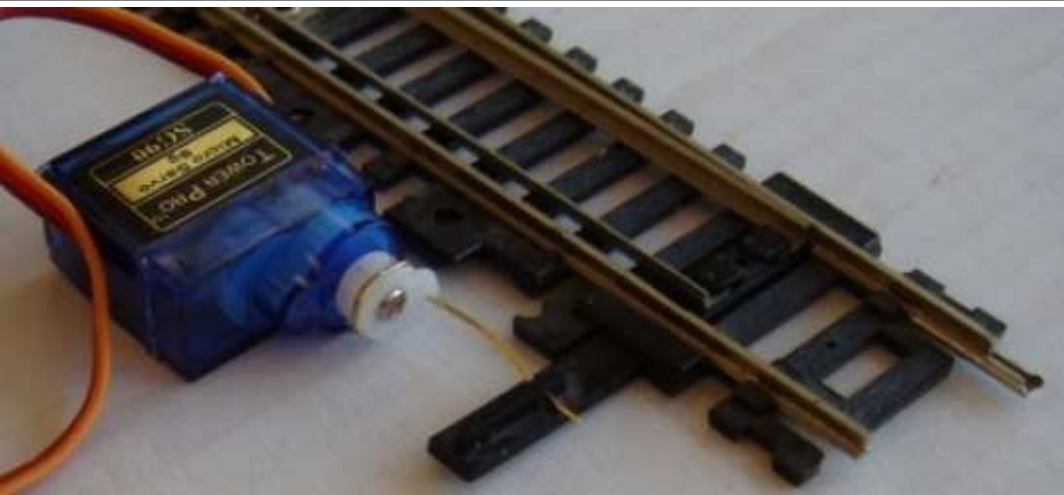
The shortest arm (supplied with the servo) can be cut with one hole remaining and the gold 0.7mm wire wound around the arm with plenty to fit into the lever on the point. Allow the 0.7mm wire to produce a "spring tension" to keep the point, in each direction, with a little bit of tension and this will allow the arm to rotate about 70 degrees.

CHOICE NUMBER 19:

This module operates a SERVO very slowly. All the other modules operate the servo fairly quickly.

TURTLE
SLOW MOTION SWITCH MACHINE
This is another slow servo point motor and controller
Buy **Turtle** **$30.50** plus $7.50 post
Fully assembled and tested with servo and leads

The SLOW MOTION SWITCH MACHINE costs $8.50 usd and comes with 2 metre of 3-core lead.
The CONTROL MODULE costs $22.00 usd and will operate one or two SLOW MOTION SWITCH MACHINES.
Shipping $7.50 usd for any number of Slow Motion Switch Machines.

This is the latest Slow Motion Switch Machine using digital control to the motor.
It is very small and measures only 31mm (1.25in).
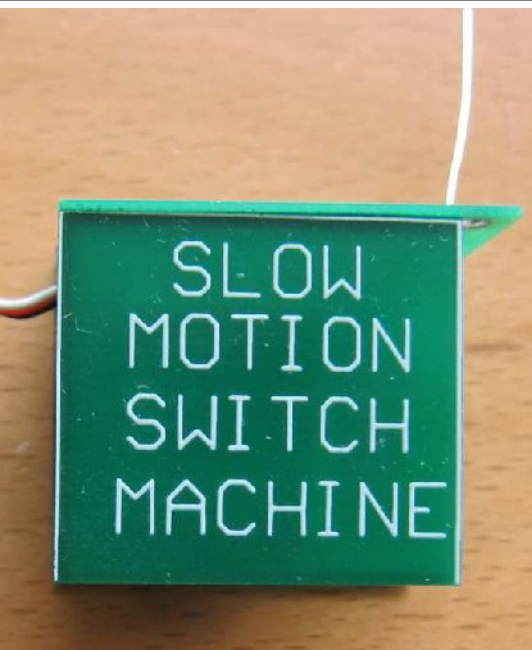
It comes with 3 small screws for easy fitting to the underside of your layout.
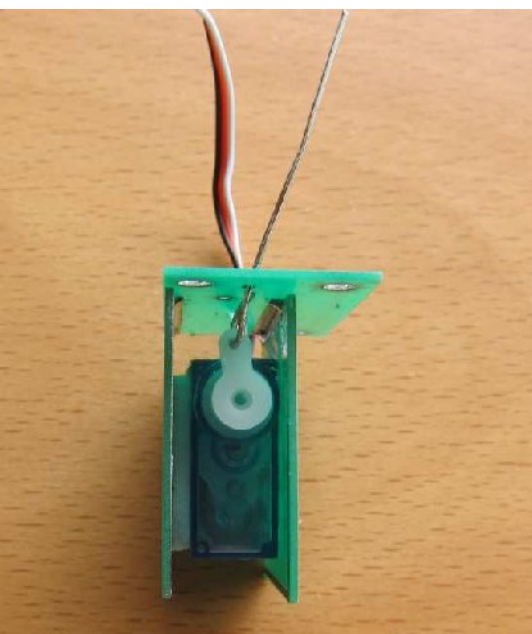
You also need a control module containing 2 switches and microcontroller and power supply.

The module is fully assembled but the two switches are in a separate bag (with fine solder 3 screws and extension lead) as they are too tall to be shipped as a small packet from Australia.
You need to fit the two switches to the small front-panel and use the nuts to get the height so the LEDs fit through the holes.
The LEDs show the position of the point.
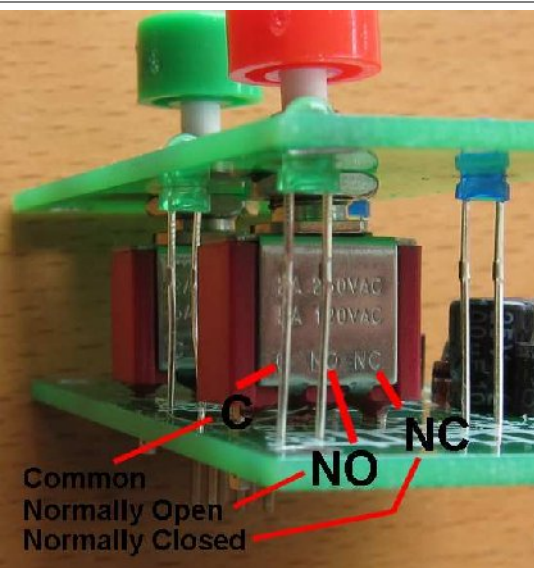
The switch MUST be fitted so the letters "C" "NO" and "NC" can be seen as per the image above. They will not work if fitted the wrong way around. These are special switches - push switches - and not toggle switches. Push the legs through the holes of the printed circuit board and before you solder the pins, try the operation of the module. When you know it operates correctly, solder the pins with the fine solder provided.

You can also get a version of SLOW MOTION SWITCH MACHINE for the topside of your layout - ask for details when ordering.

MOUNTING

The board is mounted on your control panel through a small rectangular hole with 2 mounting screws and the larger board sits behind the panel.
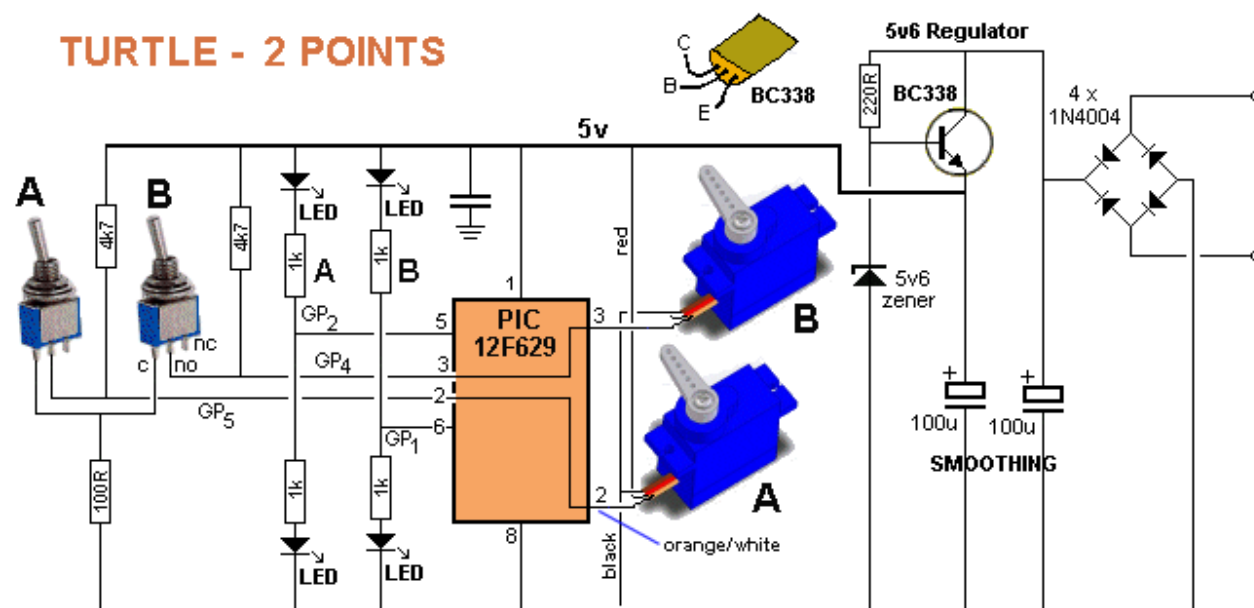
TURTLE - 2 POINTS CIRCUIT

All the work is done by the microcontroller.

Press the left push-button and the SLOW MOTION SWITCH MACHINE moves the point to the Main line. Push the switch again and the electronics makes the SLOW MOTION SWITCH MACHINE move the point to the Siding.

The second push-switch operates the other SLOW MOTION SWITCH MACHINE in the same way.

CHOICE NUMBER 20:
5 Point Controller for Servos

This module operates 1,2,3,4, or 5 servos very slowly.
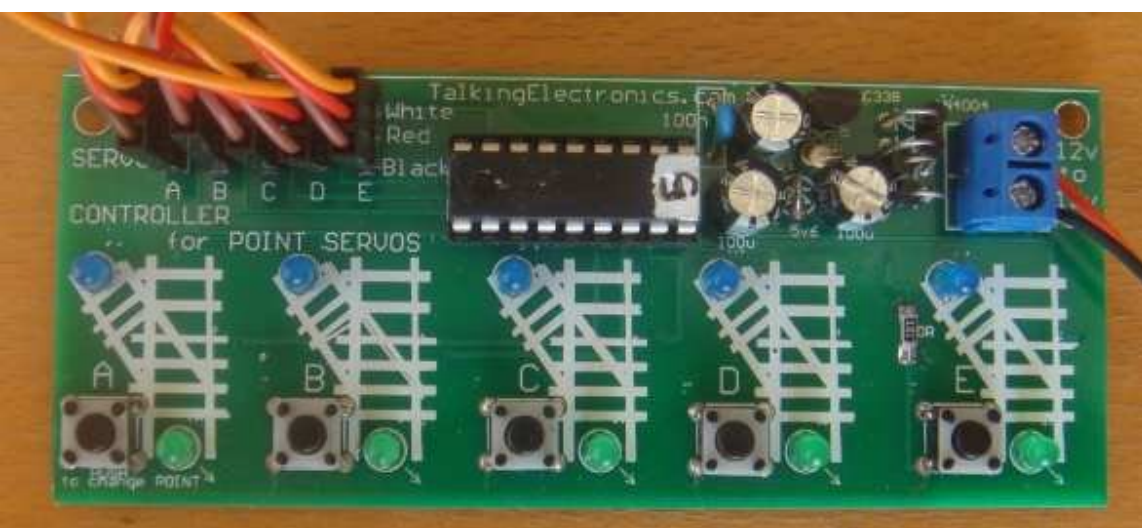
The module (containing the electronics) costs $25.00 USD (built and tested).
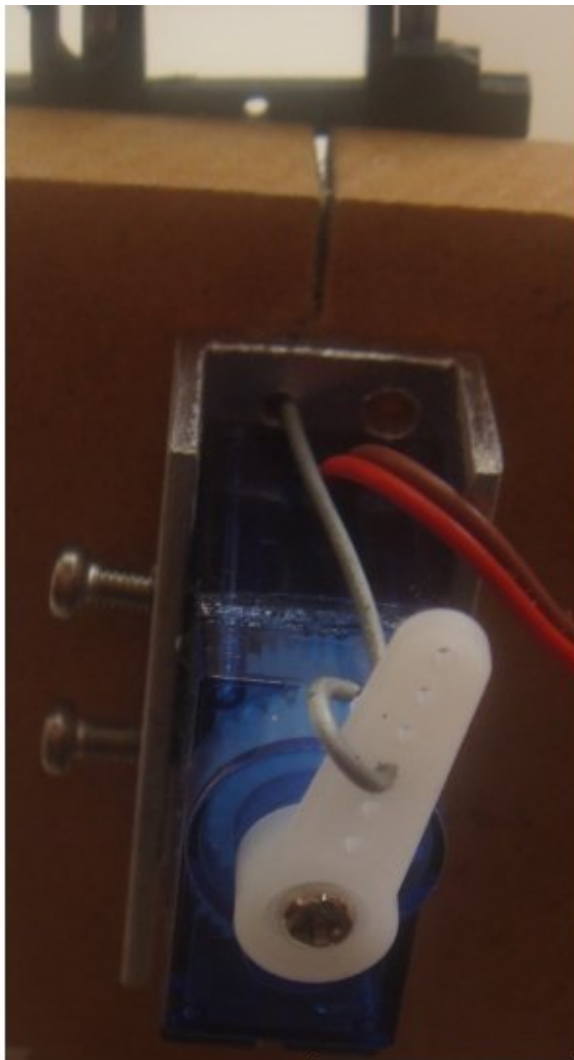
You can also get special slow-motion servos with 70 degree activation for $2.50 each and brackets for under your layout for $2.50 each. We also have 2 metre extension leads for $2.00 extra.

SETTING-UP INSTRUCTIONS

Connect the battery-snap (provided on the module) to 12v battery made up of say 8 AA cells. This is just an initial test to make sure everything works and nothing gets too hot.
If the voltage is not high enough (from flat batteries), the LEDs will just flash.
Later you can connect the module to a 12v power supply.
The LEDs will illuminate and now you need to move each point motor in both directions so the LEDs on the

board correspond to the position of the point.
Push the first switch for at least 0.5 seconds to allow the program to recognise the button.
Push it again. The point motor will reverse and the LED on the board will indicate the position of the point.
Repeat with all the buttons.
You can't just press the button quickly. You need to push it for 0.5 seconds to allow the program to detect the button.
Now you can extend each point motor with the extension leads provided.
You can get brackets to hold the point motor under the layout as shown in the image above.
Each time you turn on the module, you need to "synchronise" the point with the LEDs on the PC board by pressing each button to move the point in both directions. Wait for the servo to travel and STOP, before pressing the button again.

5 Point Controller for Servos: $25.00 USD
5 Slow-motion Servos $12.50 USD
5 2metre extension leads $10.00 USD
5 Brackets $12.50 USD
Shipping: $8.50 USD for all items

Buy **5 Point Controller for Servos** **$25.00usd** plus $6.50usd post

---

CHOICE NUMBER 21:

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.

Automatic Point Module

12v

Train Supply
12v to 14v
1Amp to 2Amp

$29.50

A

reed switch

over-ride manual point change

servo

B

wiring to reed switches
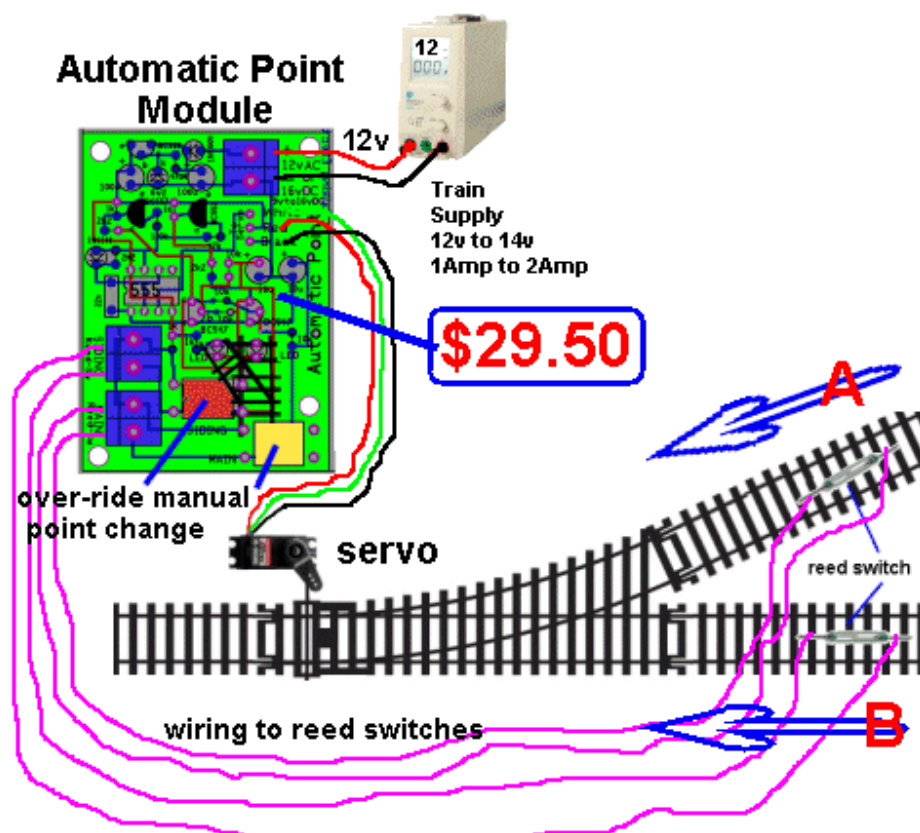
Turn your manual point into an AUTOMATIC POINT
When a train comes from direction A or B, the
point gets automatically set to prevent a derailment.

AUTOMATIC POINT with 555 IC
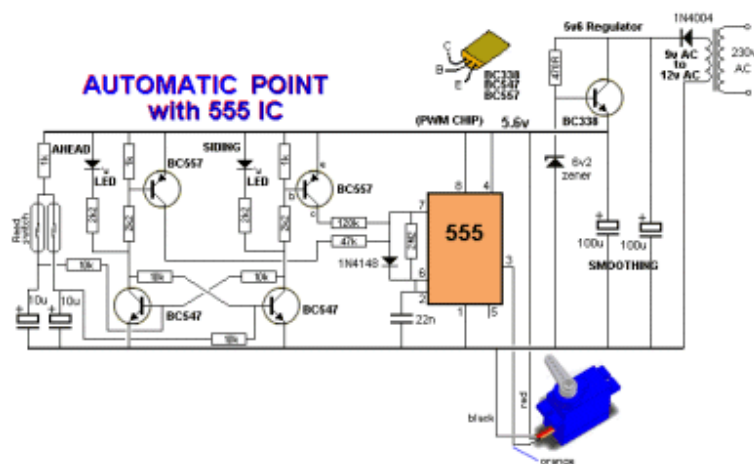
[Click](#) for large image

reed switch

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:
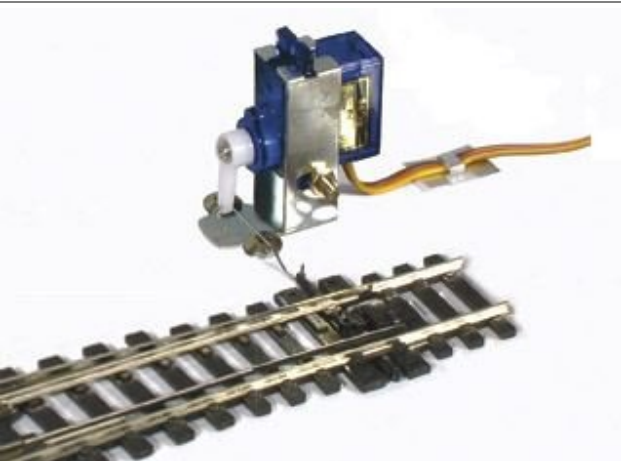
The image on the left is just an example to show the connection of the servo to the point. The servo can lay down to take up less room.
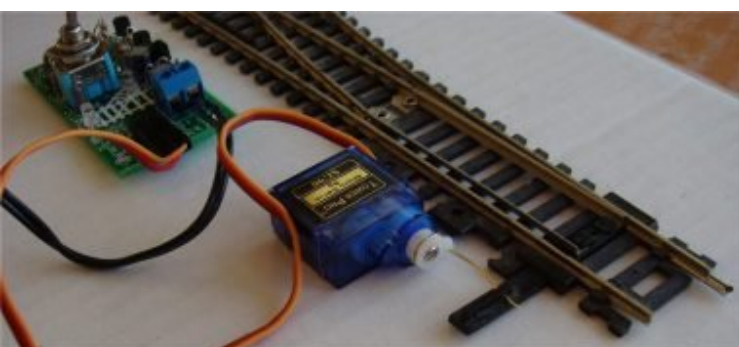
The servo rotates less than 70° and the gold wire is called the "linkage."
Any electro-mechanical device (motor, solenoid, servo) that operates a point is called a SWITCH MACHINE.
This project will only operate a normal (unconverted) SERVO as the circuit sends PWM signals to the servo to set its angle 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 slider on the track.
The gold wire is soldered to the pin so it does not change alignment.
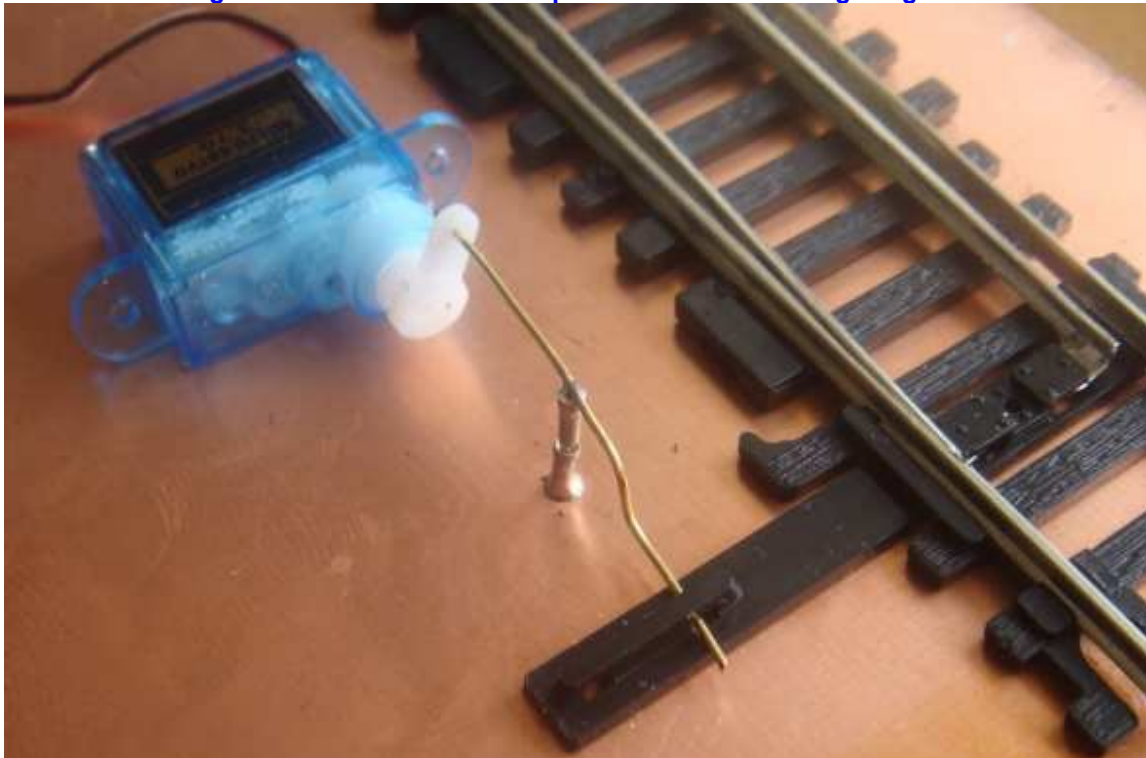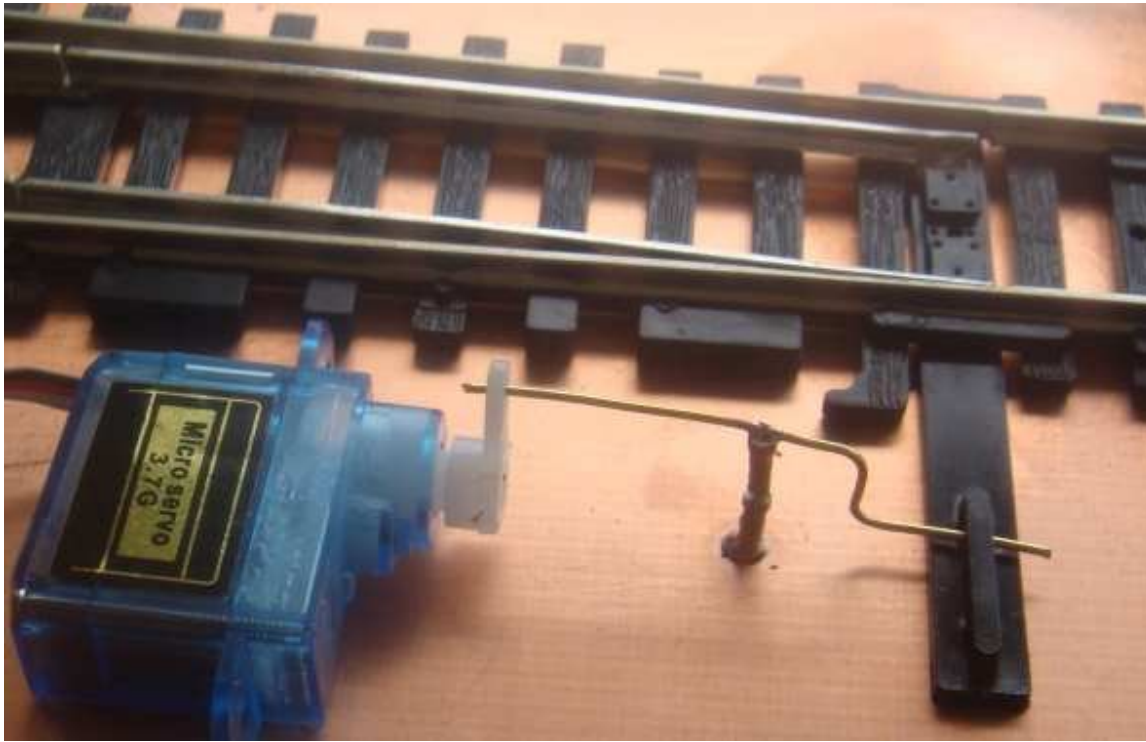
THE SUPPLY

The supply for this project is 9v to 16v DC - but it 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.
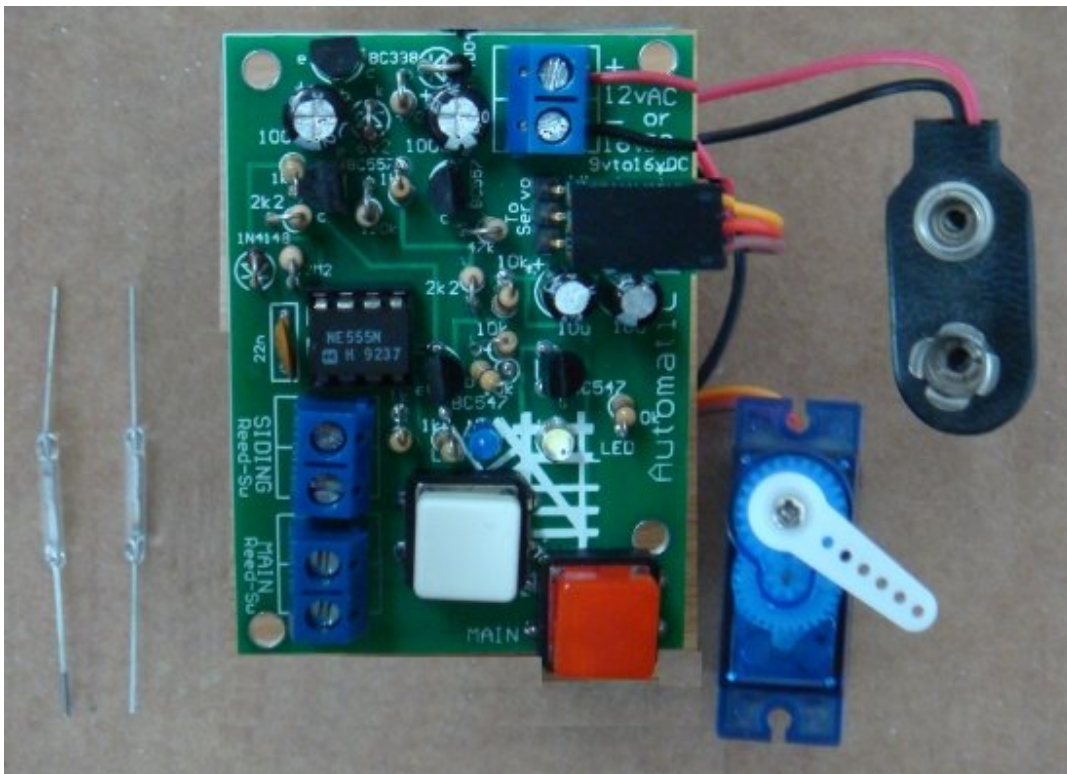
Everything fits neatly on the board
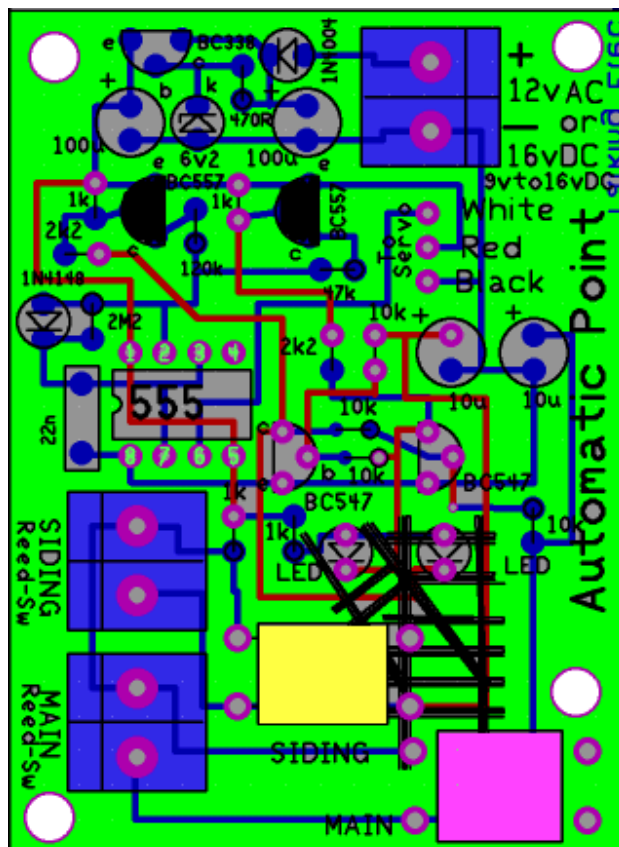
All the components are clearly identified.

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 22:

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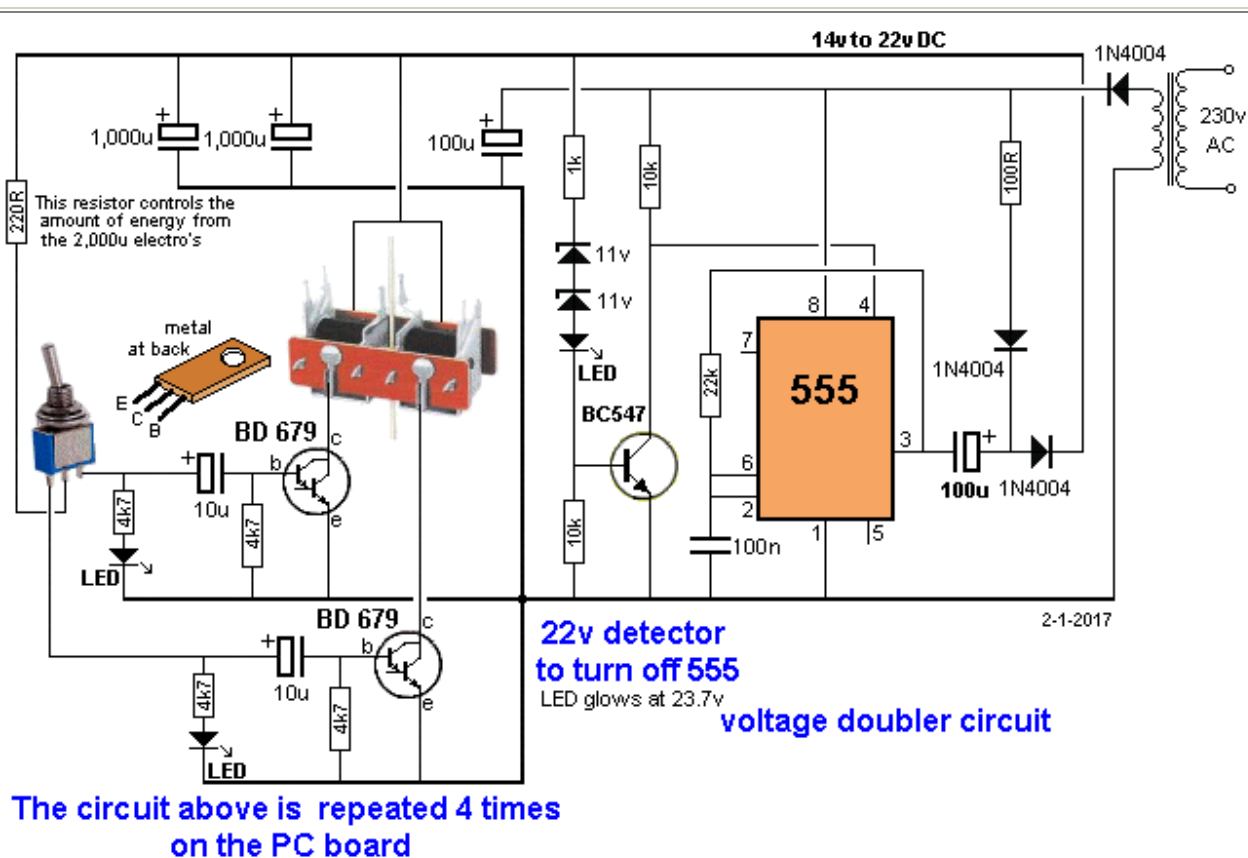
Loop with 2 Relays and Motor costs $xx.50 plus $6.50 postage. It is shown in the following image:
Click Here to order.

CHOICE NUMBER 23:

4 Points CDU Controller

The circuit above is repeated 4 times
on the PC board
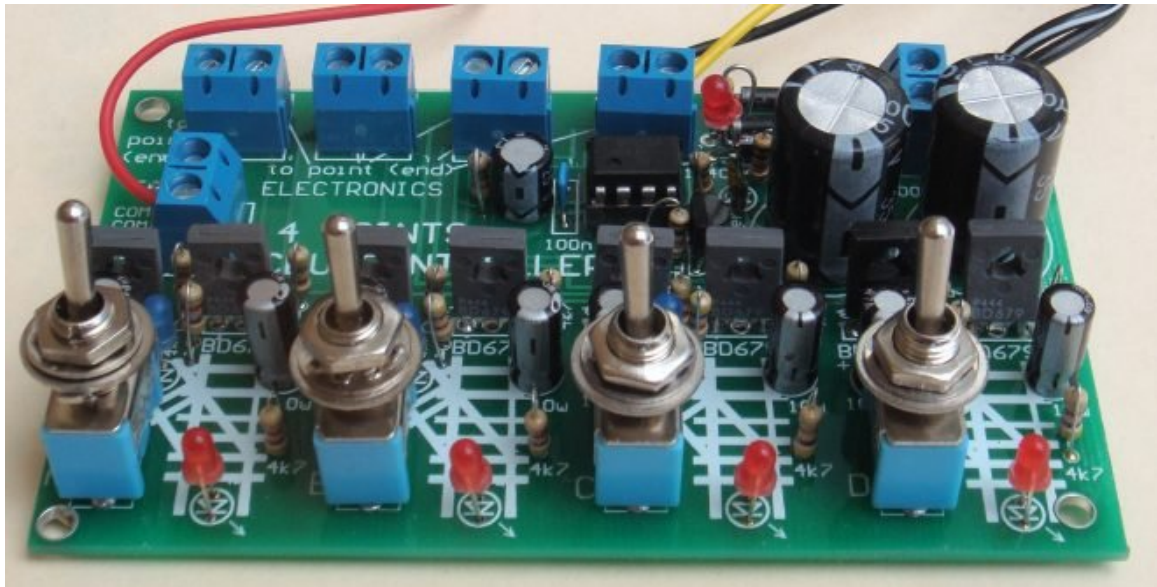
This module will change the position of 4 point motors via the 4 toggle switches and the LEDs on the board show the position of the point. The module comes with the switches separate in a plastic bag because they are too tall to post in out small posting box. You can solder the switches to the board or fir them to your control panel and use 3-core ribbon cable.   The two outer wires of each point are connected to the 2-terminals above and the 4 middle wires of the points connect to the 2-terminal block on the left of the module.

The circuit has been included so you know how it connects to the solenoid points.
The oscillator circuit using the 555 increases the input voltage to 25v.
It is fully built and tested for $35.00 usd plus $8.50 usd postage

Please log into your paypal account and send a payment to
 talking@tpg.com.au for $43.50   usd

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CHOICE NUMBER 24:

There is another COMPLETELY DIFFERENT type of Point Motor. It is used for a KATO point - to change the direction of the point.
Kato point motors operate completely differently and you need a different type of circuit to operate it.
It has a magnetic PUSH ROD. In other words, the plunger is MAGNETIC. And this means the single solenoid is classified as DOUBLE ACTING. The single solenoid consists of a single winding and has just 2 wires and it operates by reversing the supply. Reversing the supply reverses the magnetic lines of force and this causes the plunger to be attracted or repelled.
We have designed a module to operate up to 4 points.
You can get the module for 1 point, 2 points, 3 points, or 4 point.
Only the components for 1 point will be fitted for $10.00
The components for 2 points will be fitted for $15.00
The components for 3 points will be fitted for $20.00
And the components for 4 points will be fitted for $25.00
These points are operated separately and individually by toggle switches (4 switches).

KATO 4-POINT CONTROLLER

This module controls 4 Kato points.
(It does not work with any other type of point
because KATO points work by REVERSING THE SUPPLY. All
other points work by alternately pulsing one or the
other coils to get two-way operation.)

INSTRUCTIONS

Connect the supply to the terminals (at the end of the module).
The Supply can be a Plug Pack (wall wart) or from your train transformer.
It can be AC or DC.
The AC wires can be connected either way around.
The DC wires will not work if connected the wrong way so you will soon find your mistake.
Connect the Kato Point Motor to the terminals at the top of the module with the wires either way around.
The module will work with voltages in the range 10v AC to 12v AC
 or 12v DC to 15v DC and even higher.
The 1,000u electros are 35v so you can use a supply up to 35v.
But 35v may be too much for your Point Motor.
If the Point Motor "bangs" too hard in each direction, you can reduce the voltage.
Switch all the toggle switches to the UP POSITION so that none of the electros get charged at the moment and none of the Point Motors operate.
Now change any of the points to "main," allowing half a second for the circuit to do its job.
If all the toggle switches are DOWN when power is applied, it will put a lot of strain on your power supply as all the Point Motors will try to get activated at the same time.
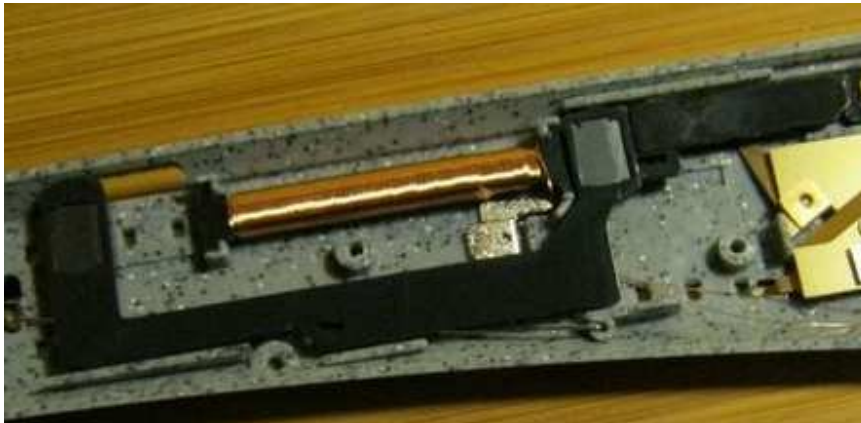
The KATO solenoid
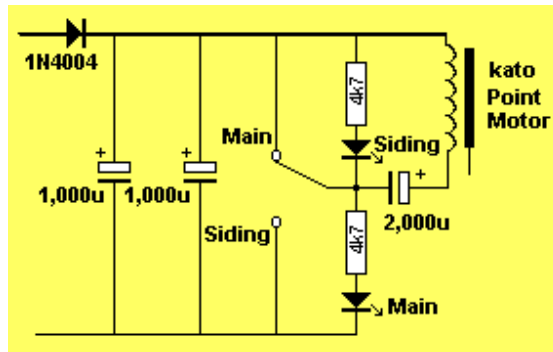
The KATO Point Motor Circuit.
The output section is is multiplied 4 times on the PC board.

The CIRCUIT

The circuit is very simple, but it is very clever. The electrolytic gets charged when the toggle switch is in the "down position" and the charging current flows through the solenoid from the supply to the electro. This makes it change the point to the siding.

When the switch is in the "up position," the energy in the 2,000u electrolytic (this is 2 x 1,000u electrolytics) flows out and through the solenoid, from the lower wire to the wire connected to the supply. This is in the opposite direction to previously and is actually a VOLTAGE REVERSAL. And because the voltage is reversed, the current flows in the opposite direction.

This activates the solenoid in the opposite direction and the point changes to the main line.

This very simple circuit does TWO THINGS. It supplies a pulse of energy so the solenoid does not get hot and creates a voltage reversal so the solenoid activates in both directions.

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

The power diode does two things. It allows AC to be connected and although only the positive cycles charge the 1,000u electrolytic, this is sufficient for the circuit to operate perfectly. The diode also prevents DC connection around the wrong way. DC around the wrong way will not illuminate the LEDs and the 2,000u will leak when voltage is applied in the wrong direction and not charge properly.

The 1,000u also reduces the impedance of the supply so the 2,000u can charge quickly and operate the point motor.

Getting a Point Motor to activate depends on the voltage you deliver to the module.

Kato Point Motors are very delicate and do not require a lot of energy for their activation, and you should start with a 12v supply.

If you think the Point does not respond and "click" strongly, you can increase the supply by adding a 5v plug pack in series with the 12v plug pack to get 18v.

If you are operating 2, 3 or 4 points at the same time, you will need to increase the supply voltage, maybe up to 24v. The maximum voltage is 35v - 36v and this is obtained by connecting a 24v and 12v plug pack in series.

You can use AC from any source, but remember, any AC voltage will be converted to the voltage marked on the supply **PLUS 50 PERCENT MORE**!!!!

Only use the minimum voltage needed and this is found by decreasing the voltage until you do not get reliable operation, then increasing the voltage by an extra 3v to 6v.

None of these voltages will damage or over-heat the point motor, they will simply make the point "click" or "bang" loudly in each direction.
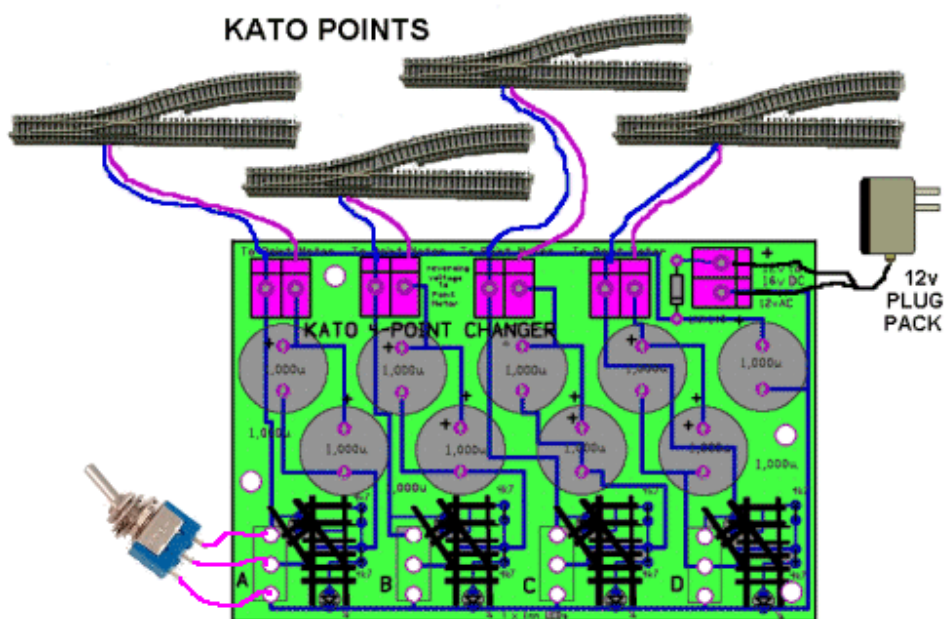
KATO POINTS

KATO 4 POINT CONTROLLER MODULE

Connecting the Kato points to the module
The module is supplied with the components soldered to the PC board,
but the toggle switches are supplied separately as they are too tall for the
posting box. This allows you to solder them to the PC board
or fit them to your control panel. The new PCB has 2 x 1,000u in the power supply

You can buy this module for 1, 2, 3 or 4 Point Motors and only the necessary components will be fitted.
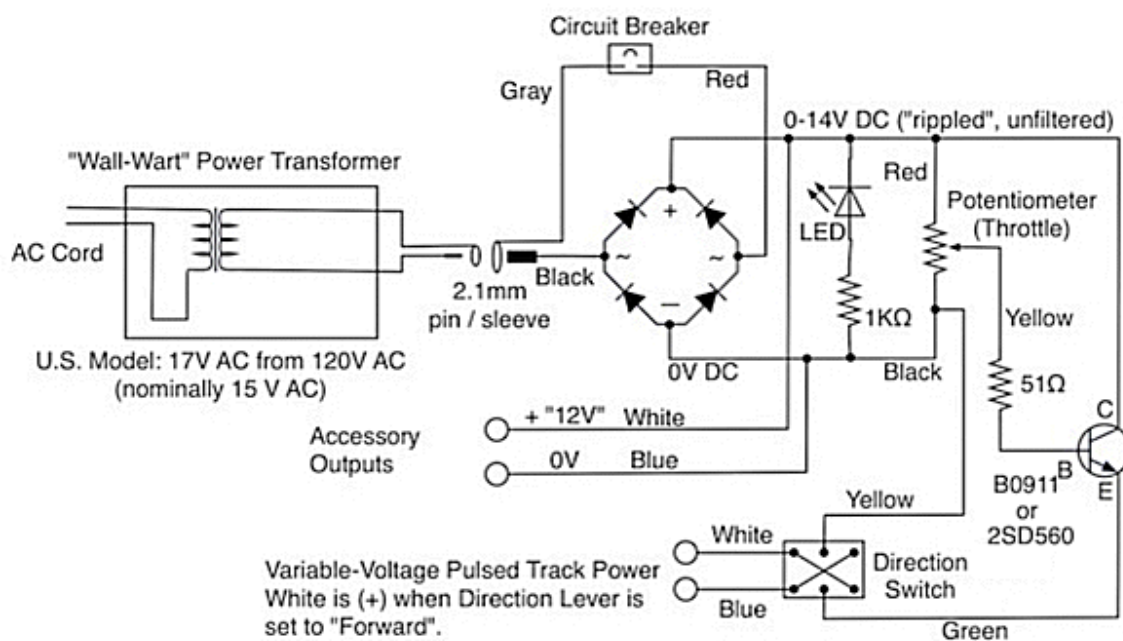
Modules are available for this project from Talking Electronics for $25.00 plus $6.50 postage.

Understanding KATO

Here is some helpful information about KATO

The KATO Throttle is called **KATO POWER PACK**

Kato Power Pack Circuit

It requires a 15v AC "plug Pack" for the best performance, but the input can be as low as 12v DC.
With 12v DC, the output will be 12v = 0.7v - 0.7 - 1.5v = 9.1v due to the voltage drops across the components.
With 17v AC the output voltage will be PULSED DC. In other words it will be a DC voltage that is rising from 0v to a maximum, 100 times a second. This is ideal for powering the motor of a loco.
It will rise to a maximum of 22v and even though it is not at this level at all times, the effect of 22v pulsed DC will be much more than 9.1v DC.
The "Power Pack" is claimed to be rated at 1.5 amps, but the diodes are 1 amp and because they are on long leads, they will get very hot when more than 700mA flows. This "Power Pack" is certainly less than a 1-amp controller.
The KATO "Power Pack" come in 8 different models KATO 7078535 Fahrregler regelbar, Kato 22-012 Power Pack, Kato N - 20-004, Kato 22-018 and many more.
They all the have same 1 amp diodes but there are two different power transistors.
The 2SD560 is a Darlington transistor and the correct symbol is:
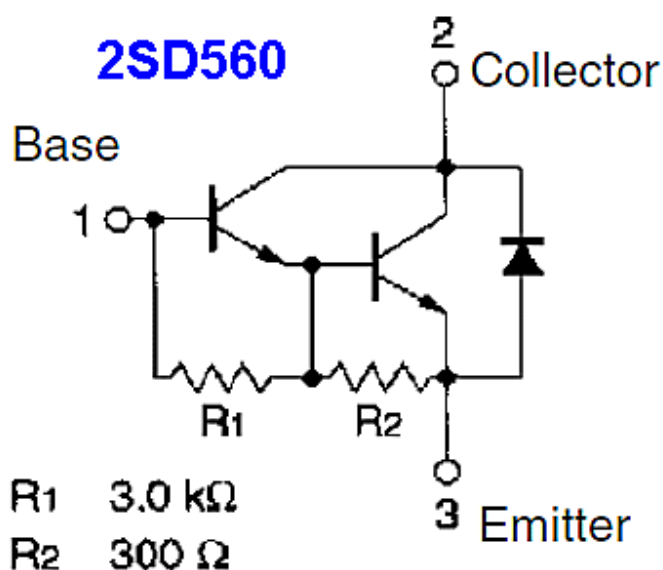
A **Kato 22-018 Power Pack** is available on eBay for $40.00 shipped and you will need an AC plug pack

The KATO 12v AC plug pack costs $25.00 to $40.00 on eBay BUT is for 100v AC and is not much use in the

rest of the world. The advertisers don't tell you it's for 100v AC. **There is NO 240v version**.

What you need is a transformer as shown above. It converts 240v AC to 12v (or 15v) at about 1 amp. https://www.aliexpress.com/item/1697253744.html? These cost about $20.00 (shipped) by Aliexpress.

You can now see the difficulty in using the KATO POWER PACK.

Now we come to adding a **KATO TURNOUT CONTROL SWITCH.** The photo below shows 5 switches added to a KATO Power Pack.

These switches have two studs on each side and they click into the studs on the right-hand-side of the Power Pack. The two terminals called 0v and 12v on the circuit above are the studs and are not 12v (as explained above) but possibly about 14v pulsed DC.

The **KATO 24-840 Turnout Control Switch** (shown above) is actually a PASSING SWITCH and only makes contact when the lever is a little-bit down from the top and a little bit up from the bottom. These switches cost about $8.00 on eBay.

Here is the equivalent of how the switch works. It is equal to a change-over switch (to reverse the polarity) and a "touch switch" to deliver a pulse:
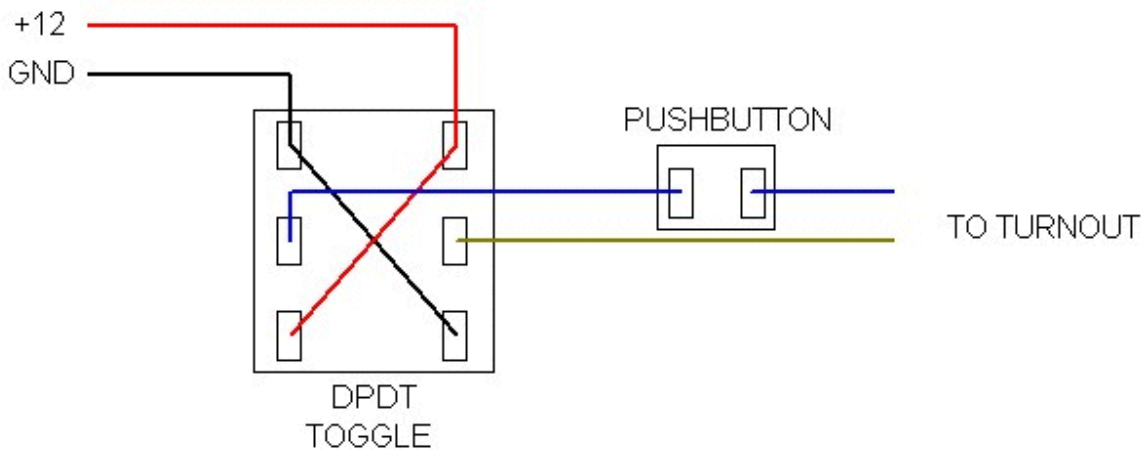
If you don't have a KATO POWER PACK, you can buy a **Kato 24-829 Accessory Adapter**. It is also called **Kato 24-842 DC Converter**. It contains 4 diodes and converts an AC voltage to PULSED DC. The Passing Switches will then send the pulsing DC "around one way" to the point via a pulse or "around the other way" via a pulse. Here is a **Kato 24-829 Accessory Adapter** clicked onto two **KATO 24-840 Turnout Control Switches.**

If you have 15v AC from a **"TRAIN TRANSFORMER,"** you can connect the 15v to the two wires coming from the back of the **Kato 24-829 Accessory Adapter.** If you have 12v DC, you can connect to the two wires (around either way) but the output will be 10.5v DC. This will be sufficient to pulse the KATO POINT MOTORS (solenoids).

Talking Electronics has designed a number of modules to replace KATO modules.

THROTTLE WITH PWM
Built and Tested: $35.00 plus $6.50 postage. Click <u>HERE</u> to buy a module.

This module takes the place of a **Kato 22-018 Power Pack** and uses a readily available 15v DC plug Pack.

4-POINT CONTROLLER FOR KATO POINTS

Modules are available for $25.00 plus $6.50 postage, built and tested for 4 points.
This is cheaper than 4 **KATO 24-840 Turnout Control Switches.**
You can use the 15v DC plug Pack from the Throttle with PWM module shown above.
You don't need the **Kato 24-829 Accessory Adapter**

KATO DISTRIBUTION BOARD $18.00 plus $4.50 postage Buy Here

This module will allow you to illuminate all your LEDs.
There are 4 separate brightness controls. Two controls have shafts that can be easily adjusted and two controls are via mini trim pots.
The **Distribution Board** comes fully built and has sample LEDs to show the brightness.
6 flying leads can be fitted into the JST 2mm sockets and 12 sets of LEDs can be fitted into the screw terminals.
The end of the module has 12 sets of female machine pins and you can insert 0.5mm wire into them.
The input voltage can be 9v AC or DC up to more than 20v as the 7805 regulator delivers 5v to all the LEDs. As you add more LEDs, the regulator might get warm and you can add a heatsink if you cannot hold it in your fingers.
These modules are very popular as they solve the problem of illuminating stations, roads and scenes with the appropriate level of brightness. You can use any colour LEDs as each section is individually protected with a current-limiting resistor. **$18.00 plus $4.50 postage Buy Here**

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FREE THINGS !!!

Some of the modules and power supplies come with free wire and switches and terminal blocks to make connection easy.
Hook-up wire and stranded wire is very expensive by the metre and the length we supply will get out out of trouble.
The spring-terminals connector block are very cleverly designed. But you have to be an Einstein to work out where to put the wire.
When you push the lever (button) on the top, the metal spring produces a gap just below the button and when released, the spring digs into the wire and you cannot remove it. You will get some of these FREE when you buy the modules. The wire will be different colours and different thickness.

HERE

NOT HERE

ON TOP OF SPRING !!

Not Here

Here is another clear picture of how to fit the wires
into the terminal block.
The wires go above the metal spring and just below the "push-
button."
When you push the lever on the top of the terminal block, the spring
is depressed and a it creates a space for the wire. Releasing the
lever grips the wire very tightly by the edge (end) of the flat spring.

Let's look at the 20 choices 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.

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. You can 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 !!!

WIRING A POINT MOTOR
Point Motors take a high current when they are operated for the very short time they are intended to work.
Most point Motors have a coil resistance of about 3.8 ohms and when operated on a supply of 12v, this will allow 3 amps to flow.
Normally, wiring for 3 amp will require medium duty hook-up wire because the current will be flowing for a long period of time and thick wire prevents it getting hot. But with a solenoid-type Point Motor, it is only activated for less than a second.
This means thin hook-up wire is perfectly suitable.
3 metres of thin hook-up wire will have a resistance of about 1 ohm and if 3 amps flows, the voltage drop across the wire will be 3 volts.
But most **Capacitor Discharge Units** are charged to a voltage higher than 12v and can be 24v.
If we take 24v, the current will be 5 amps and the voltage drop will be 5v.
This gives the solenoid 19v.
The Capacitor Discharge Unit is designed to give 24v at the beginning of the pulse and gradually drop to almost zero after less than 1 second.
This give the solenoid Point Motor an initial kick to start moving and then the current gradually reduces so the "end clunk" is not so strong.
This means the wiring to the Point Motor can be almost any thickness as it has very little effect on the operation of the solenoid.

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.
This means you need an input voltage of 14v DC, to get 12v out, 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 300mA to 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. It "kicks" the motor in bursts of about 600Hz 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. The ammeter is not a square meter as shown above but a side-meter as shown in the POWER SUPPLY project. But it is FREE, so don't complain.
$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

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

See the project: <u>HERE</u>
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.

Here are two controllers that may be available from Model Railway suppliers and hobby shops. They are expensive but look really nice.
In this article we are showing you everything because some hobbyists want to build it themselves and others want to buy a ready-made item.

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).
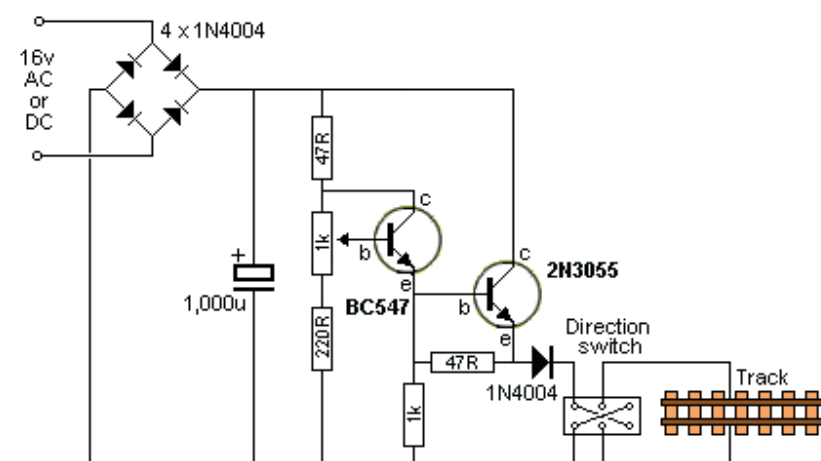
Train Throttle Circuit
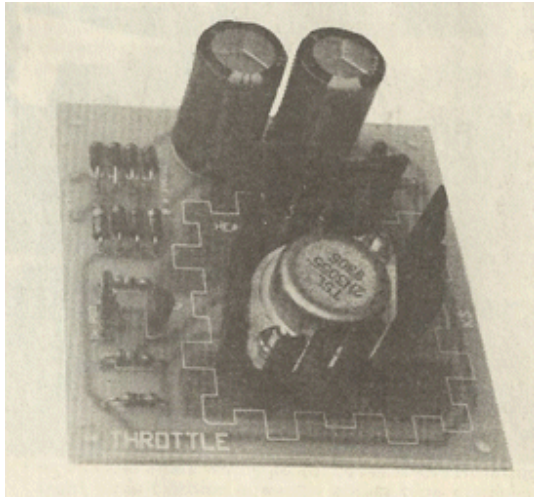
The 8 power diodes are now replaced by 4 x 1N5404
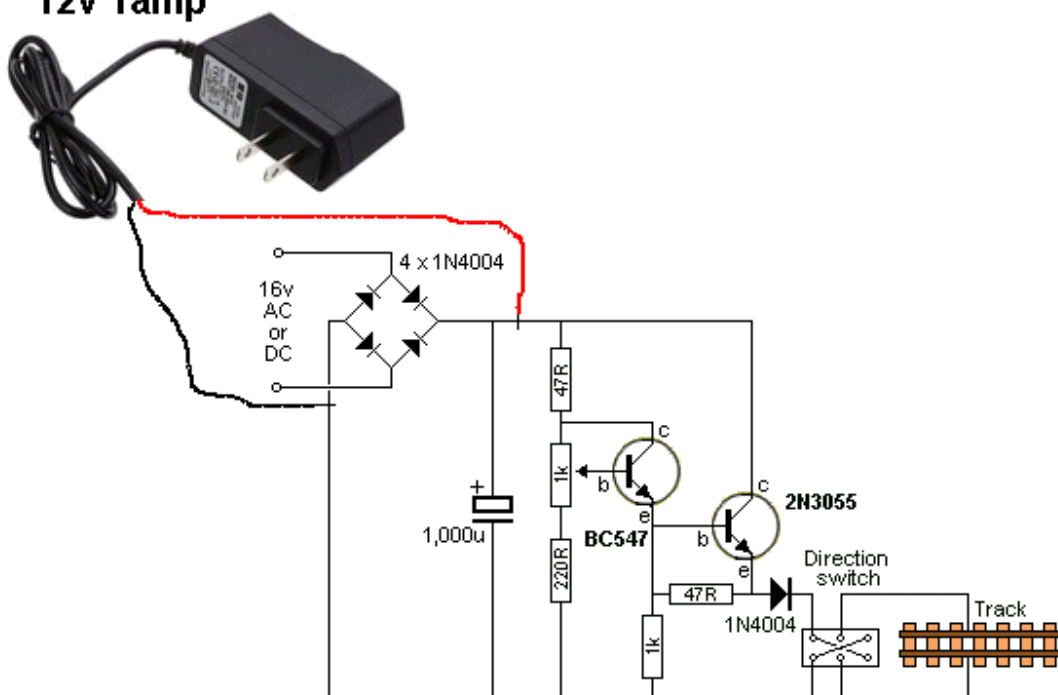
AC plug packs are very difficult to buy, but 12v 1-amp DC or 2-amp DC can be purchased at very low cost.
You can increase the output by 1.5v if you connect the positive and negative leads of the DC plug pack to the following points on the PC:
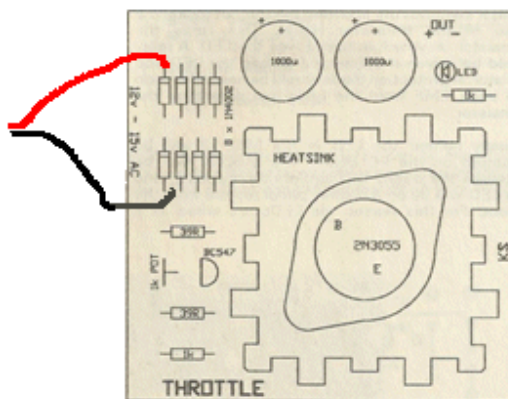
The layout of the PC Board.
You can connect the plug pack directly to the points shown

on the diagram above. You do not have to remove the diodes.
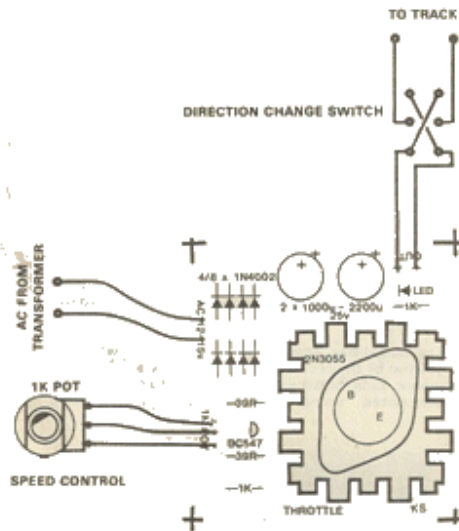
Wiring the pot, power input wires and reversing switch to the PC board

The control knob for the Throttle kit

The $2.50 plug Pack above was purchased as 12v @ 1 amp. It was easily opened-up via a screw and clip, to reveal the PC board shown below.
The output voltage is determined by the zener diode at the front of the board. The 12v zener was replaced with 15v and now the output is 15v DC. I would limit the current to 800mA, but a 15v supply can be connected to many of the throttle circuits to give 0v to 13v DC output.

The new 15v zener converts this power adapter to 15v output.

**You can also use a white LED in series with the
12v zener diode to get 15v output. Note the cathode of the zener is connected
to the cathode of the LED and the 1k current-limiting resistor is
linked with a jumper.**

This gives you a very low cost throttle.

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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.
By this we mean the motor gets pulses from the throttle that allow it to start very slowly.
The module is capable of delivering 3 amps (due to the thickness of the tracks) 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 on the output bridge are capable of handing more than 10 amp and the trackwork on the board can be modified to handle 5 amps 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 5 amps. If you want to control more than 5 amps, you will need to connect the supply directly to the MOSFETs in the bridge and by-pass the 5 amp diodes.

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.
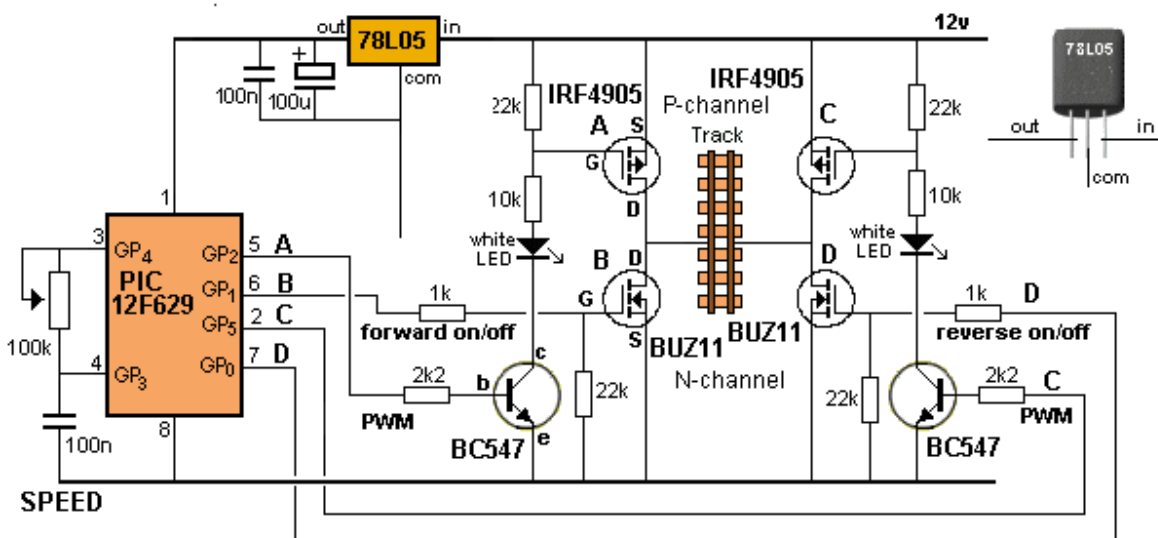
All the digital signals are controlled (and generated) by the microcontroller and the pot determines the timing of the waveform and the activation of the H-bridge.

The two lower MOSFETs turn ON or OFF to take one or other of the output leads 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.

NEW VERSION

The latest version was requested by a customer. He wanted the control facing the front:
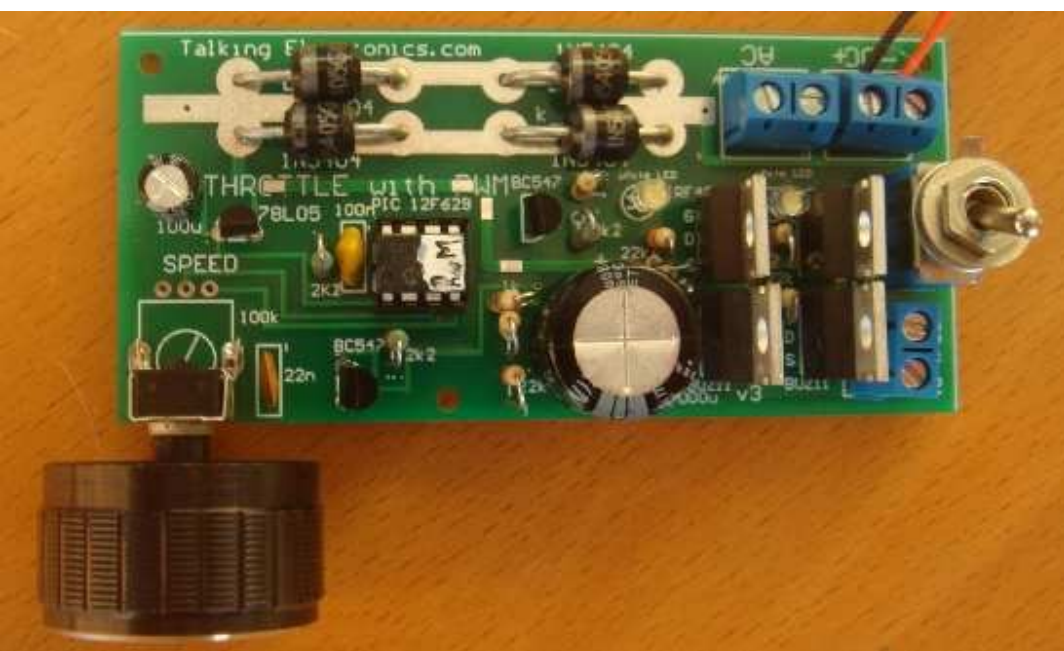
The cost is the same for either module but you must specify which version you want. The switch and knob are not attached when posted as the module must be less than 2cm high for posting in the box we use. Both modules come with the **TRACK PICK-OFF** (shown below) to deliver the output of the module to your layout.
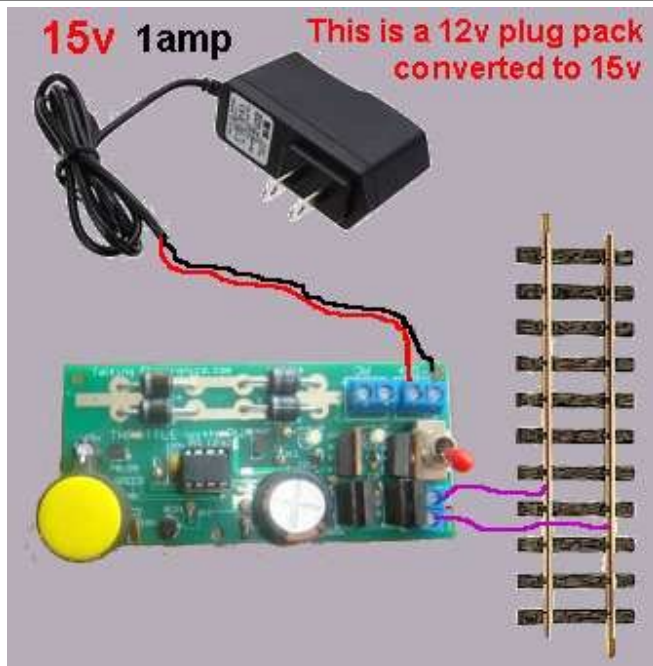
Connect a plug pack and the throttle project is ready.
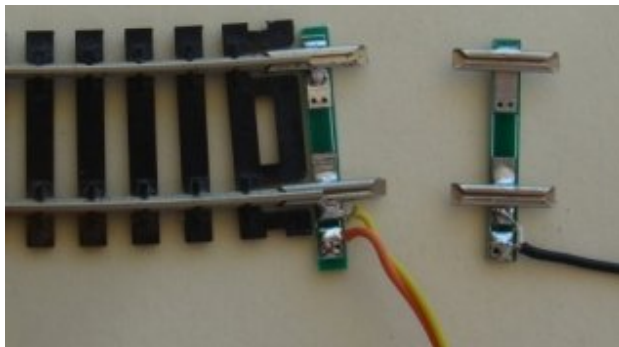
This type gives better current capability.

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

It will just pass 1 amp.

UPGRADE YOUR CONTROLLER

The following images of controller are called DC CONTROLLERS. They increase and decrease the DC voltage and most have a reversing switch. There is nothing wrong with these controllers, but if you want to start the train very slowly, and have a controller-knob that has both forward and reverse, **THROTTLE WITH PWM** is the upgrade.

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 its output 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 your 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

Servo Speed (slow) Controller

Buy a Module
Fully Built $25.00 plus $6.50 postage

Sometimes you want a servo to rotate slowly to produce animation that is realistic for the scale model you are designing.
This project provides different speeds.
It also has a repeat feature that activates the servo back-and-forth at the speed you have chosen.
It allows you to ANIMATE things.

The output of the servo moves about 70 degrees as this will give the greatest "throw." You can select the hole on the arm to produce the travel you want.
The repeat feature allows you to produce models with "pumping action" or "see-saw" action as a servo is smaller and cheaper than buying a motor and gearbox.

You can use it to control a point or a set of boom gates as well as swing-gates or a drawbridge or crane or a "see-saw" action. It has so much potential. You can get a smaller servo or a linear-movement servo for very tight spaces, but there is nothing cheaper than the standard 9G servo.

Here is a set of gates controlled by 4 servos.
https://youtu.be/bc6jyj93Ee4
Our module can be used to control this:

SERVO SPEED CONTROLLER

5v6 Regulator   1N4004

8v to 12v

BC338

5.6v   BC338

470R

6v2 zener

100n

22k   22k   3k3   22k

10k

100n

GP0   7
GP1   6
GP2   5
GP3   4

PIC 12F 629

1

GP5   2

8

red

black   orange

100u   100u

SMOOTHING

Forward
Reverse   Speed   Repeat?

no
yes

100n
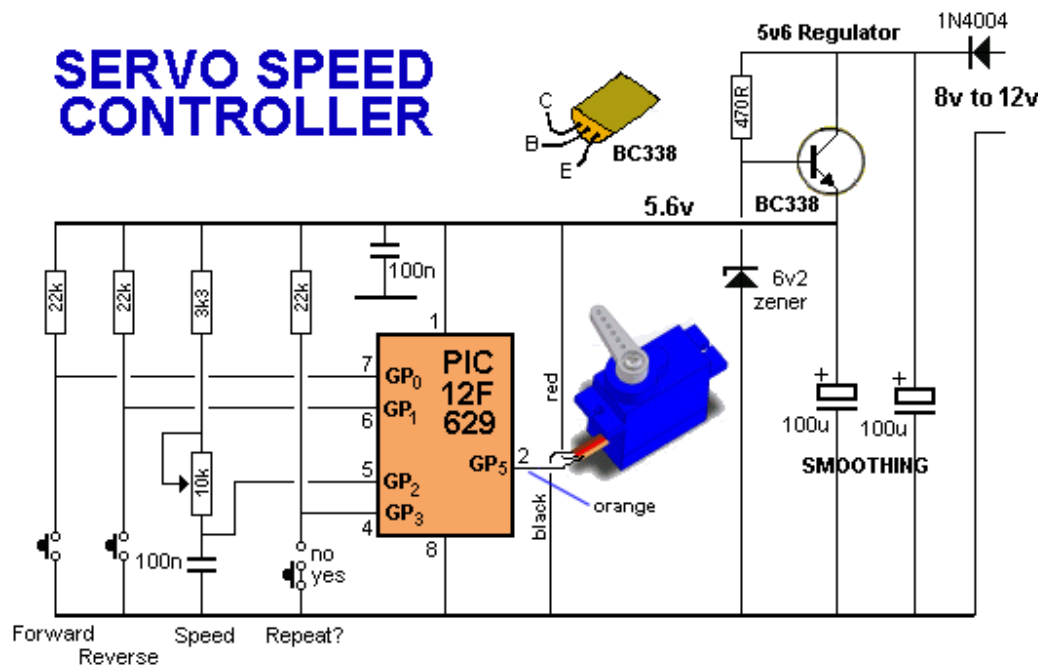
All the functions are in the PIC12F629 microcontroller
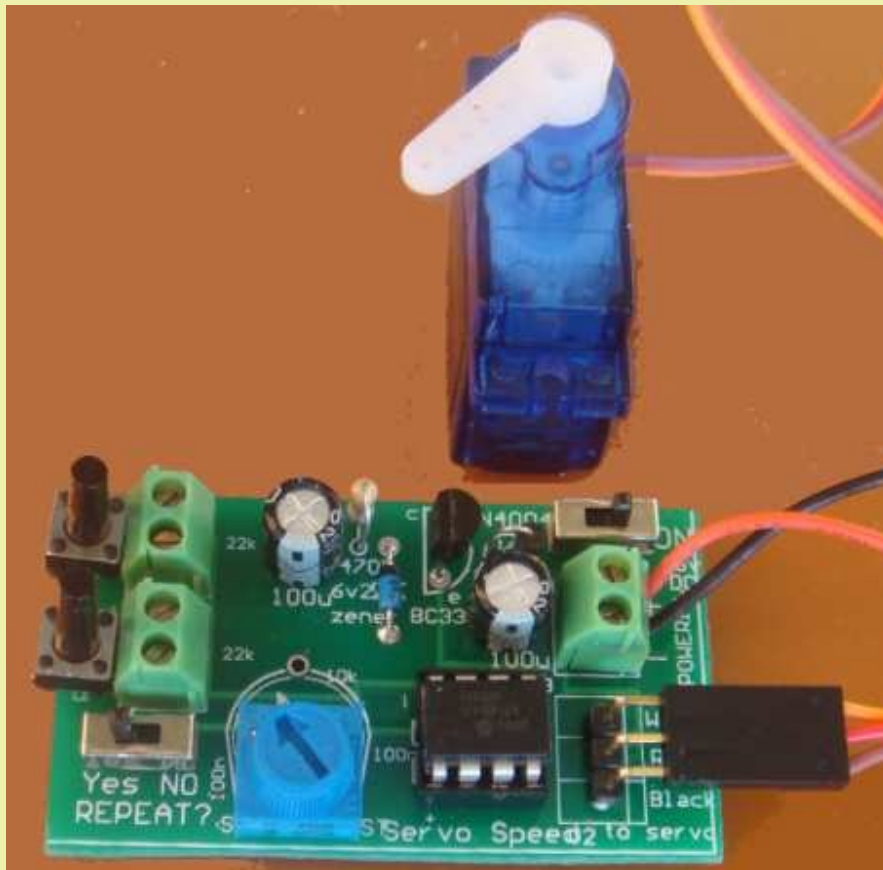
The module comes with 2 Test Switches and extension lead for servo, plus the servo and 0.6mm and 0.7mm push rods. You just need a 8v to 12v supply. .
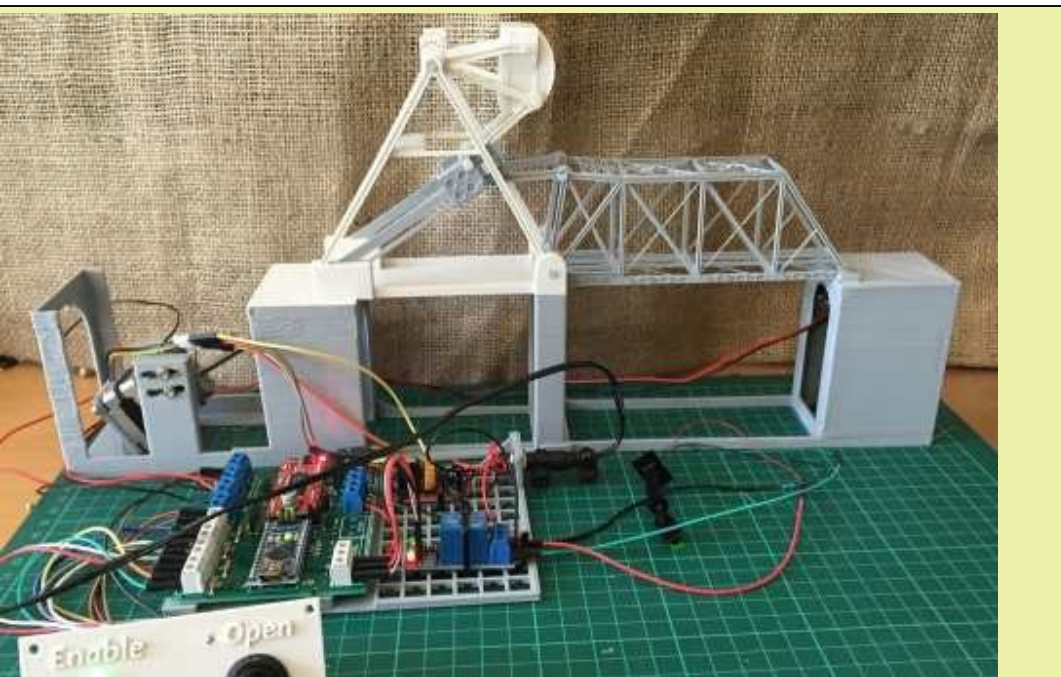
All the complex electronics in the project above can be reduced by using our module and a servo.

CHAPTER FIVE

DCC

DCC stands for **Digital Command Control** and basically means you can control more than one train on the same track.
It is expensive to add this feature to your layout as you need a COMMAND CONTROLLER and a loco that has a DIGITAL DECODER fitted inside the loco. A command controller is about $200 and a loco with a Digital Decoder fitted is about $200 and you need two locos to take advantage of this system.
I have used a COMMAND CONTROLLER "**NCE POWER CAB**" and is is very slow and messy as it is designed for a single person to control two trains.
But what if you have two "drivers?"   . . . . two hobbyists who want to drive the two trains at the same time?
All the controllers on the market do not allow this feature.
But Talking Electronics has produced a very simple Dual DCC Controller for two DCC Decoders for locos that do not have a decoder.

Here is the **Dual DCC controller**:

Buy Dual DCC Controller
Fully Built $43.00 plus $6.50 postage

This Dual DCC controller will control 2 locos at the same time and is an ideal way to create a DCC set-up. And the cost is just $43.00 AUD plus $6.50 posted worldwide.
It can also be used with 2 DCC locos that you have converted from DC to DCC via two Motor Decoders shown below.
The only additional item you require is a 12v DC supply from a SLA battery or a 15.9v DC supply from 4 Li-Ion cells (18650) or a 15v AC supply from a train transformer.

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DCC Decoder for Motor

This is a 1amp decoder NOT 500mA as per most of the small decoders advertised.
The output has 3amp FETs so the output stays as "cold as a frog."
Lots of these decoders have been sold and you can create a new DCC section using the controller and decoders because it is very easy to set-up and can be used by your friends, children or as test set-up as no programming is required and both controller can be used at the same time. It is much easier to use than all the hand-held controllers on the market and puts new life into two of your DC locos. (Don't forget: they have to be converted to DCC.)
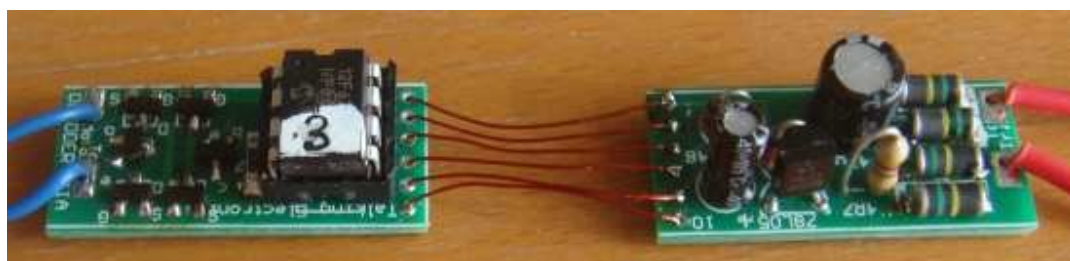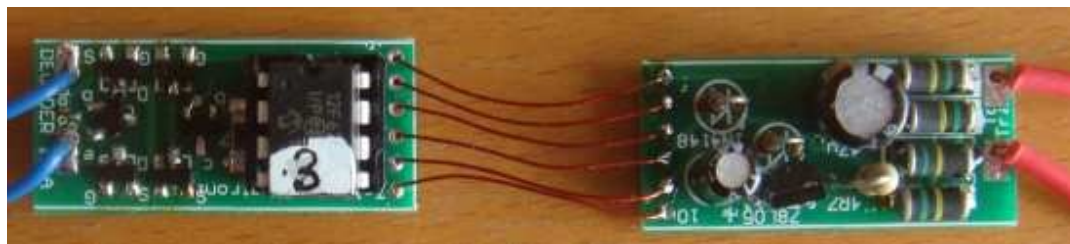
The Decoder can be put into a Coal Tender

You can turn a DC Loco into a DCC loco with this universal Motor Decoder for $18.00 plus $4.50 postage worldwide.
All you have to do is cut the two wires to the motor and insert the module.
The image above shows 2 screened leads (equal to 4 wires) from the loco. These 4 go to the input and output of the module.
The module is fitted in the tender if there is insufficient room inside the loco.

INSTRUCTIONS FOR INSTALLING THE MOTOR DECODER:
When you receive your Motor Decoder, it will have an address such as 3, 5, 31, 32, 33, 34, 35, 36. You can request any address when buying the module.
The Decoder comes with leads and alligator clips so you can test everything before installation. The leads near the 4 power diodes clip onto the two rails of your DCC layout.

Place a NEW 1 metre length of track next to your layout.

Place the DC loco on the new track.

Connect the other two leads to this new track.

Now set your controller to address show on the chip and use the throttle knob to drive the loco forward and reverse.

Make sure you are happy with the performance.

Now open the loco and cut the two wires to the motor.

Make sure no wires are connected to the chassis.

Now connect the two wires next to the 4 power diodes on the Motor Decoder to the DCC track. Connect the other 2 wires and alligator clips to the motor.

Place the "bogey" (motor and wheels) on the DCC track and carefully make the loco move back and forth very slightly.

You have now proven the Motor Decoder will work correctly when fitted inside the loco or in a coal tender or any suitable carriage behind the loco.

The cost of a DCC layout will be about $43 + $18 + $18 + power supply + postage.

DCC POINT CHANGER using a servo

Talking Electronics has produced a module that detects the DCC signal on the track and changes a point.
But to explain this we have to start at the beginning.
To operate the DCC Point Changer you need a DCC Controller such as NCE POWER CAB. There are a number of suitable types, BUT NOT A HORNBY CONTROLLER.
The Power Cab has a keyboard to select an address and these address are generally the address of a loco. But the same range of addresses can be used to access other items such as the operation of a point.
We have used address "40" to operate our **DCC POINT CHANGER using a servo,** shown below.
You can have 1, 2, 3, 4, or 5 **DCC POINT CHANGERS** on this address and to operate each point, the keys 1, 2, 3, 4, 5 are used in TOGGLE MODE. By pressing key, the first **POINT CHANGER** will activate the point. But you will not know the position of the point, if you cannot see it move.

So we have a DCC Point Identification module that picks up the signal from the track and shows the result on a display.

You need 4 things:

1. DCC POINT CONTROLLER - such as NCE Power CAB

2. DCC POINT CHANGER with a servo

3. DCC POINT IDENTIFICATION Module

4. Track pick-off for each DCC POINT CHANGER

TO SERVO
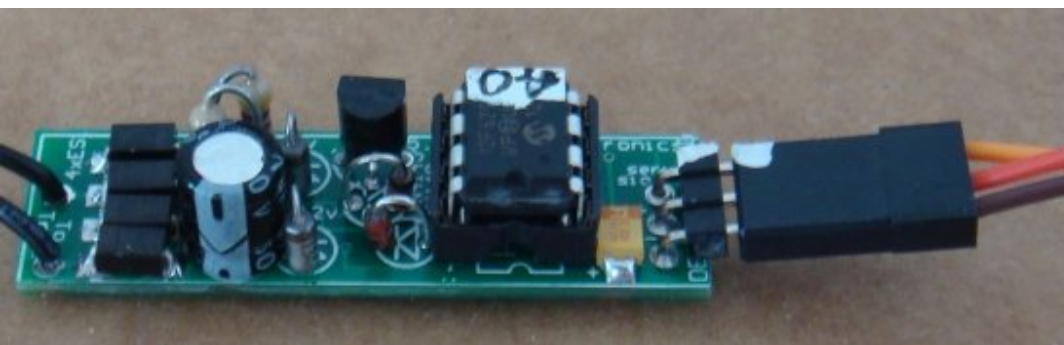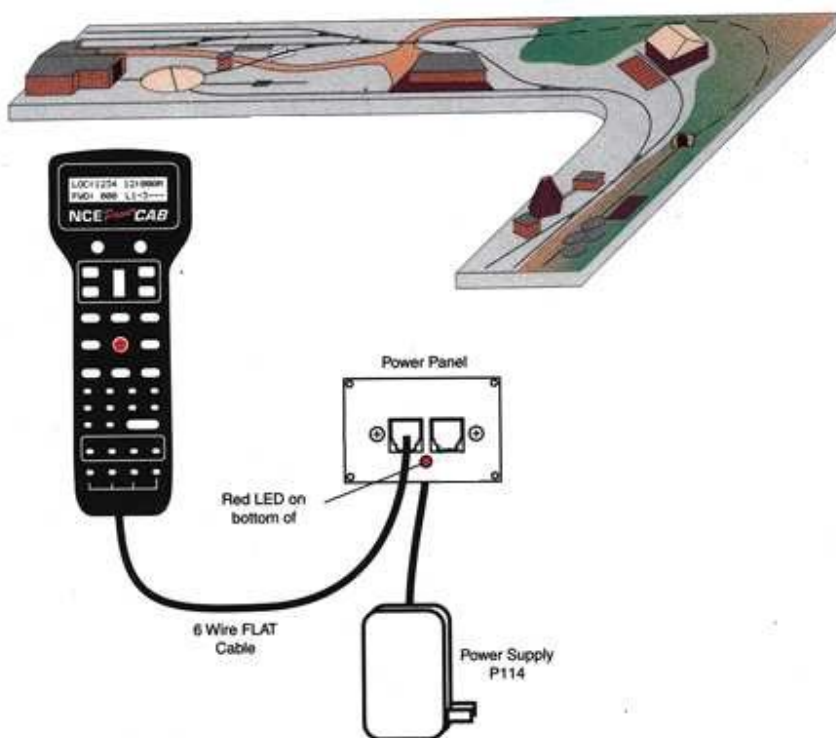
DCC POINT CHANGER using a servo
Buy DCC Point Changer with servo: **DCC Point Changer with Servo**
$20.50 plus $6.50 post

If you have 5 DCC points, you will need to order:
DCC POINT CHANGER using a servo with address 40 - toggle key1
DCC POINT CHANGER using a servo with address 40 - toggle key2
DCC POINT CHANGER using a servo with address 40 - toggle key3
DCC POINT CHANGER using a servo with address 40 - toggle key4
DCC POINT CHANGER using a servo with address 40 - toggle key5
If you have more DCC points, you will need to order:
DCC POINT CHANGER using a servo with address 41 - toggle key1
DCC POINT CHANGER using a servo with address 41 - toggle key2

DCC POINT CHANGER using a servo with address 41 - toggle key3
DCC POINT CHANGER using a servo with address 41 - toggle key4
DCC POINT CHANGER using a servo with address 41 - toggle key5

You will also need a connection to the track to pick-off the signal **to operate the DCC Point Changer and also power the servo.**
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 shows and how it it fitted to the track.
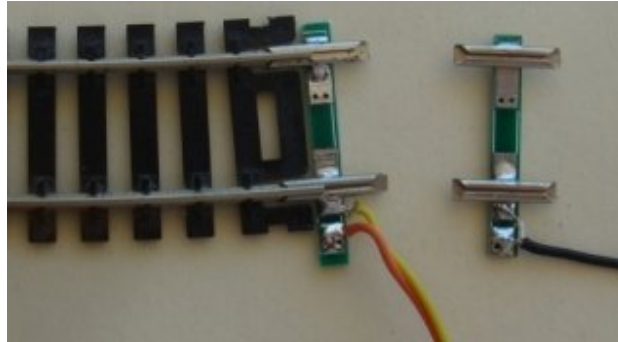
Comes with 1.5metres of screened lead

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.

Track pick-off $1.50 each **Track pick-off** Let me know who many and which type.
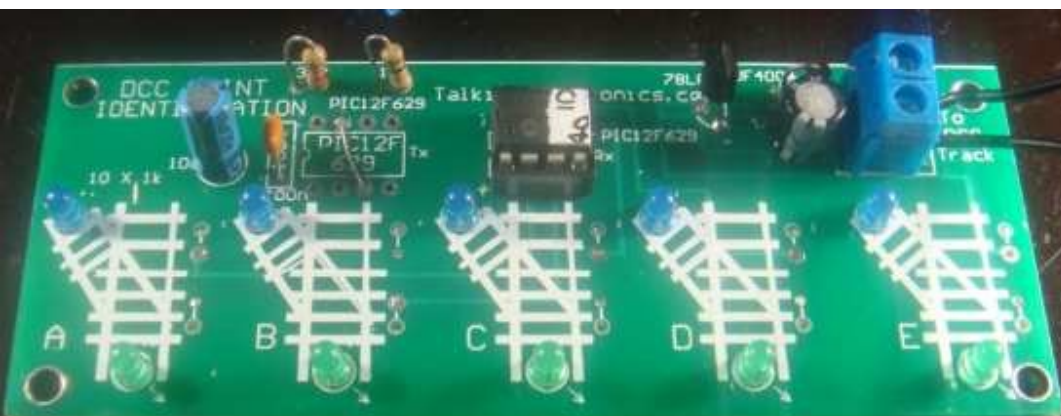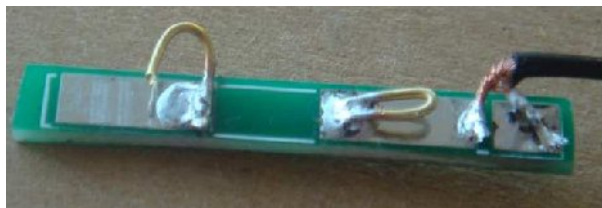
DCC POINT IDENTIFICATION Module
Buy: **DCC Point Indicator**
$10.50 plus $6.50 post

CROSSING LIGHTS

We have designed 4 different **CROSSING LIGHTS** MODULES to cover the different requests from customers.
You need to read through the details of each module before ordering.
Some are low-cost and operate all the time. Others are activated by the train and some automatically turn off after 20 to 60 seconds - the choice is yours. You can buy the ready-built and tested modules for less than a kit of parts.
You can buy a module with just Crossing Lights or Lights and Sound and finally a set of modules with Lights and Sound and Boom Gates.
You can add these modules to a larger order and pay only one postage. Email talking electronics before making any large order to get the best costing.
email: Colin Mitchell

1: Crossing Lights 2-Transistor
$5.00 plus $4.50 postage
Buy: Crossing Lights - 2 Transistor
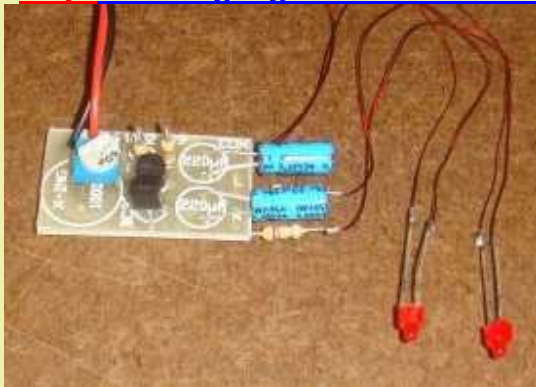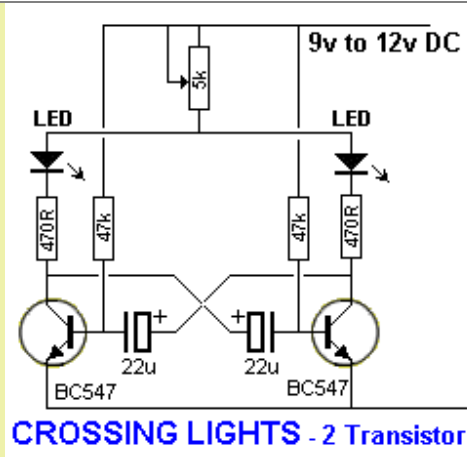
This is the simplest and cheapest **CROSSING LIGHTS** Module.
It uses a 2-transistor flip flop circuit and the mini trim pot adjusts the brightness of the LEDs and the flash-rate (at the same time).
It operates all the time when the supply is connected and does not have any train detection feature. It connects to 9v - 12v DC and you need an on-off switch to turn it off.
Cost:$5.00usd plus $4.50usd shipping
The module comes with 2mm and 3mm LEDs and you can buy components from Talking Electronics to make your own **Crossing Lights**.

2: Crossing Lights - Surface Mount 555
$5.00 plus $4.50 postage
Buy: Crossing Lights - SM 555
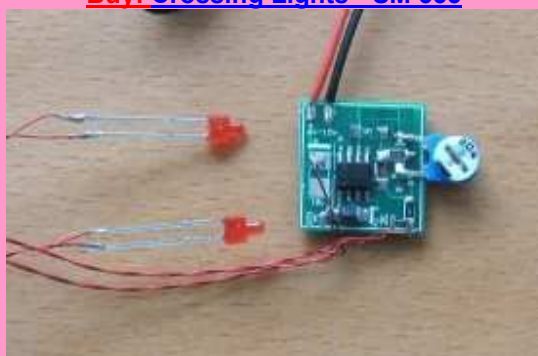
This is the surface mount version of the low-cost **CROSSING LIGHTS** above.
It operates all the time when the supply is connected and does not have any train detection feature.
The mini trim pot adjusts the flash-rate of the LEDs
The module comes with 2mm and 3mm LEDs.
Cost:$5.00usd plus $4.50usd shipping
You can buy components from Talking Electronics to make your own **Crossing Lights**.

3: Crossing Lights 3v
$15.00 plus $6.50 postage
Buy: Crossing Lights - 3v

Crossing Lights 3v Module and two reed switches with 12mm super magnets. The LEDs are connected to 600mm leads

This is a self-contained module.
Fit the reed switches between the rails and place a super-magnet under the loco.
It is activated by the train.
It turns off automatically after the train has passed and no on-off switch is needed.
The module comes with a 3v cell in a coin-holder and is self-contained and starts-and-stops by the action of the train.
Cost:$15.00usd plus $6.50usd shipping.
Talking Electronics has components to make your own Crossing Light for the LEDs.

4: Crossing Lights - 555
$15.00 plus $6.50 postage
Buy: Crossing Lights - 555

AUTOMATIC CROSSING LIGHTS - 555
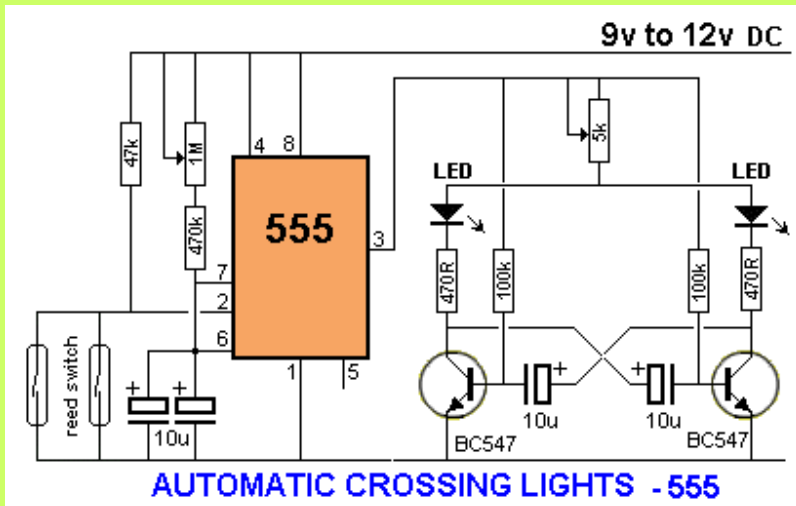
This module is connected to 9v to 12v supply. The module turns off automatically after 30 seconds but the 555 IC takes 5 - 10mA when "shut down" and that's why you need to use your train power supply.
Fit the reed switches between the rails and place a super-magnet under the loco.
Talking Electronics has components to make your own **Crossing Lights** for the LEDs.

CROSSING SIGNALS also called CROSSING LIGHTS

The 4 modules above will need **CROSSING SIGNALS**.
The simplest **CROSSING SIGNAL** is 2-head. These signals cost about $15.00 from suppliers on eBay.

You can make your own from a kit of parts from Talking Electronics for $5.00 plus postage.
You will need tools, soldering iron and black spray paint to complete the signal.

TRAIN DETECTORS

We have designed more than 5 different modules to cover the requirements for detecting a train.
There are 5 different sensors, 5 different outputs, a delay option, a relay version and two isolated options.

The detectors detect the presence of the loco. They are one of the following:
1 Reed Switches, or
2. IR Detection on one side of the track, or
3. IR Detection across the track or
4. IR Detection under the track.

The output can be:
1. Up to 50mA
2. Up to 100mA
3. Up to 1 amp
4. or 3 amps or more

The output can have a delay features where it is ON for 2 seconds to 2 minutes.
The output can isolated or non-isolated.

This gives more than 10 different options and you have to read this article to work out which module will be the most suitable for your application.

Reed switches are the cheapest but you have to put a magnet under each loco.

IR modules detect a beam of light and by using an Infra-red beam. The natural lighting on your layout will not effect the operation of the sensor.
If the Infra-red transmitter and receiver are together, the beam is bounced off the loco and this is called **REFLECTIVE DETECTION**.
If the beam is across the track the beam is cut by the loco. This is called **BROKEN BEAM DETECTION.**
The beam across the track will also work for two tracks.
All our detectors are very sensitive but some are more sensitive than others and you have to test a module and ask for an exchange if you want the other form of detection.

DECIDING ON THE MODULE FOR YOUR APPLICATION

Here's how to decide on the module you need:
Firstly you have to work out what you want to turn ON when the train approaches. Is it LEDs or globes or a motor?
Then you have to know what current your device takes. Normally this is of no concern, but some of the Train Detector Modules have a transistor switch and the capability of the switch may be limited to 50mA, 100mA or 200mA. One module will handle 3 Amps or more.

Then you have to decide if you want REED SWITCHES or Infra-red sensors.

The simplest is a set of two reed switches. This will detect the train in both directions.
If you want to pay a little more, you can have 2 IR detectors.

Then you have to decide if you want a DELAY feature.
Some modules have an on-time (also called a DELAY) from 1 second to 30 seconds.
You may want to activate a set of lights at a station as the train passes or a windmill or a set of crossing lights and some of our modules provide an activation for a period of time. You select the DELAY TIME by adjusting the mini trim pot on the module.

Now that you know all the features of the modules, you can select the right one to suit your application.

There is one final option. Two modules have an ISOLATION feature where the output (the output is a SWITCH) is isolated from the electronics of the module and this means you can turn on a device that has its own power supply.

The output of all the Train Detector modules is a SWITCH - just like the wires from a reed switch. Or the connections for a relay.
When the Train Detector module detects a loco, the resistance between the two wires is very low. We say "low" because the switching device may be a transistor. It will be zero ohms when the switching device is a relay.
When the "switch" in the Train Detector module is a relay, you can connect the two wires (to the module you are activating) around either way.
When the "switch" in the Train Detector module is a transistor, you must connect the two wires (to the module you are activating) around the way will explain in an accompanying diagram. This is because the transistor only becomes a "switch" in one direction.
If the module you want to control is powered by a different power supply to the supply for the Train Detector, you will need to buy the RELAY VERSION. This version is classified as ISOLATED.
Finally, you need to know if you want the Train Detector to be able to switch a very small current - such as 50mA or a higher current - such as 500mA or 1 amp.
If you buy the relay module, it will switch everything, but the other modules are cheaper.
Finally, you can buy a module that remains active (switched) for 1 sec to 30 seconds. This is called DELAY TIME or ON-TIME.

IR DETECTOR

Since you cannot see the Infra-red beam of the Train Detectors, we have designed a detector that you move around in front of the beam and work out where it is the brightest. This detector also works for 38kHz beams. It is essential for detecting problems. Ask us about the kit.

And we also have a **LED TESTER** that will illuminate and test LEDs and also test leads for continuity.   Ask us about the kit.

Now we come the modules:

THE FIRST TYPE
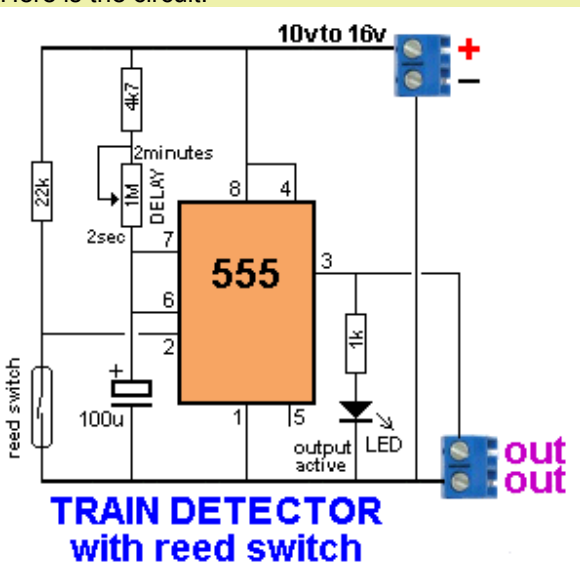
This is our simples and cheapest TRAIN DETECTOR. It is called **TRAIN DETECTOR with reed switch**. It is fully built and tested and costs $8.00 plus $6.50 postage.
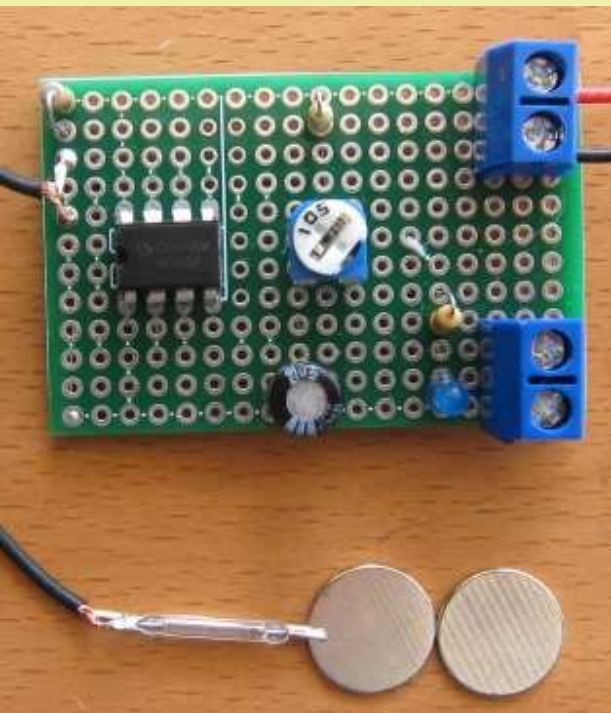
You will get the module on a Printed Circuit Board. The photo shows the prototype.

It comes with a reed switch on 1500mm lead and two very strong super magnets that fit under two of your locos.
Here is the circuit:

The output goes HIGH when the loco is detected and stays HIGH for 2 seconds to 2 minutes, depending on the setting of the 1M mini trim pot

THE SECOND TYPE

This is another simple TRAIN DETECTOR. It is available as a set of **6 Train Detectors** on two separate Printed Circuit board.
Here is an image of our test-board with 5 different photo transistors, where we compare the sensitivity of each photo-transistor. We only supply the most sensitive photo-transistors in the kit.

remove the 10k for greater sensitivity
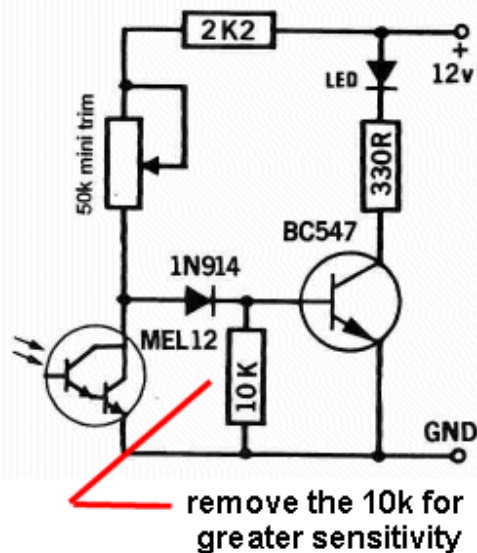
The 10k resistor i

The 10k resistor is removed to increase sensitivity

The LED illuminates when the photo-transistor does not see light and it goes out when it is brought up to a light-source.

The PC board above shows 5 circuits. The new kit contain 6 modules (circuits) and comes with 2 PC boards containing 3 circuits on each board and costs $21.00 for the 2 boards and all the components.
It is called **6 TRAIN DETECTORS**

Normally you mount the photo-transistor between the sleepers and the ambient light in the room will turn the LED off. When the train passes over the photo-transistor, the LED illuminates.
The circuit will not deliver much more than 12mA and maybe a little more if the 330R resistor is reduced to 220R.

THE THIRD TYPE
This module contains 6 separate circuits on the printed circuit board and uses a HEX Schmitt Trigger IC. It also has a delay feature with a timing that is fixed by the value of the 22u electrolytic and 100k resistor.
The complete kit costs $26.00   It is called **HEX TRAIN DETECTOR**
Each output is capable of delivering 10mA.

HEX TRAIN SENSOR (With delay)

ooooooooooooooooooo0000000000000000000000000oooooooooooooo
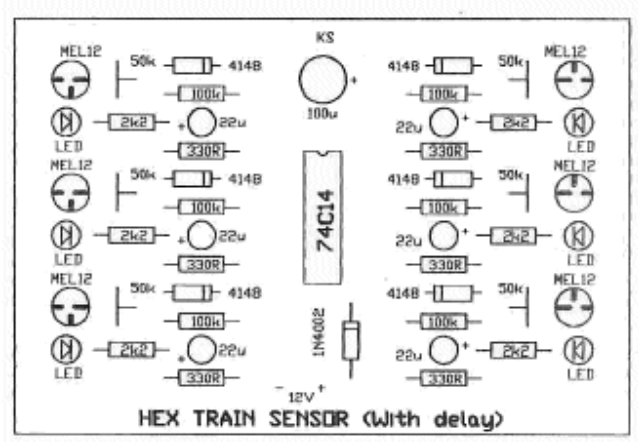
THE FOURTH TYPE - Reflective Detection

This module has two Infrared sensors that are placed between the sleepers and are fitted into two 3mm diameter holes in the base of your layout, so almost nothing is visible.

It is called **TRAIN DETECTOR TD-01 under track detection**

It is fully assembled and comes with two IR detectors on 1metre and/or 2 metre leads for $23.00 plus $6.50 postage.

There are 3 different detectors that can be fitted to this module:

- 2 separate LEDs to be fitted through 3mm holes
- IR module to be placed on the track between the rails
- IR module to be placed on one side of the track

All types cost the same (($23.00) but you need to specify which type you want.

Here is the circuit:
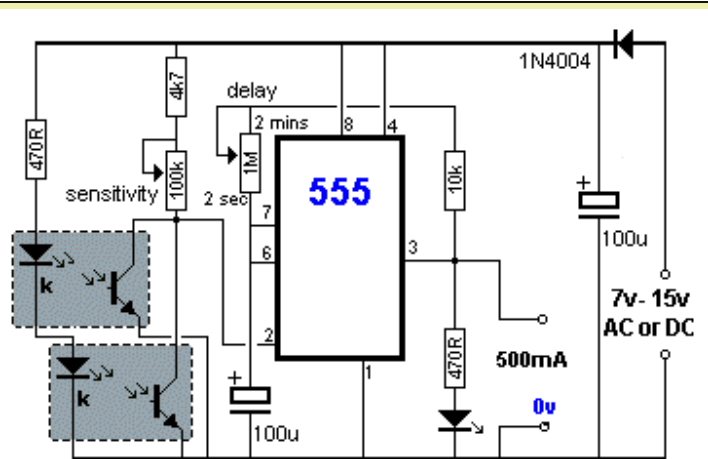
TRAIN DETECTOR - under Track

You will notice the transmitting LEDs are in series so you need to connect BOTH sets of sensors for the circuit to work.
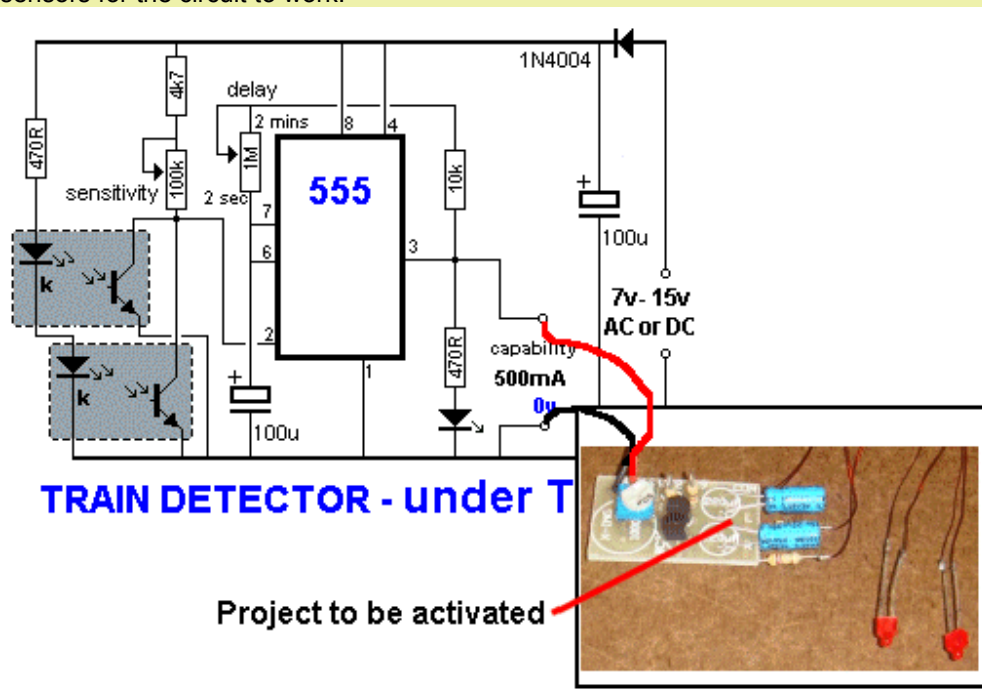
TRAIN DETECTOR - under T

Project to be activated
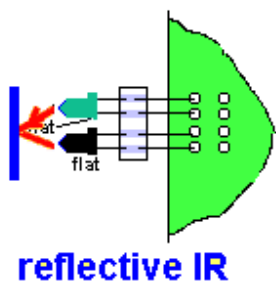
reflective IR
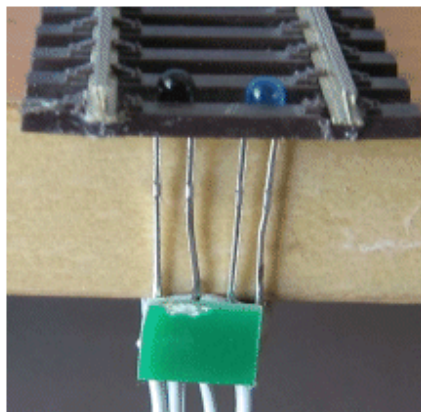
The circuit uses **REFLECTIVE IR** detection and this means the receiver does not detect infrared when "sitting around" (it escapes into the air). When the train passes over the LEDs shown above, the receiving LED detects the reflected infrared beam and the circuit turns ON for a period of time as determined by the 1Meg mini trim pot.

The output goes HIGH and is capable of delivering about 300mA to 500mA. The output voltage will be about 2v-3v lower than the supply voltage due to the voltage drop of the 555 IC.

This module also supports a reflective module containing two LEDs that can be placed between the rails:
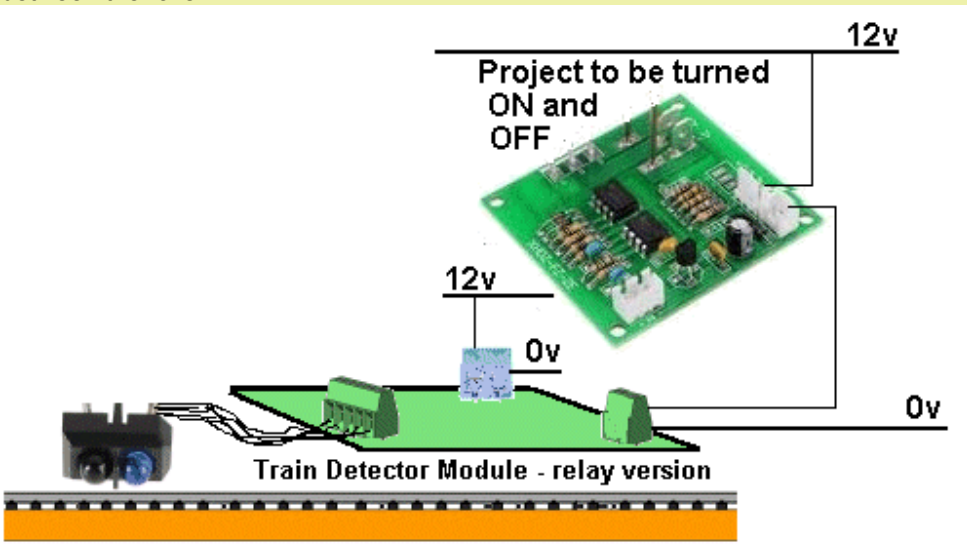
And the module supports a reflective module containing two LEDs that can be placed beside the track:
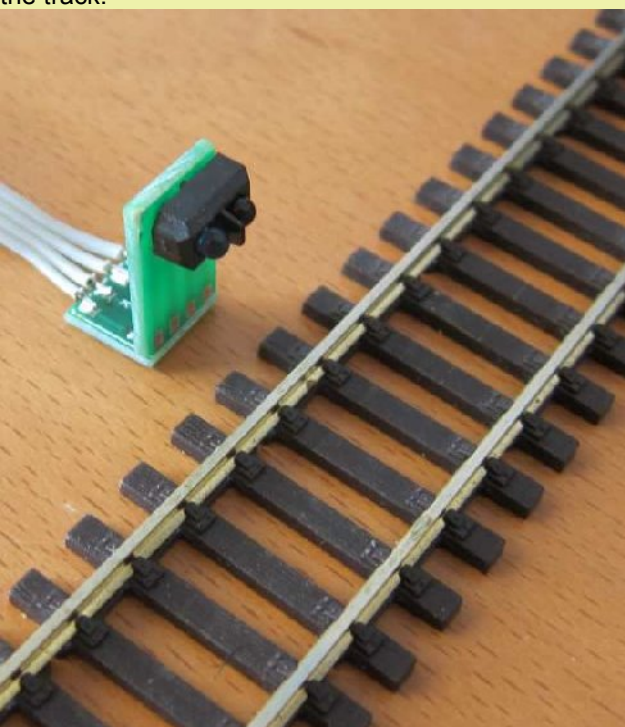
ooooooooooooooooooooo00000000000000000000000oooooooooooooooo

THE FIFTH TYPE - Broken Beam version
This module uses the same type of circuit as above but with different detectors.
It is called **TRAIN DETECTOR TD-01 across track detection**
It is fully assembled and comes with two IR detectors on 1metre and 2 metre leads for $23.00 plus $6.50 postage.
Here is the circuit:

TRAIN DETECTOR - TD-01 with Delay

TRAIN DETECTOR - TD-01 with

Project to be activated

Tx
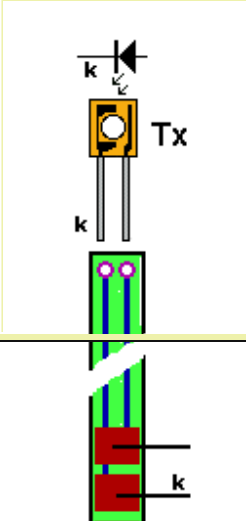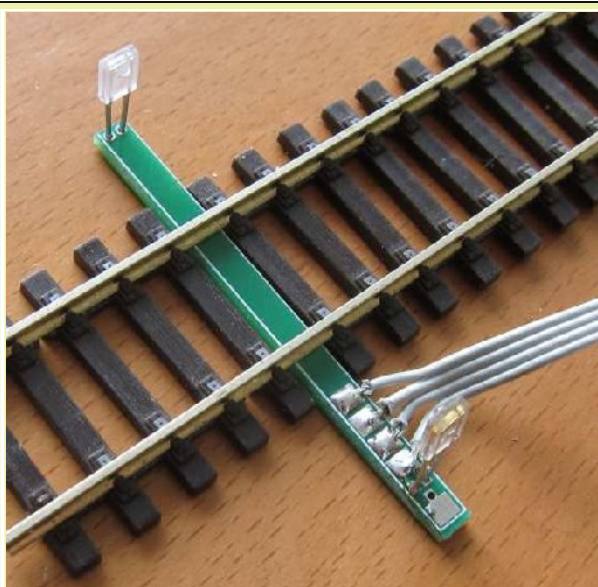
The detection is called **BROKEN BEAM** and the train interrupts the IR beam. The delay can be adjusted from 2 secs to 2 minutes via the 1Meg mini trim pot.

THE SIXTH TYPE - Isolated Output - Reflective Type
The **output** of the following two modules is completely **isolated** from the electronics on the board.
This allows you to operate a project that has its own power supply and may be connected to a different transformer.
When you have this type of arrangement, there can be leakage in each power supply that puts a high voltage between the output leads and what is called "earth." The leakage current will be very small but the voltage can be sufficient to damage transistors and IC's.
This happened 4 times with a customer until I asked for the module to be put on batteries and then use different power supplies. One of the supplies was "leaking."
An isolated output allows you to power a project that may need a very high supply voltage or it may have supply leads where one is 0v and the other is say 12v, but when you test the 0v lead with one probe of the multimeter and place the other probe on the 0v terminal of another power, you get a reading of say 17volts. This is the "leakage voltage" we are talking about.
The current will be nearly zero but a voltage higher than 15v will damage integrated circuits and microcontrollers.
That's why we have an isolated module.

The first isolated module uses a 4N25 opto-isolator and can pass 50mA via its output terminals. This is idea for small loads such as LED lighting on a station or CROSSING LIGHTS.
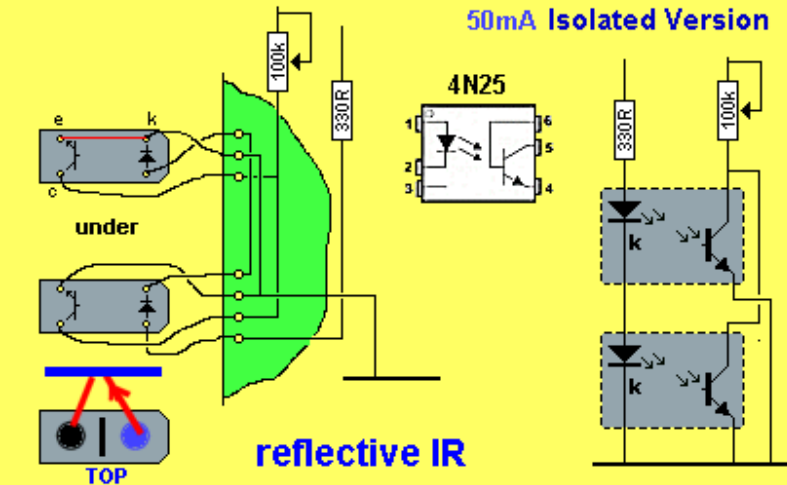It is called **TRAIN DETECTOR IR using 4N25**
It is fully assembled and comes with two IR detectors on 1metre and 2 metre leads for $24.00 plus $6.50 postage.
Here is the circuit:

TRAIN DETECTOR - IR using NE 567 chip

NE 567

BC557

1N4004

4N25
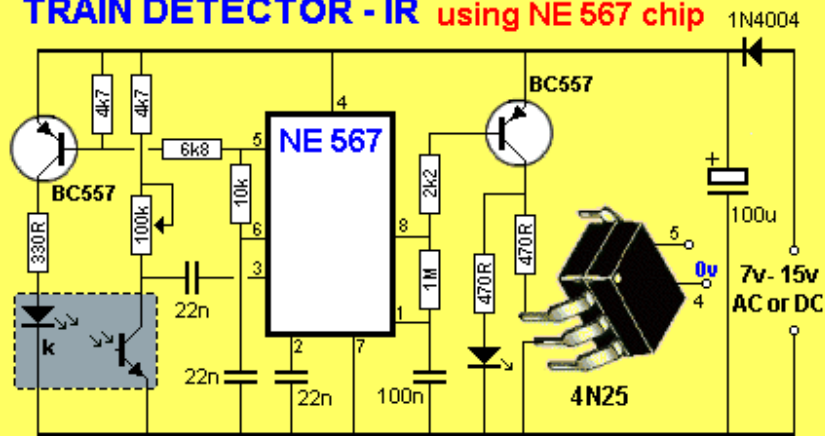
50mA Isolated Version

reflective IR

under

TOP

The second isolated module uses a relay and can pass 1Amp via its output terminals. This is idea for larger loads such as sound modules, motors, and motorised point controllers.
It is called **TRAIN DETECTOR IR using RELAY**
It is fully assembled and comes with two IR detectors on 1metre and 2 metre leads for $25.00 plus $6.50 postage.
Here is the circuit:

TRAIN DETECTOR - IR using NE 567 chip
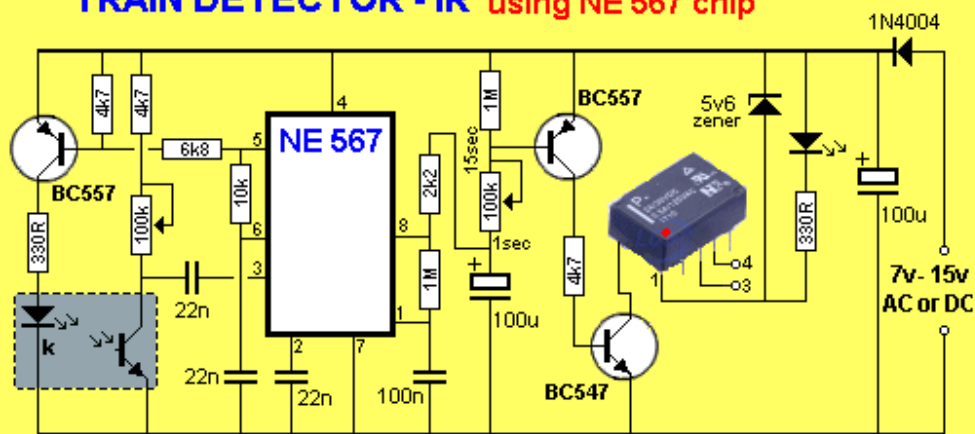
1 amp Isolated Version
relay holds for 1 to 15 seconds

reflective IR
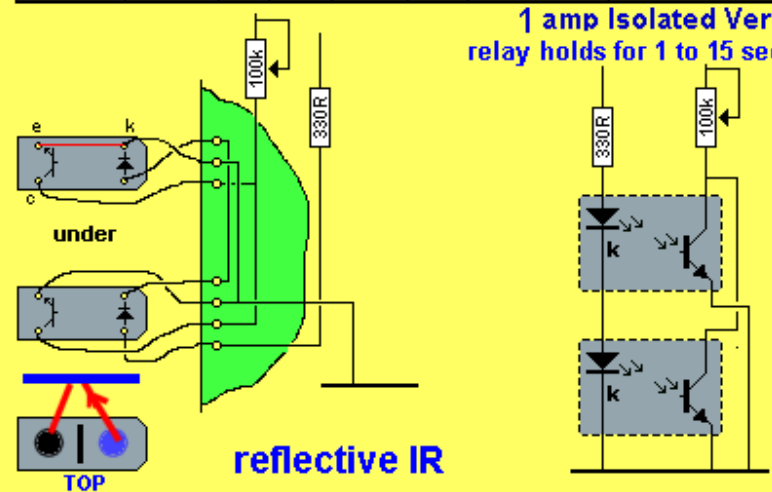
Both isolated modules connect to the IR module shown in the following image and they can be placed **BESIDE THE TRACK**, **BETWEEN THE RAILS** or **THROUGH 2 x 3mm HOLES** in the base of your layout. Both sets of sensors mush be connected as the IR LEDs are in series.
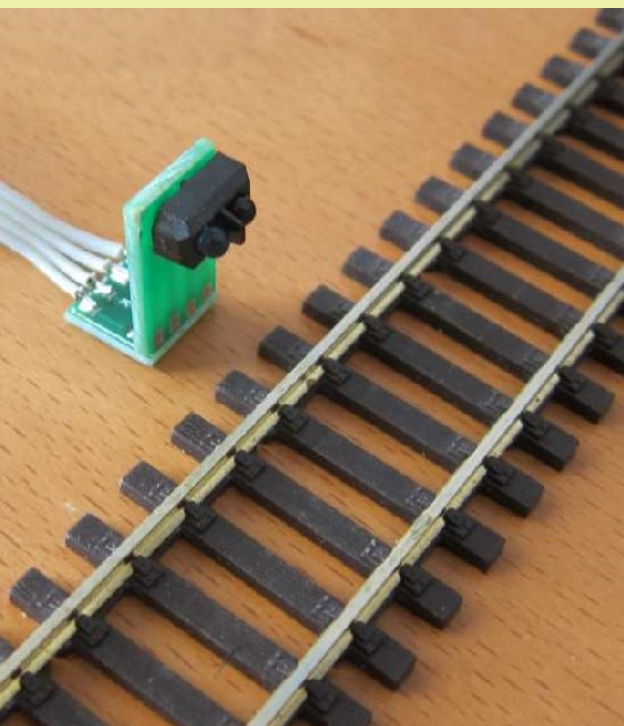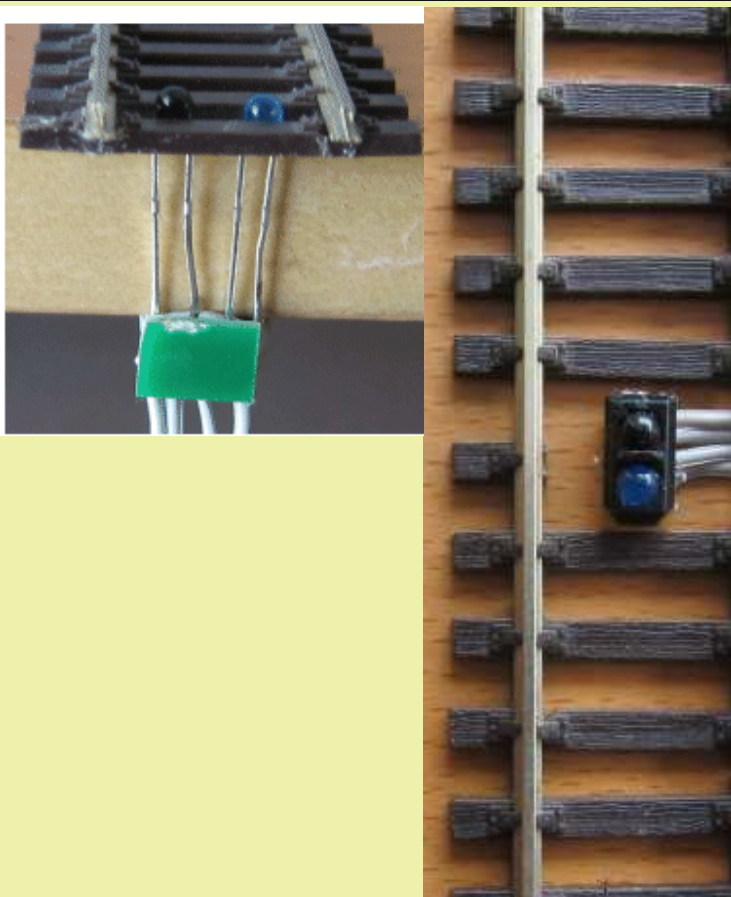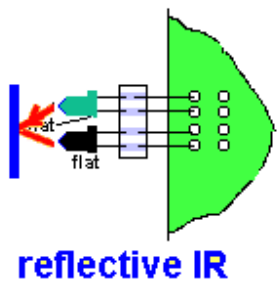
reflective IR

All modules use REFLECTIVE IR detection and will detect up to about 15cm.
BROKEN BEAM detection will detect up to 20cm and can be used for one set of tracks or across two tracks.
You need to ask for the extension lead for the BROKEN BEAM detector.

THE SEVENTH TYPE - 5amp capability on the output pins.
This module is deigned to handle HIGH CURRENTS. More about this when the PC boards are received from the manufacturers.

Here is the list of modules:

TRAIN DETECTOR with reed switch. Fully built and tested: **$8.00** plus $6.50 postage.

6 TRAIN DETECTORS (kit) . . $21.00 (no delay)
6 Photo-transistors in kit

HEX TRAIN DETECTOR (kit) . . $26.00 (with delay)
6 Photo-transistors in kit

All the following are fully built and tested:

TRAIN DETECTOR TD-01 . . $23.00 (with delay)
- with 2 sensors - between the rails
- with 2 sensors - beside the track
- with 2 sensors through 2x3mm holes

TRAIN DETECTOR IR using 4n25 . . $24.00 (isolated type) (no delay)
- with 2 sensors - between the rails

LIGHTHOUSE LIGHT

Add this module to your layout for a very effective Lighthouse Beacon. Double-faced super-bright 1206 LEDs can be mounted in all types of models to give the effect of a rotating light. The effect is very effective. Microcontroller circuit with 5v regulator. Input voltage can be 8v to 15v DC or 9v battery. You can get single flash or double-flash and you have to request the double-flash version.

LIGHTHOUSE BEACON

$15.00
plus $4.50 shipping

white LED

LIGHTHOUSE BEACON

LED gradually increases in brightness
then flashes very brightly to simulate
the rotation of a Lighthouse and then
gradually dies.   Very effective.
Microcontroller circuit.

6v to 15v DC supply or 9v battery

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
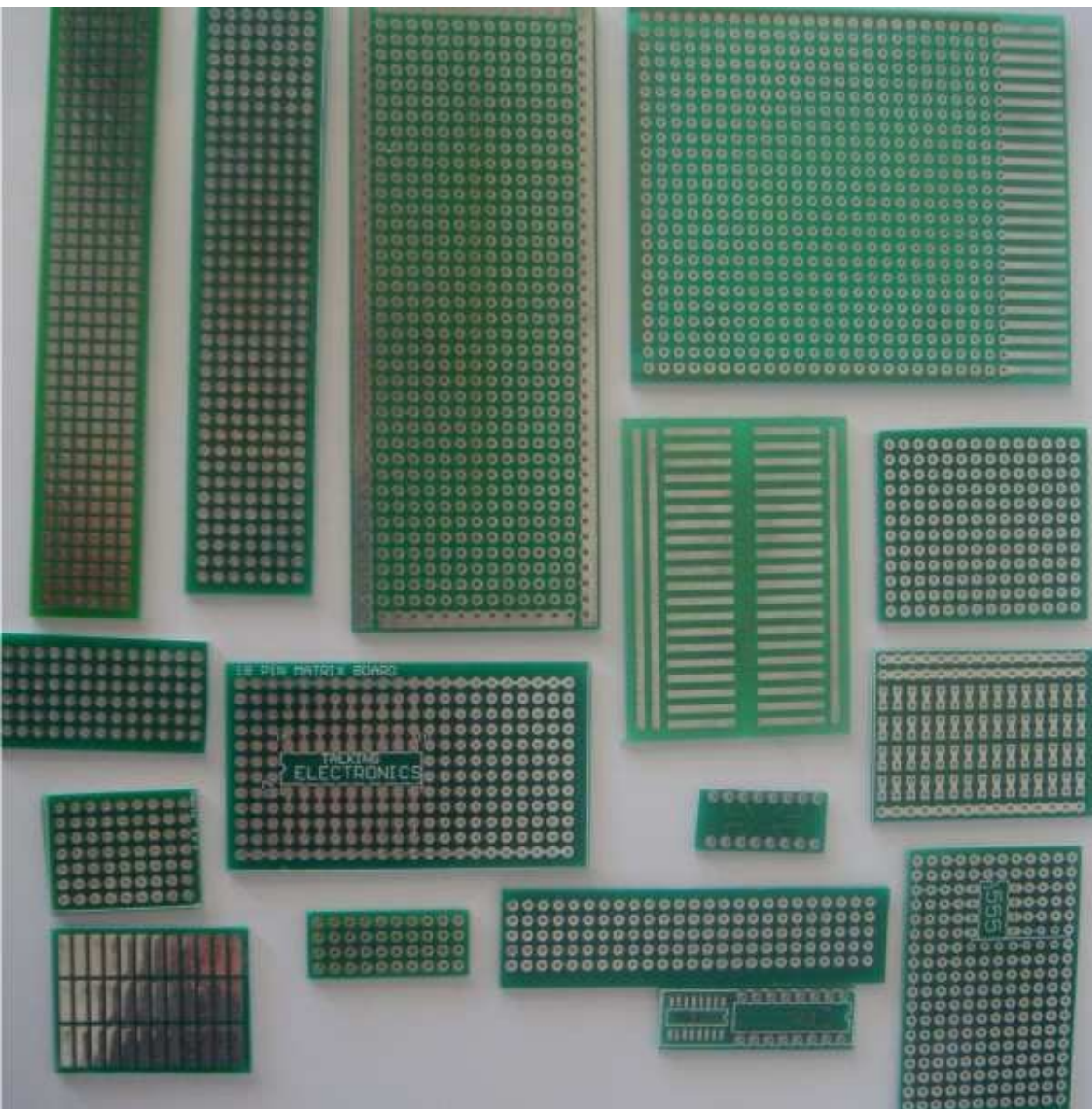
SMALL BOARDS $2.00 each
MEDIUM BOARDS $2.50 each
LARGE BOARDS $3.00 each
Click Here to order

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.
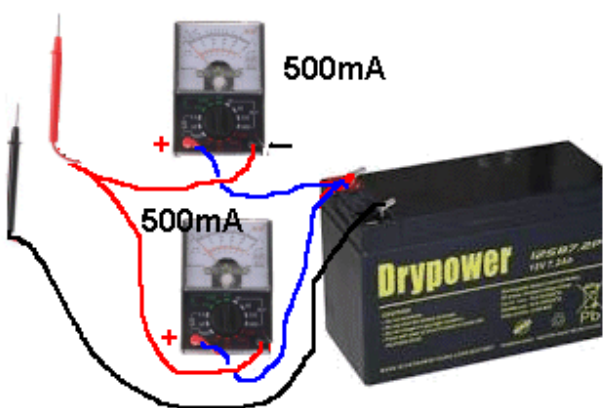Finally, an analogue meter lasts a lifetime. And if you damage it, the cost is only $5.00
And you get 500mA range, a digital meter gives 200mA.
Analogue Meters are on eBay

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.

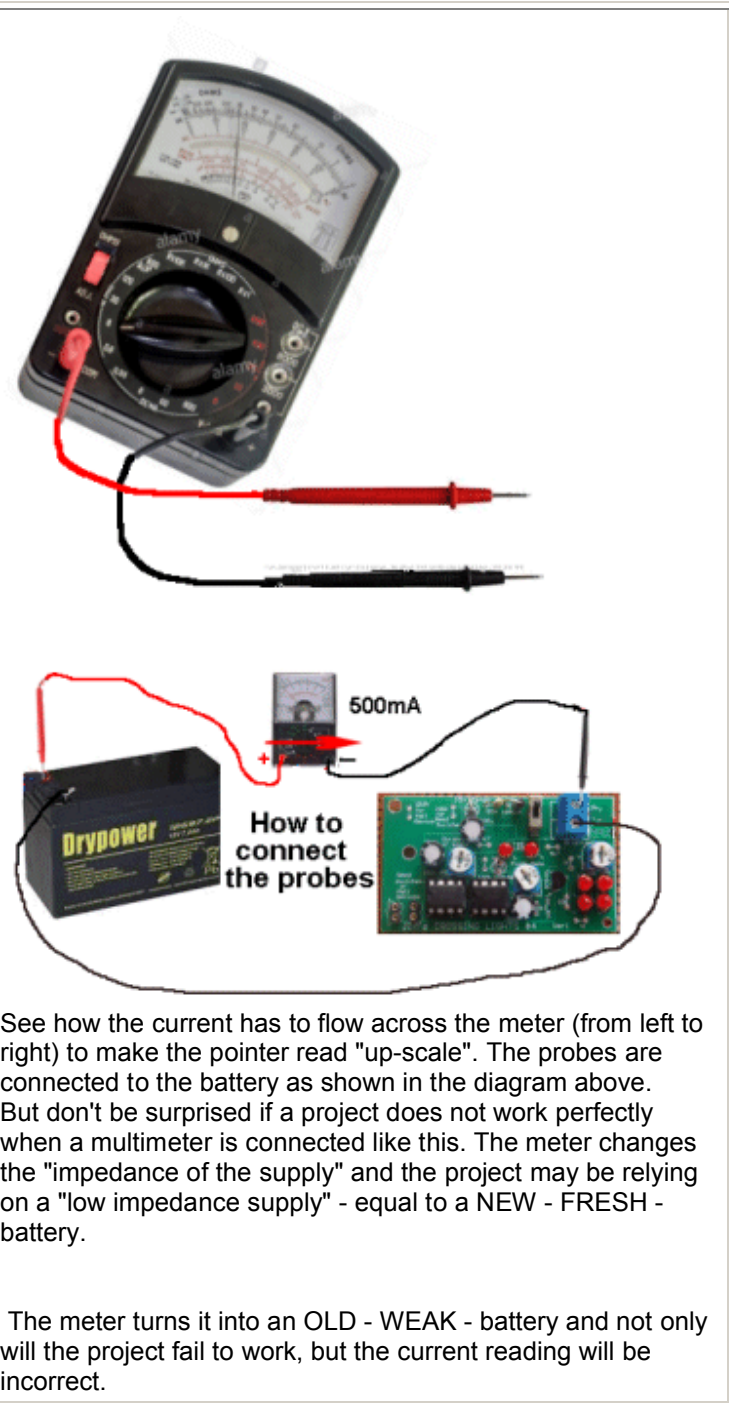When measuring CURRENT, you use exactly the same reasoning as when you are measuring voltage.

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 pointer read "up-scale". The probes are connected to the battery as shown in the diagram above. But don't be surprised if a project does not work perfectly when a multimeter is connected like this. The meter changes the "impedance of the supply" and the project may be relying on a "low impedance supply" - equal to a NEW - FRESH - battery.

The meter turns it into an OLD - WEAK - battery and not only will the project fail to work, but the current reading will be incorrect.

THEORY
SERVOS

$3.50

17.5mm

22mm

Micro servo
3.7G

20mm

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" (the PCB inside the case) 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)

SERVO WITH "NO END STOPS"
There is another SERVO on eBay called TENSTAR ROBOT 9g and it has no "end-stops." This is a vast improvement as the servo will not get "jammed" at the end of its travel.
The servo has a "pot" as the feedback but it does not have any "stops" and thus the wiper passes the end of the curved track.
I tested this servo by trying to find the "dead spot" where the servo did not respond to a position that would normally be past either of the "end-stops." The program in the servo detects when the wiper is not on the track and sends the arm to a starting position - proving this servo is the best one to buy.
"No stops" means the servo will not get jammed if it is forced (by an outside force). Sometimes, when these servos are used in a Robot-Fighting situation, they get forced to move (when in a collision) and this jams the gears. This servo does not have that fault.
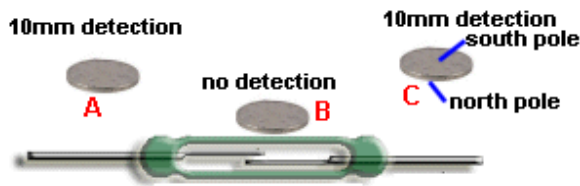This servo also operates slowly (when connected to some of our

modules) and does not "jitter" when used in our projects.

THEORY
REED SWITCH DETECTION

10mm detection
A

no detection
B

10mm detection
south pole
C
north pole

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. It does not matter if the north or south pole is near the reed switch - you need the magnet to sweep across the reed switch from one end to the other to make sure the reed switch activates.

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.
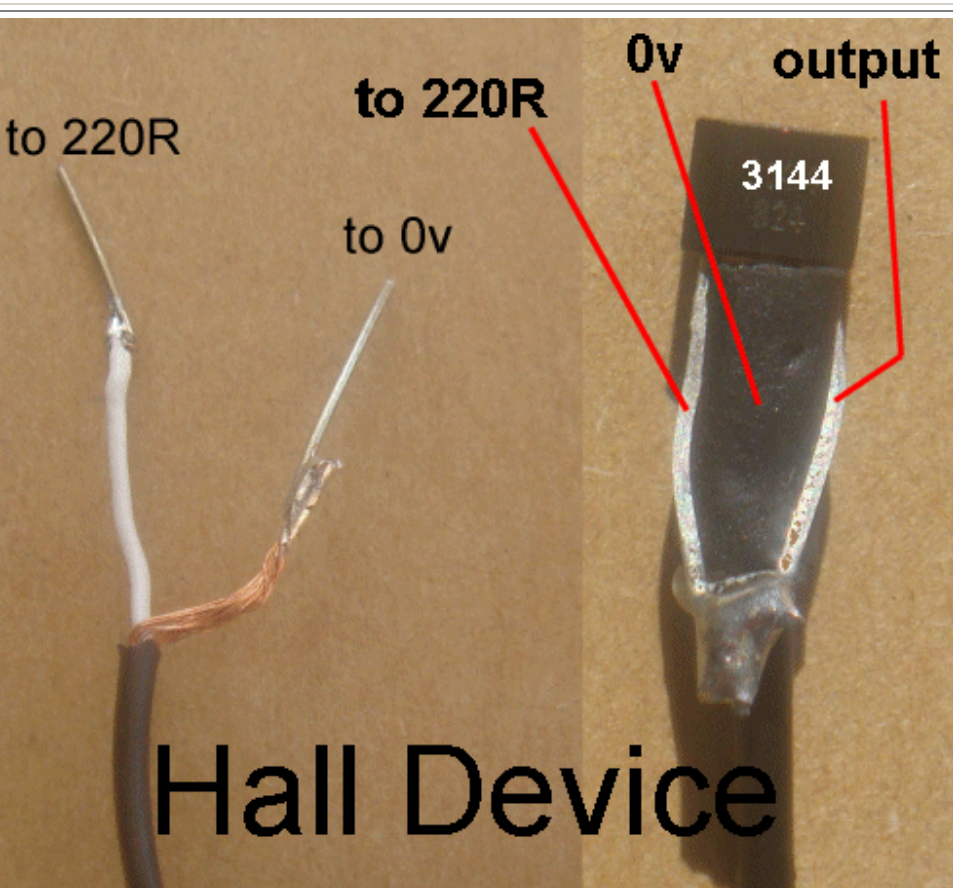
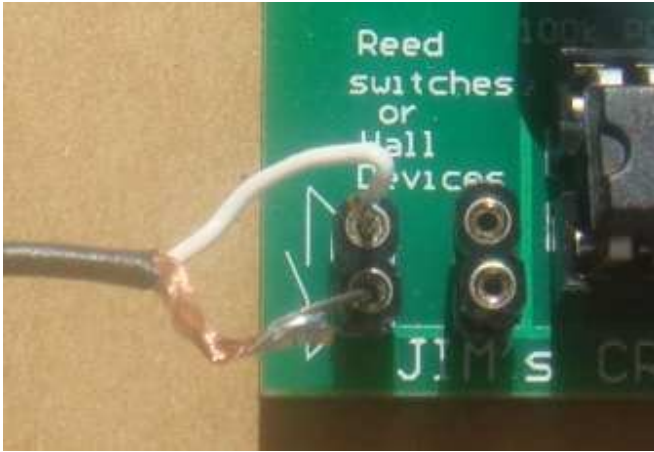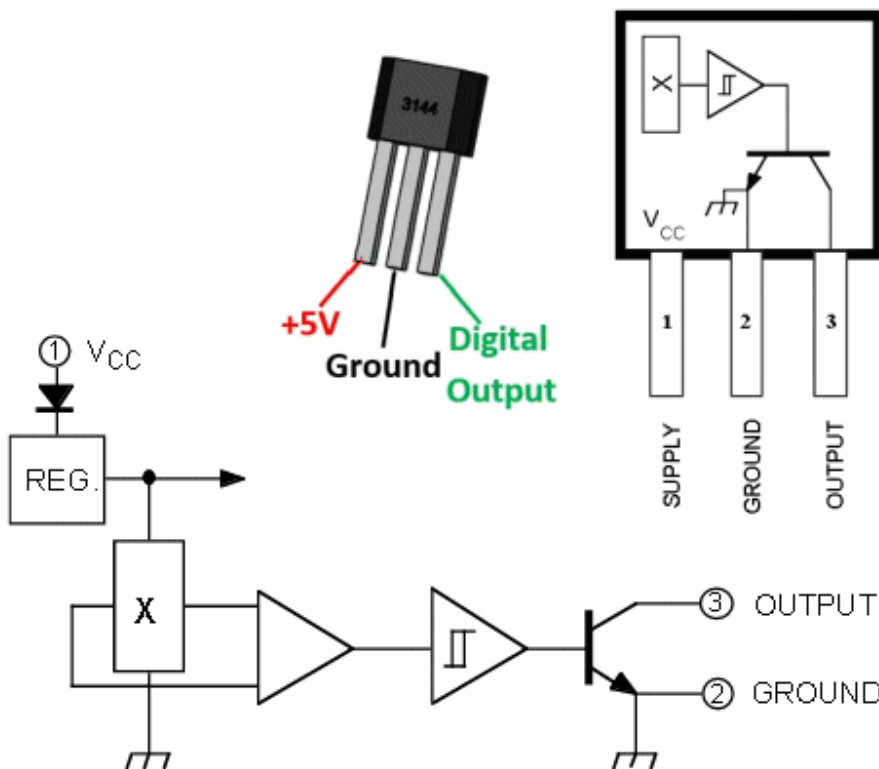**Connecting the screened lead to the Hall device**
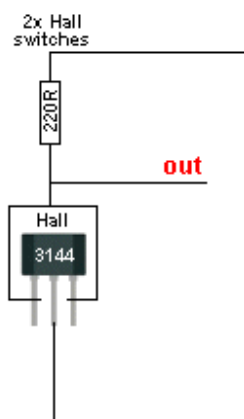
This is the circuit for the Hall Device

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 lead."
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 may be the low impedance of the input line (on the Flashing Lights Module) - due to the 220R load resistor.

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. Note: The two lithium cells are 6v for the supply.
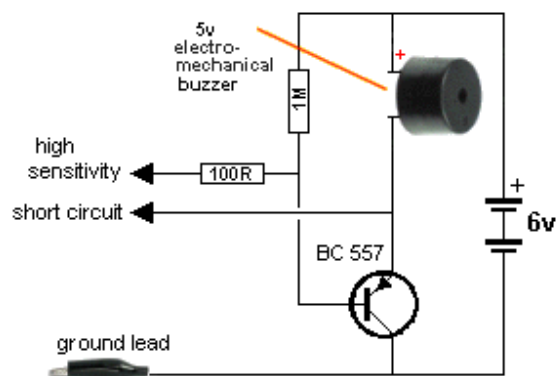See the full project HERE
LED Tester Kit
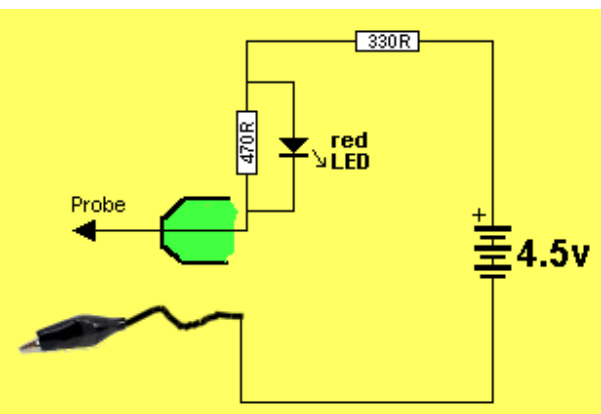
The LED Tester Circuit

TEST EQUIPMENT

CONTINUITY TESTER

This project tests for continuity and resistance and other things as well.
It's a very handy piece of test gear. Note: The two lithium cells are 6v for the supply.
See the full project HERE

The Continuity Tester Circuit

The Continuity Tester comes as a kit for $3.50 plus $4.00 postage.

The circuit has no switch and it has two levels of sensitivity.

One probe makes the buzzer squeal when the resistance is very low. Anything above 300 ohms does not produce a sound.

This is called the SHORT CIRCUIT detector. It detects continuity of tracks and wiring.

The other probe allows resistances up to 40k to be detected and as the resistance increases, the sound from the buzzer decreases.

This lets you detect a resistance between two points.

Continuity Tester Kit

Our 3 pieces of Test Equipment are:

LED Tester
Continuity Tester
Track Tester

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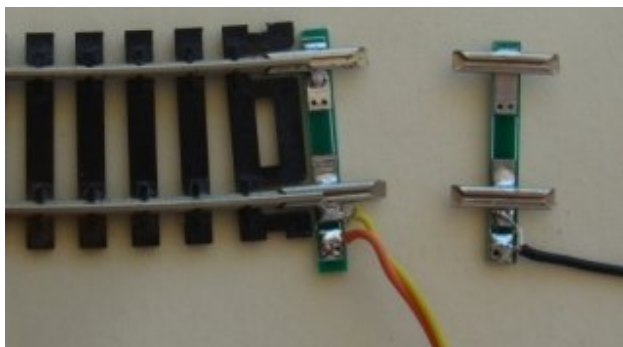
Twin lead or screened lead can be used for the Track Pick-off PC board

Here is the module connected to a project:
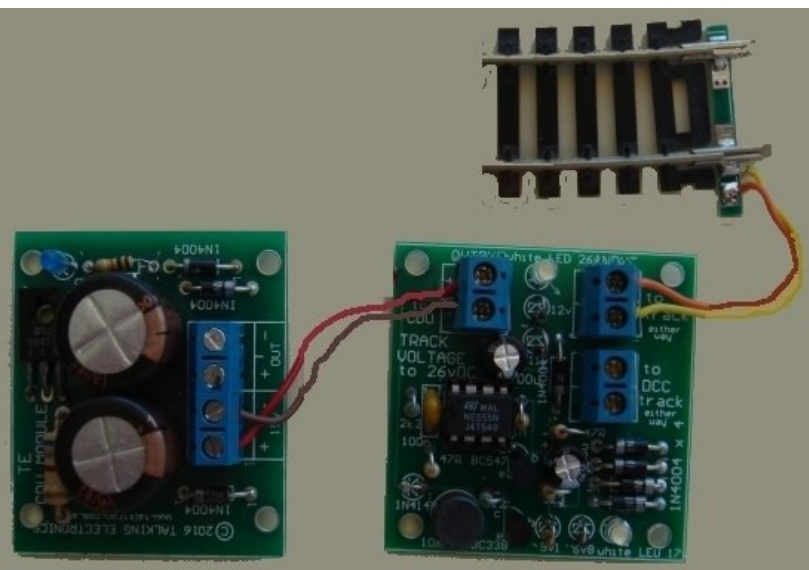
If it is not easy to connect the track joiners to your layout, we have:

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.
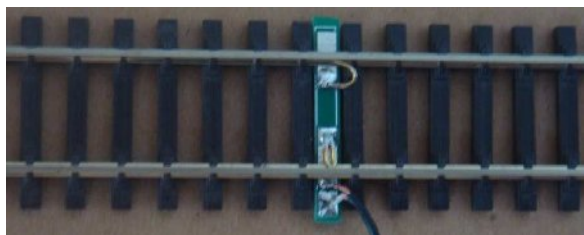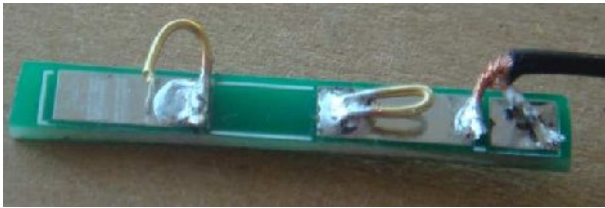
TEST EQUIPMENT

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   5v1
629   zener

AC DC DCCTRACK TESTE

16v-18+   red

14v-15.9   yellow   4x1N4148

12v-13.9   orange

10v-11.9   green

Positive   Positive
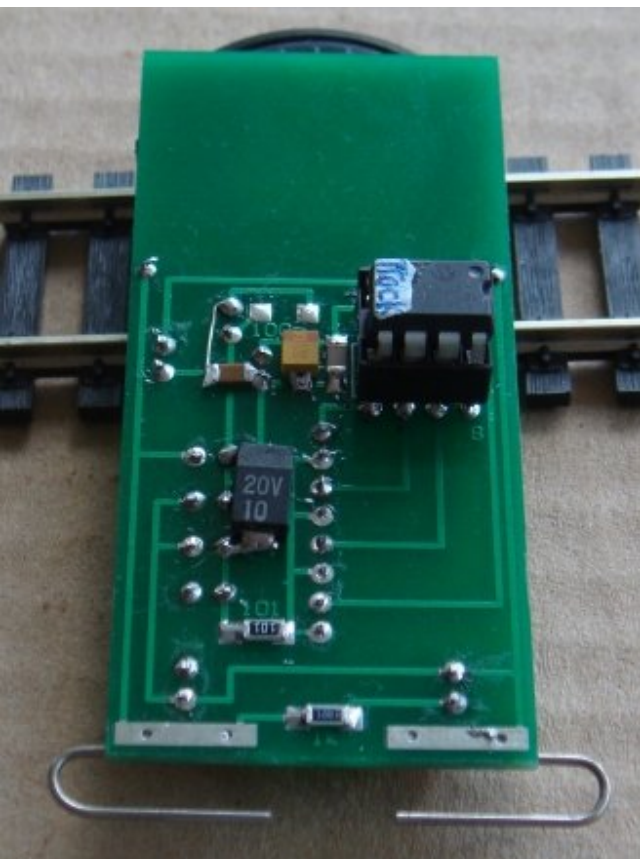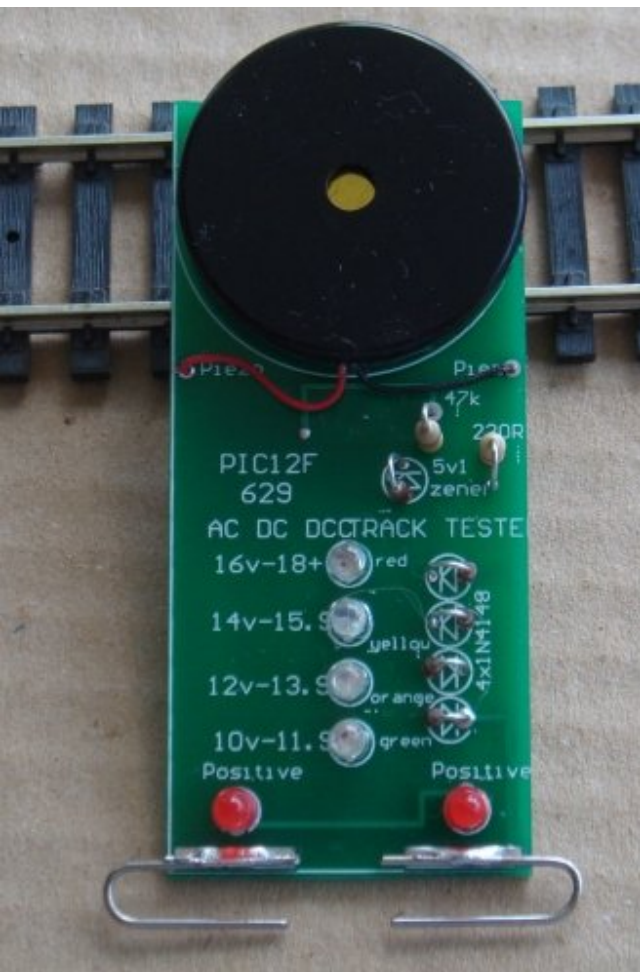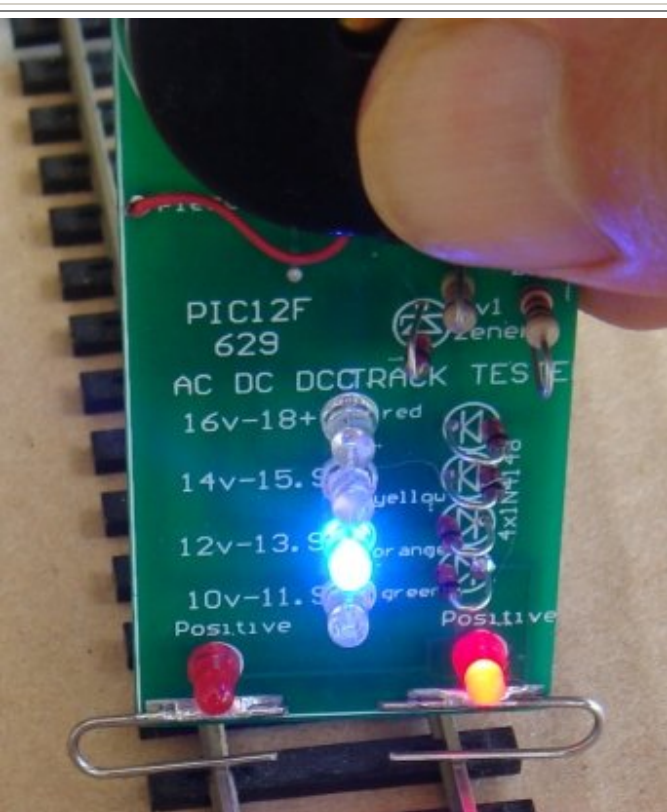
MINI TRACK TESTER

This is a smaller version of the other Track Tester is built and tested for immediate use. We have produced the **Mini Track Tester** so there is no excuse for you not having a Track Tester. It is invaluable for detecting and listening to faults.

It can be used on all gauges by touching the springy terminals onto the track and listening to noise on the track via the piezo and see the voltage of the track via the LEDs.

It will indicate the polarity of the track as well as the voltage, with 4 LEDs.

It is much faster and easier to use than a multimeter as you only need one hand and you can be adjusting the voltage with the other. You can find dirty rail-joiners by connecting the tester and wiggling the rails and listening to the piezo.

The piezo will buzz when DCC is present and the LEDs will indicate the positive rail and the presence of a voltage from 3v to more than 16v.

The **MINI TRACK TESTER** costs $5.50 USD plus $4.50 USD posted to any country in the world.

Click Here to buy **Mini Track Tester**.

TEST EQUIPMENT
OVER-CURRENT DETECTION
Requested by William Hicks:
This circuit detects when the tracks are overloaded by too many trains.

1 x 1R = 650mA
2 x 1R = 1.3A
3 x 1R = 1.9A
4 x 1R = 2.6A
5 x 1R = 3.2A
6 x 1R = 4A

from throttle

0v - 15v

1 amp to 5A

Direction switch

1 x R22 in parallel with 1 x 1R = 4A (R22 = red-red-silver-gold)
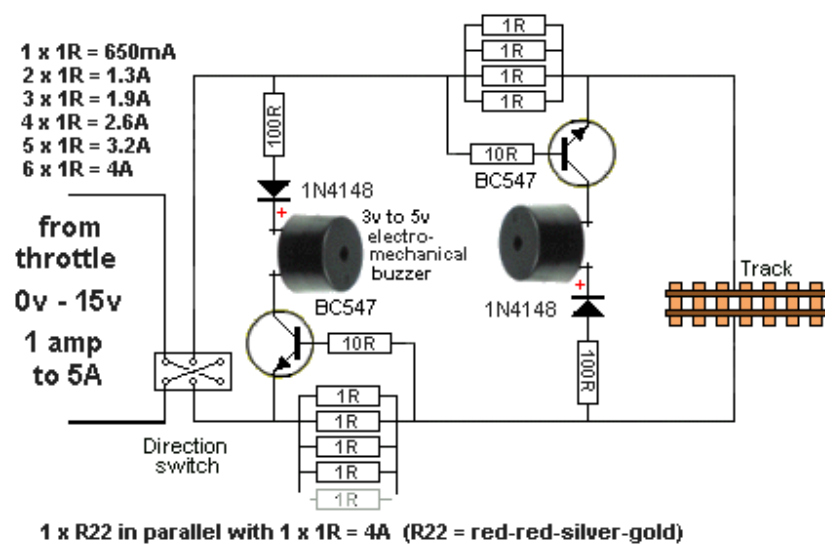
Note: Each 1R resistor needs to be 0.5watt   0R22 needs to be 5watt!!
The circuit will drop 1.4v when full detection-current is flowing.

Here is the simplest over-current circuit:
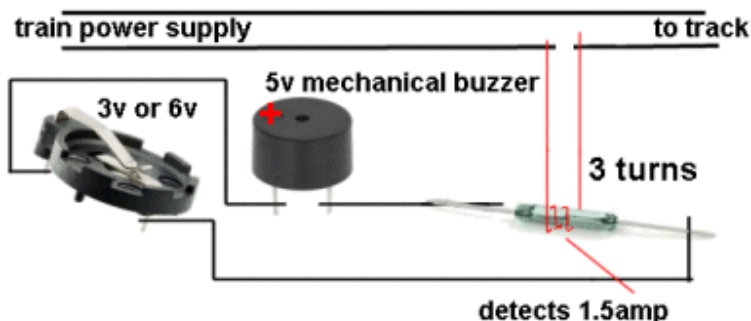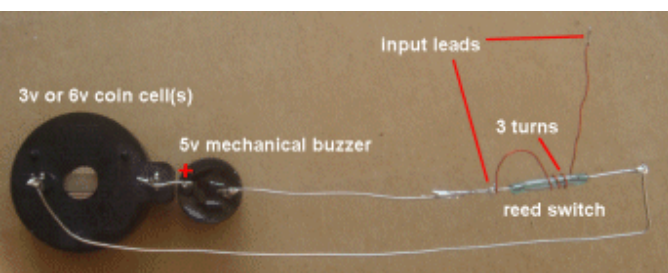
The reed switch closes when about 1.5 amps flows for 3 turns wrapped around the centre of the reed switch. 2 turns will detect about 2 amps. Keep the reed switch at least 6cm from the mechanical buzzer as the magnet inside the buzzer will turn the circuit ON all-the-time.
The sensitivity of reed switches 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.
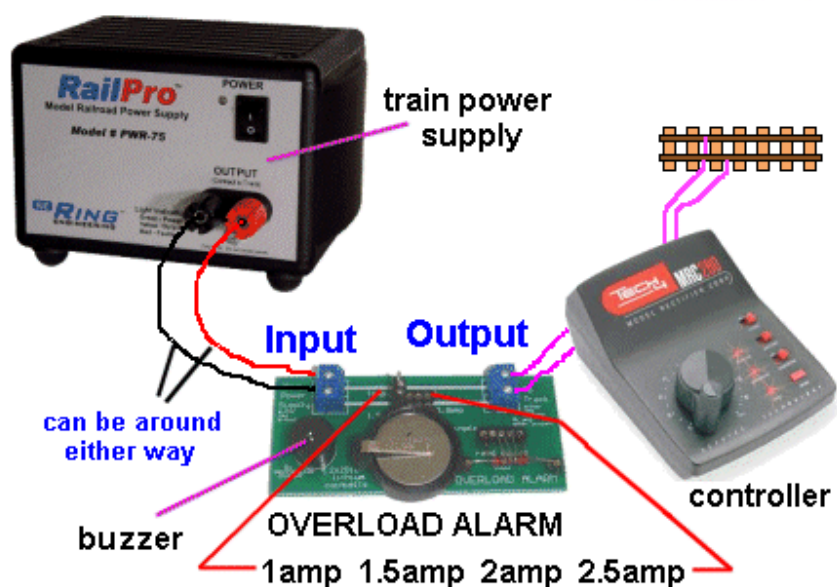
The Overload Alarm Module is fitted between the Train Power Supply and the Controller

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.

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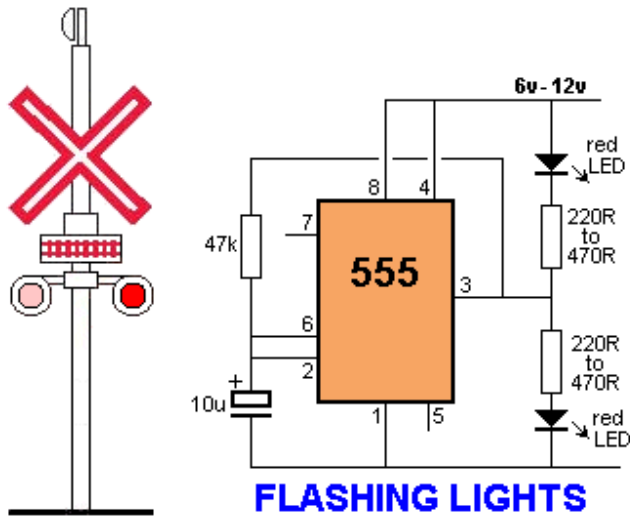
FLASHING LIGHTS

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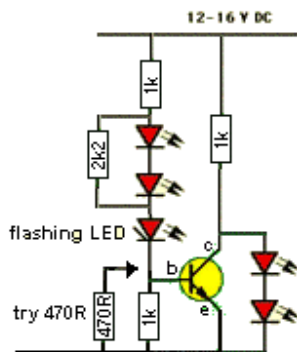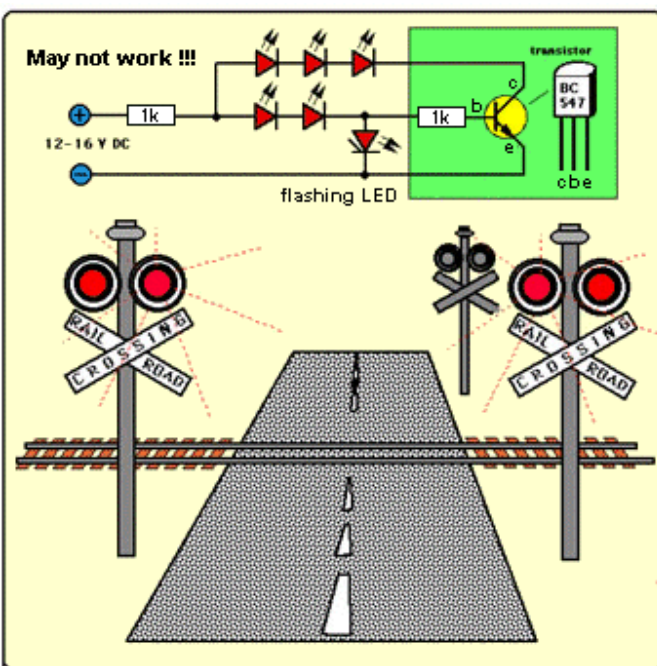
This circuit has been designed by
Colin Mithcell AND IT WORKS !!!

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.

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.

TRAFFIC LIGHTS
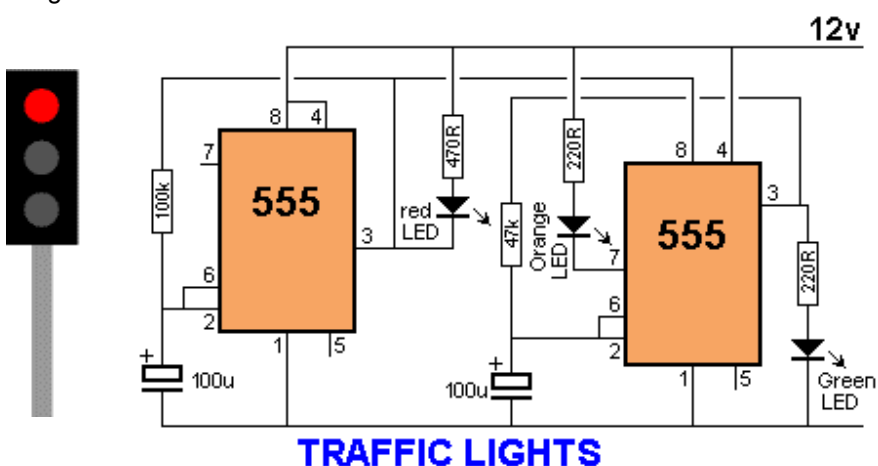
Here is a further description of how the circuit works:
Both 555's are wired as oscillators in astable mode and will oscillate ALL THE TIME when they are turned ON. But the second 555 is not turned on all the time! The first 555 turns on and the 100u is not charged. This makes output pin 3 HIGH and the 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.

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. This circuit is used in the next article.

12v

4017

555

Clock

Clock Inhibit
Reset
Ground

1N4148

yellow N/S

green N/S

green E/W

yellow E/W

red N/S

red E/W

100R

100R

47k

10u

4 WAY TRAFFIC LIGHTS

(2)

Output:

1	2	3	4	5	6	7	8	9	10

NORTH AND SOUTH

EAST AND WEST

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.

$5.00

$5.00

$5.00

$5.00

$25.00 - fully assembled
$20.00 as a kit of parts

$4.00

$4.00

$4.00

$4.00

$20.00 as a kit of parts
$25.00 - fully assembled
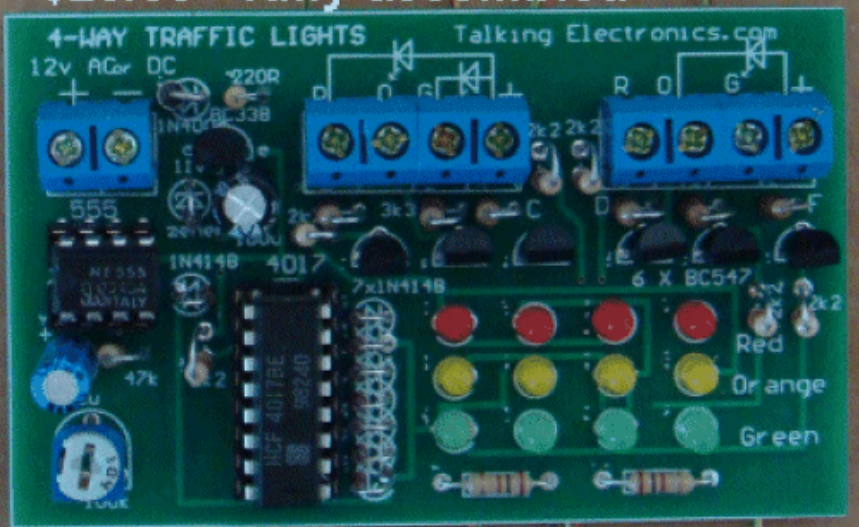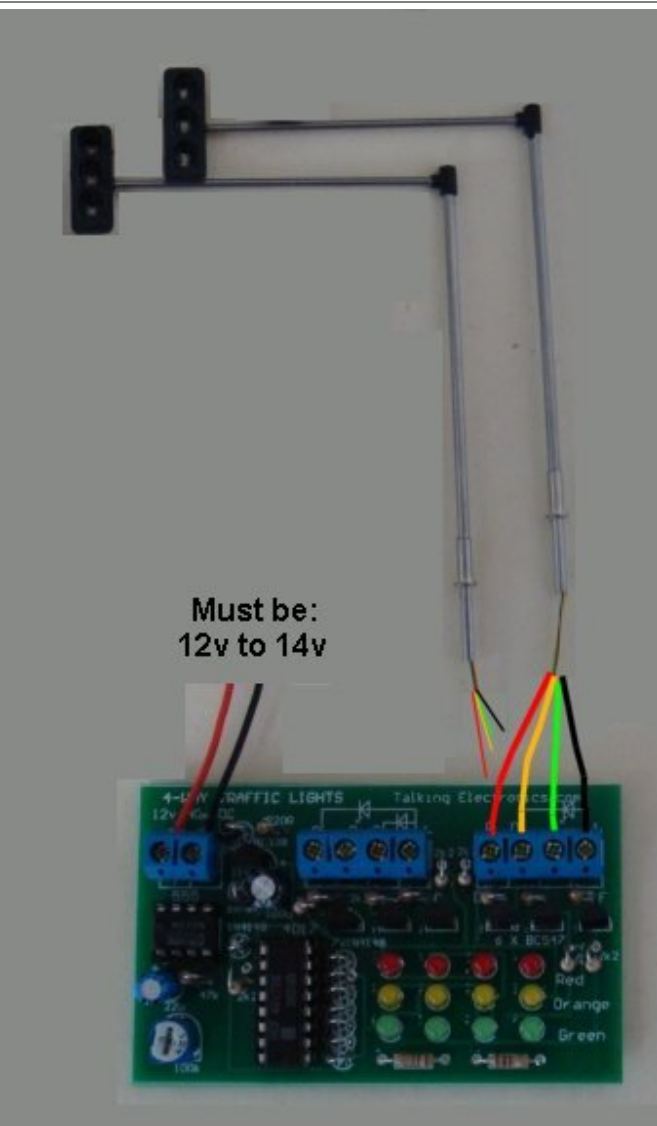
This image shows how to connect the very fine wires from the end of the post to the screw terminals. The kit contains fine screened lead and two of these leads are used for each overhead signal to the terminals. Two overhead signals are joined in parallel to the first set of four screw terminals and two overhead signals are connected to the second set of four screw terminals.

k = SHORT LEAD

flat side of LED

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.
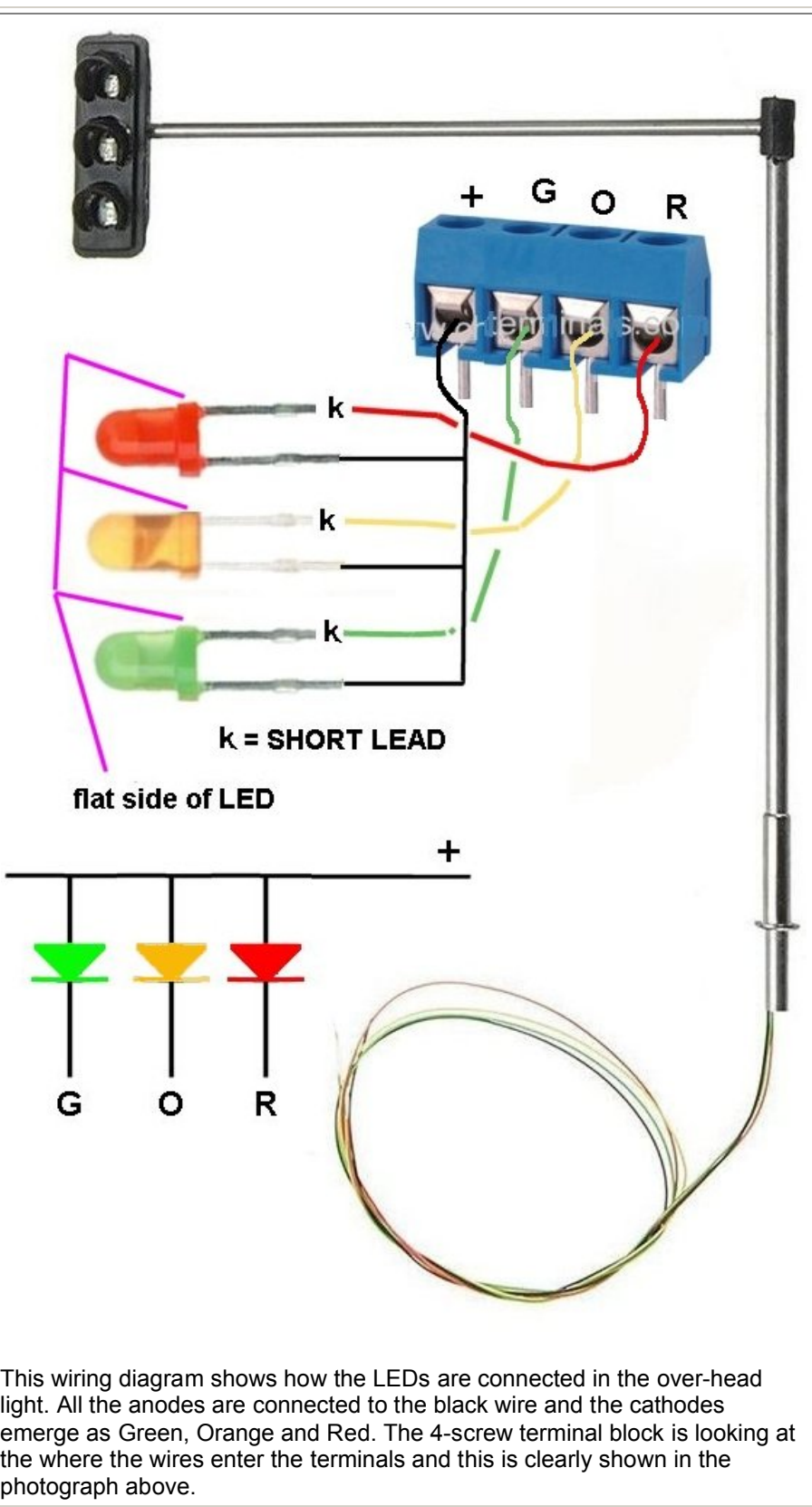
Crossing Lights and Sound - UK

This circuit produces **Crossing Lights and Sound** (a wailing sound) for the 3-light crossings in the UK and has an amber light in the middle to indicate the Lights are about to activate. It comes with piezo sounder, two reed switches on 90cm leads and two super-magnets.

The module also comes with components to make your own crossing lights ($2.50 usd extra) and you will need a hobby saw, sand paper, glue, paint and soldering iron to complete the signal.
More details HERE
Cost:$25.00usd plus $6.50usd shipping.
Modules are available

Jim's Crossing Lights MkIV

This module operates Crossing Lights and includes "ding-ding-ding" from a mini speaker. It comes with 2 reed switches that activate the module via a very thin super magnet (provided) on the train.
More details **HERE**
Cost:$25.00usd plus $6.50usd shipping.
Modules are available
See below for more details.

The next module has Crossing Lights and Sound and also Boom Gates. It is activated by IR beam across the tracks.   Cost of the modules and Crossing Lights and Boom Gates and two servos that activate the Boom Gates: $90.00 plus $9.50 Postage
Modules are available for this project

to Index

Jim's Crossing Lights MkIV

Kits are available from
Talking Electronics for $18.00 plus $4.50 postage.
See the FULL PROJECT HERE with more details of the Hall Device
The kit is the latest module for type-A lights and type-B lights
Fully built and tested modules come with 2 reed switches (1200mm leads)
and 2 super magnets for $25.00 usd plus $6.50 usd postage

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.
The latest module is version #5 and has a change-over switch for Common Anode lights and Common Cathode lights. This is called Type-A and type-B lights

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/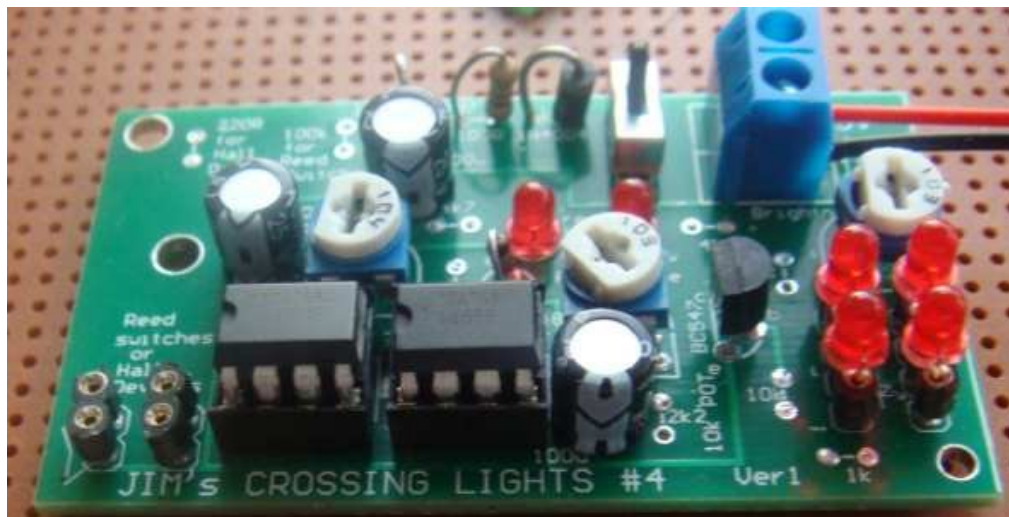47 = 20mA. This current will also flow through the 15v zener and is called the REGULATION CURRENT or wasted current and the wattage dissipated by these two components will not be noticed at the moment. But if the supply voltage is raised to 20v, the "wasted current" will be 100mA and the wattage dissipated 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.

black wire

red wire

red wire

1k
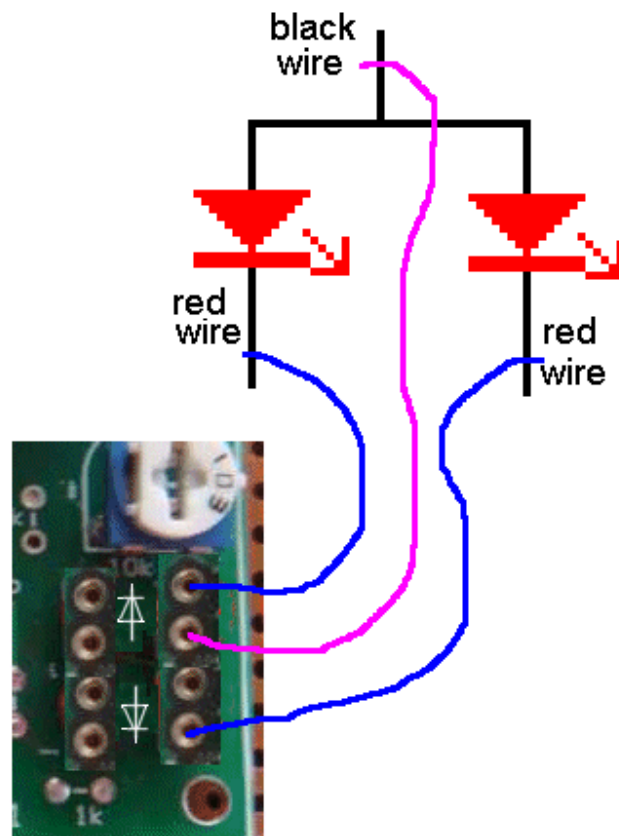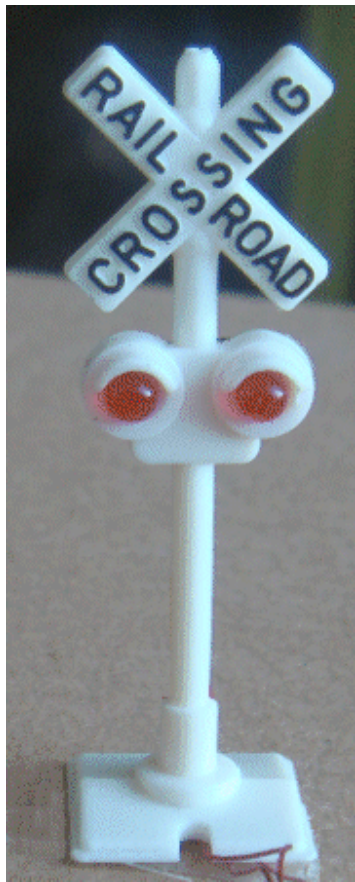
The Crossing Light above is available from Talking Electronics for $5.00
You will need 2 of these. (HO scale)
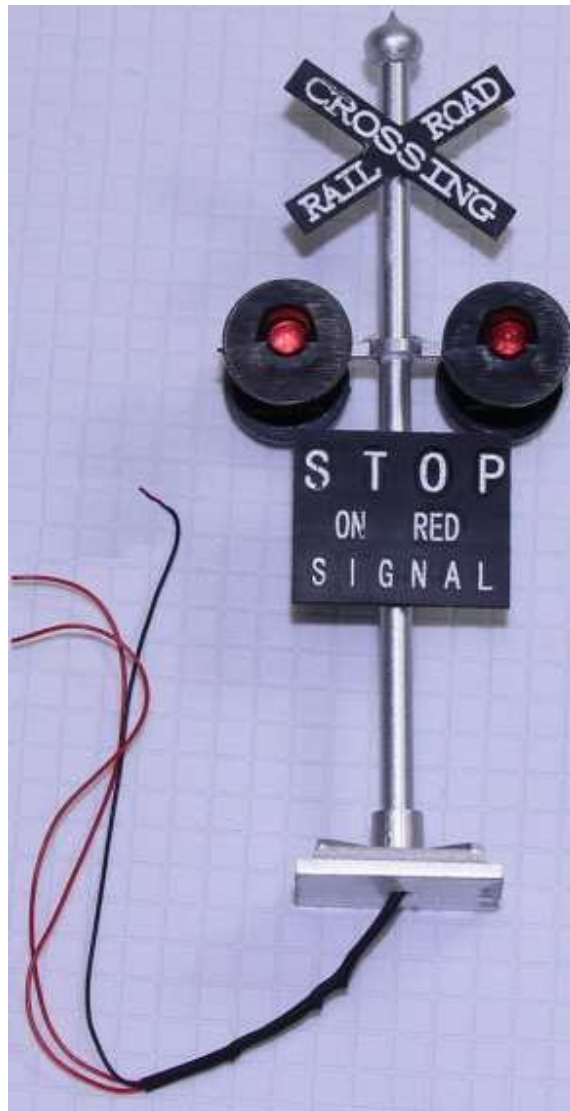
This crossing Light is on eBay

Jim's Crossing Lights
$18.00
plus $4.50 postage
Kits are available 1 - 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.
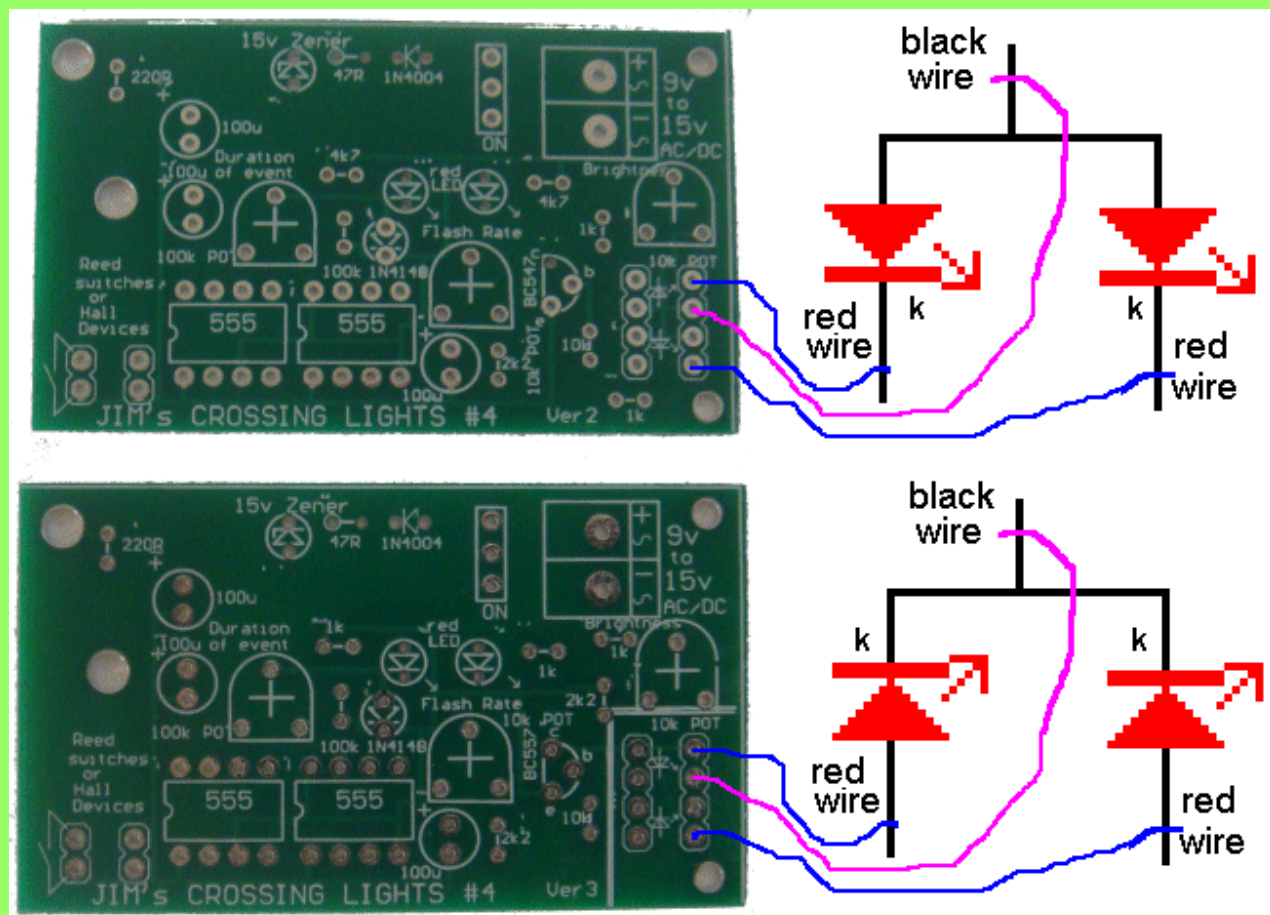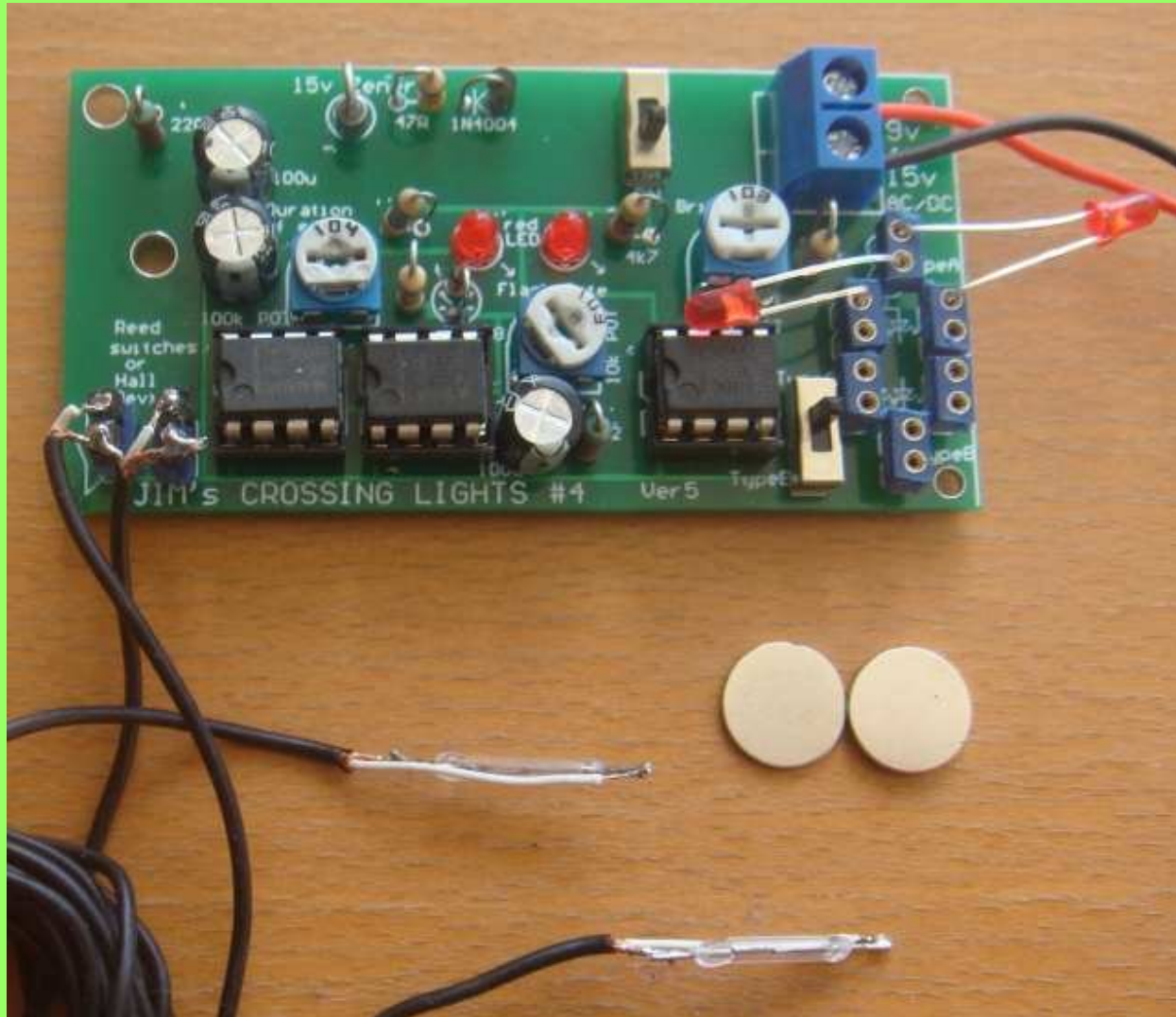

The wrong type of Crossing Light will NOT work with the wrong module.
You can test each Crossing Light with a 6v battery and 1k resistor or use the LED Tester project.
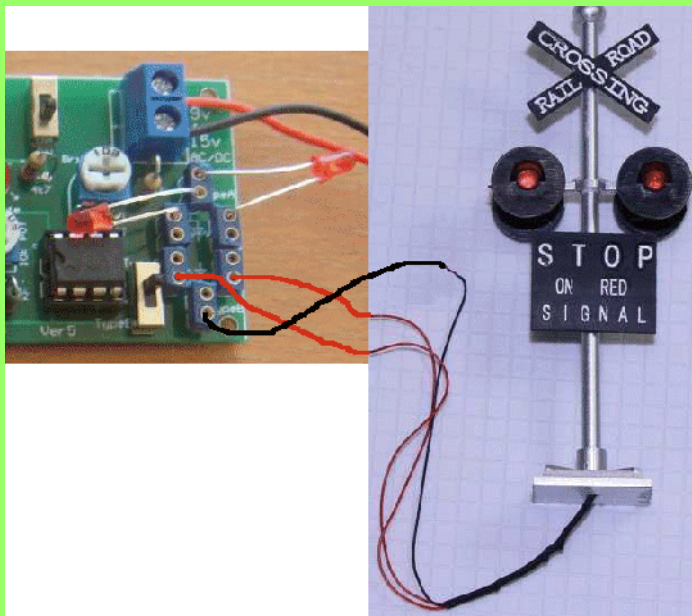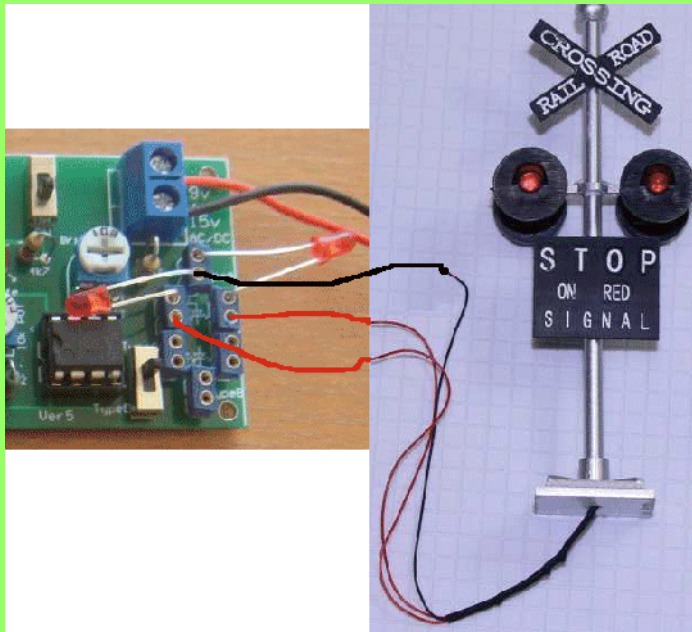With the ver2 PC board, the LEDs must illuminate when the positive of the 6v battery is connected to the black wire and the red wire is connected to the 0v of the battery. You will need a 1k resistor to prevent the LEDs

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.

LATEST VERSION . . . .

A new version of JIM'S CROSSING LIGHTS (called ver5) has been produced for customers who cannot work out which type of lights they have installed. It has a change-over switch and works with both types - very clever !!!

The image above shows the fully built and tested module. It comes with 2 reed switches on 1200mm leads and 2 super magnets for $25.00 usd plus $6.50 usd postage. Order a module: Jim's Crossing Lights for TypeA&B lights

Connecting the Lights:

Flick the switch and the Lights will work.

CROSSING LIGHTS and SOUND - UK

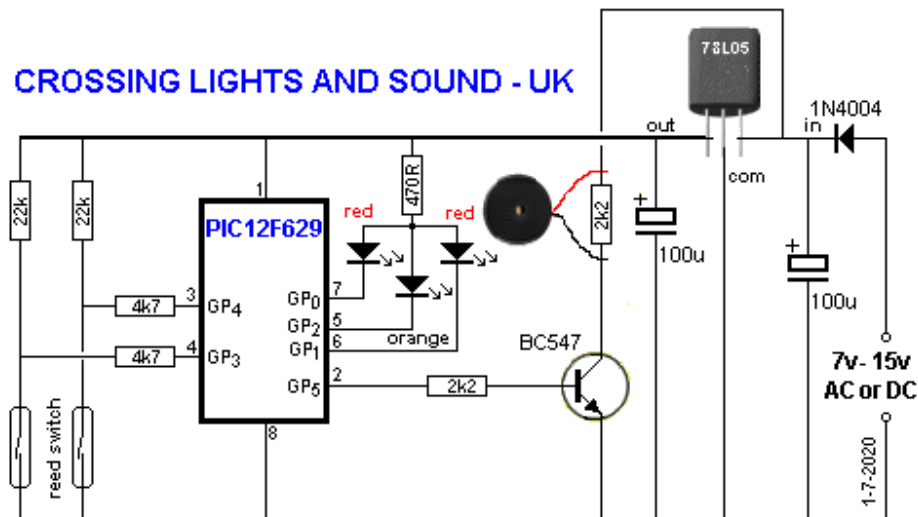This circuit produces crossing lights and sound for the 3-light crossings in the UK.
The orange light comes on to indicate the lights will be operating and then the red lights flash and a High-Low siren sound is produced.
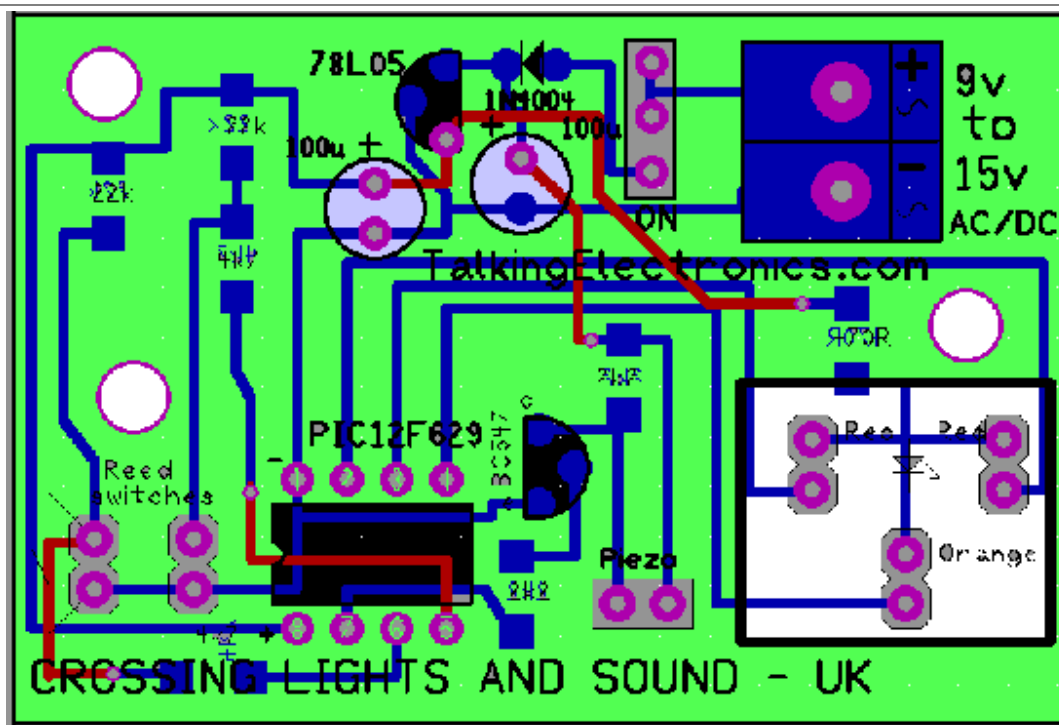The module comes built-and-tested for $25.00 usd and includes piezo sounder, two reed switches on 900mm leads and two super-magnets.
You can also get the components to make your own sign for $2.50 extra and includes the base-board and 3 LEDs and wire and 2mm copper/brass pole that you solder to the base-board. Very similar to the pic below but you get the 3-light version.
Order a module: Crossing Lights and Sound - UK

CROSSING LIGHTS AND SOUND - UK

PIC12F629

GP4 GP0
GP3 GP2
     GP1
     GP5

red   red

orange

BC547

470R

2k2

2k2

22k   22k

4k7

4k7

reed switch

78L05

out   in
       1N4004
com

100u

100u

7v - 15v
AC or DC

1-7-2020

STOP
when
lights show

Jim's LEDs

also called **LED DISTRIBUTION BOARD** **Jim's LEDs is available**
from
Talking Electronics for $18.00 plus $4.50 postage.

This is another module requested by Jim Hamilton who supplies Z scale signs, houses and lighting to hundreds of modellers. His website is: Scaleworkshop, South Australia, Mob 0412111152
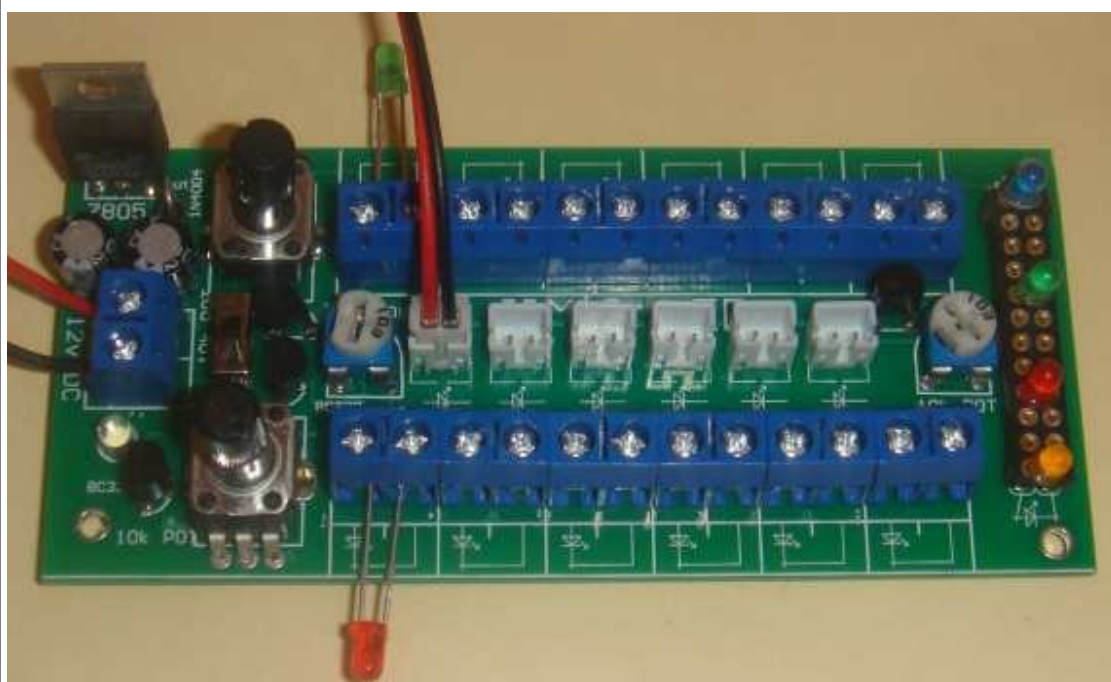
The module is a DISTRIBUTION BOARD capable of illuminating 30 LEDs across your layout. There are 4 separate brightness controls. Two controls have shafts that can be easily adjusted with your fingers and two controls are via mini trim pots.
The **Distribution Board** comes fully built and has sample LEDs to show the brightness of each LED.
6 flying leads can be fitted into the JST 2mm sockets and 12 sets of LEDs can be fitted into the screw terminals.
The end of the module has 12 sets of female machine pins and you can insert 0.5mm wire into them and illuminate a further 12 LEDS.
The input voltage can be 9v AC or DC up to more than 20v as the 7805 regulator delivers 5v to all the LEDs. As you add more LEDs, the regulator might get warm and you can add a heatsink if you cannot hold it in your fingers.
These modules are very popular as they solve the problem of illuminating stations, roads and scenes with the appropriate level of brightness. You can use any colour LEDs as each section is individually protected with a current-limiting resistor.
You can add two red and or green LEDs in series to any output but two blue or white LEDs in series will not work because the 5v supply is not high enough.

6 SIGNALS

6 SIGNALS is available from
Talking Electronics for $19.00 plus $4.50 postage.
Plus $4.00 for the two reed switches

This project adds interest to your layout by providing SIGNALLING

The timing for this project starts when the loco passes over one of the reed switches and the train strops at the first signal.
On the 6 SIGNALS module you need to program the time for the first signal via pot #1 through to the sixth signal via pot #6.
On the PC board you will find the timing for each pot - from a few seconds - to about 15 seconds.
The first signal remains red for say 6 seconds and then you can progress to the next signal.
The second signal will remain red for your second programming time and then you can advance to the third signal.
The first 3 signals will be activated by the reed switch at the bottom of the diagram (see diagram below) near the chip.
And the next set of 3 signals will be activated by the other reed switch.
The second reed switch will start the timing when the train passes over the switch and this will allow you to obey signals 4, 5 and 6.
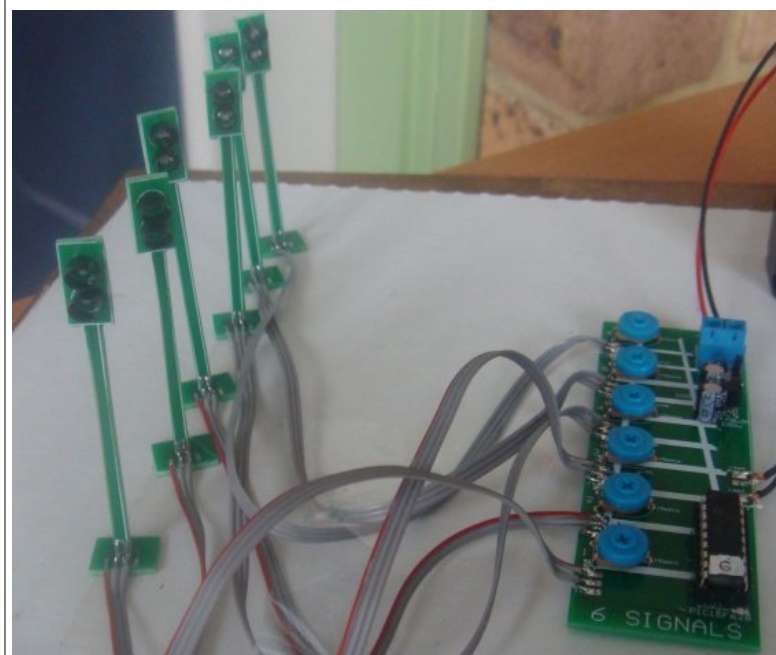
The LEDs in the signals bought on the web have the two anode leads connected together with a resistor soldered to this join. The other end of the resistor is soldered to a black wire. The anode of the red LED is soldered to a red wire and the anode of the green LED is soldered to a green wire. These wires are very fine and the module is supplied with machine pins that fit into a 3-pin socket supplied on 1 metre leads ($1.50 extra). Remove the resistor and solder the machine pins to the 3 fine wires.
You can now fit the signal to your layout and place it over a 3mm hole for the 3 wires. Push the machine pins into a 3-pin plug under your layout and the signal will illuminate.