THE POWER SOURCE

There are many choices of power source, all of them being able to cope well with most applications. All our kits, except Chrome and Copy Cad, will work well from a car battery or a battery charger. Even a cheap 2 amp trickle charger will plate surfaces of up to 30 square inches, which is sufficient for many of the small parts likely to be plated in our operation. If you decide to use a rectifier, you need not be concerned at to how you are going to control the power, as these units have built in rheostats. But, if you want to use a simple control, without the use of these more expensive units, then you will need to control the power with either a rheostat or light bulbs. Please see the section on 'Controlling the Power'.

The 25 amp & 60 amp Rectifier.

Powered by 110 volts, these rectifiers will plate continuously all day long. They are ideal for the smaller workshop with a higher output.

The 25 amp rectifier will plate up to 20 sq. inches of chrome, but will admirably cope with all other plating tank requirements.

We suggest that this machine is your best choice. If you require to plate occasional larger parts with chrome, then set up large batteries and the salt water rheostat system, as this is more cost effective than purchasing the 250 amp rectifier.

The 60 amp machine is capable of plating smaller items with chrome up to approx. 50 sq. inches in total surface area.

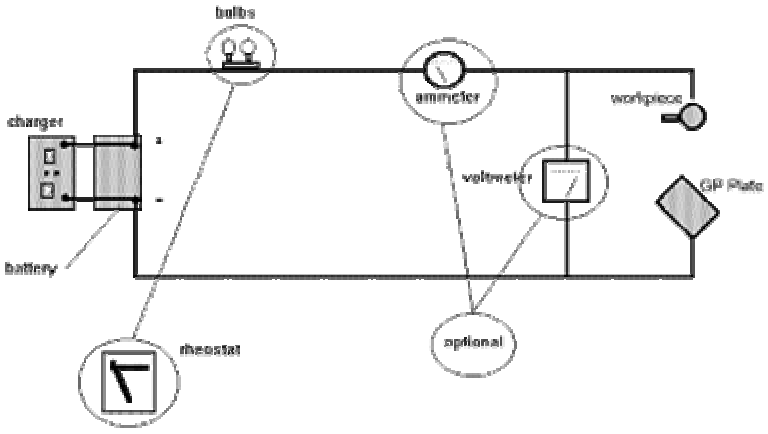
The 250 amp Plating Rectifier

This unit will plate chrome parts up to approx 200 sq. inches in surface area. It is not suitable for chrome plating small parts less than 20 square inches, or for any other type of small item plating, because the lower end of the 'tuning' range is simply not fine enough to give you an accurate result. For these parts use the 25 amp rectifier.

The only disadvantage of rectifiers, is their cost. For the occasional plating job, the initial cost may be prohibitive. So, an alternative low cost method is to use light bulbs to control a battery. See the next section on “Controlling the Power”.

The 6 & 12 volt Battery

Giving pure 'ripple free' DC current, these batteries are the obvious preferred choice of power source, and are able to supply high amperage for a short duration, ideal for chroming small parts.



As the usual current requirement is 2-6 volts for most plating jobs, it is preferable to use a 6 volt supply. By using 12 volts, we have more difficulty in disposing of the additional heat. Much larger rheostats are required. So, it makes more sense when designing your system, to use the correct voltage in the first place. 6 volts is our preferred voltage output for all power sources, except LCD Anodizing.

a. Battery chargers

Battery chargers do a good job on anodizing, but the current still needs to be controlled. Using light bulbs will do this economically. Set the charger to the 12 volt position.

There are some major misconceptions about using battery chargers as power sources. Battery chargers are rated for driving a partially discharged battery, not a grounded load

like anodizing or plating. As an example, the voltage was measured and current of a charger under load. This unit was rated for 12V at 10A, when loaded the results were as follows:

- At 0 A (no load) V=13.4 V
- At 3.66 A (3 Ω) V=11 V
- At 5.35 A (2 Ω) V=10.7 V

A 10 amp load wasn't tested as it would overheat the charger and open its thermal circuit breaker if operated for any realistic length of time. If this unit were rated as a transformer isolated unregulated power supply, using a full wave rectifier (which is what it is) the rating would be 10.8 V at 5 A. Larger or smaller chargers will scale accordingly.

Besides not putting out the voltage and current that you think you are getting, battery chargers also have no effective means to reduce the voltage and current provided to the load. You can compensate for the first problem by de-rating the battery charger as discussed above, and there is something you can do about the control problem. A perfectly simple way to solve the control problem is to use an ordinary 600 W lamp dimmer to control the input to the charger. This is shown in Figure 6. A charger is a transformer load, not a motor load. The dimmer can power a transformer as easily as it can power a light bulb. The resolution you can actually get isn't great, but it is better than you can get using any reasonable number of power resistors or light bulbs to control the current.

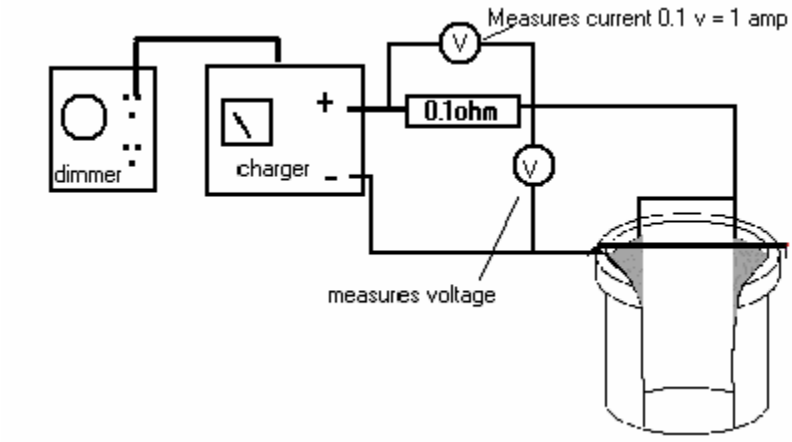


Figure 6. A Variable Voltage Battery Charger Power Supply

Combining battery & charger for chrome plating

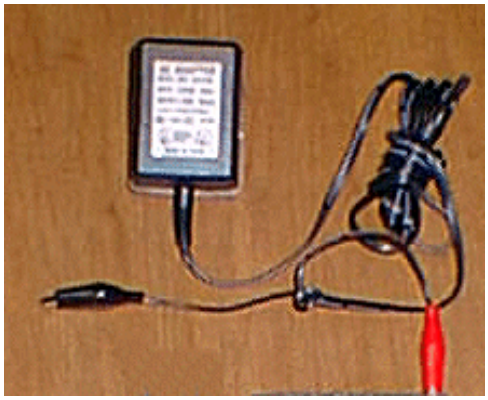
If you are chrome plating larger parts up to approx. 200 square inches, we suggest you use a combination of battery and a larger battery charger. Use a battery with a high cranking amps rating, such as a marine deep cycle trolling battery or a ready made 6 volt battery from a golf cart.

You should couple the charger to the battery and then draw your current from the battery.

Unlike plating other metals, chrome plate will not form unless there is sufficient power. The part will just sit in the tank bubbling away all day until you increase the power.

If you are plating larger parts and not getting the chrome to deposit, place a second battery in parallel. Additional amps will be provided in this manner.

Power for very small items



We have introduced a new PLUG 'N PLATE power pack to our COPY CAD system.

This unit supplies 1.5 volts @ 300milli amps (ma). As the requirement for Copy Cad, gold, zinc etc is 1.5 v @ 25 ma per sq. inch of surface area, then this unit will plate up to 12 sq. inches. (It will actually plate up to about 16 sq. inches in practise)

Using the 'ROBBER' technique, see the section 'Controlling the Power', very precise plating can be achieved on smaller articles. This unit is much preferred by us than using small batteries, as the output from these varies tremendously as the battery wears out. However, batteries may still be used, as follows:-

When you are plating very small items, such as a nut & bolt, or a washer, with a zinc, nickel, COPY CAD or copper plate, a smaller control system will be required. As bulbs, rheostats and most rectifier units will not reduce the current from a six or 12 volt battery sufficiently, you can use a simple flashlight 1.5 volt battery as your source. You can connect the battery directly to the anode without a bulb or resistor in the circuit. We have found that an AA type battery will plate an item up to 5 square inches in surface area beautifully with any of the systems mentioned above. If you have a very small article, use an older ' flat' battery. If the color of the plate is dark, then use a smaller, flatter, battery. This is a great way of using up those old batteries!

The Arc Welder

This is not our preferred choice of power unit, never the less it will work well providing you make some following modifications. Most arc welders supply 24 volts output and very high amperages, the latter being ideal for chrome plating. However, this voltage is generally too high, and needs to be reduced.

By setting a 2:1 step down transformer in the line between the main 120 volt circuit and the charger, you will drop the input voltage to 60 volts. Therefore the output voltage will be 12 volts, a more acceptable figure for our purpose. We suggest you control the current at the source because it is more economical to get a mains step down transformer, than a 24 volt, 300 amp setup.

Alternatively, if you have a 220 volt Arc Welder, this can be wired to a 110 volt supply, which will reduce the output by half.

Consult a qualified electrician for this work.
This system can produce dangerous currents to the tank, if the modification is incorrectly carried out.
This work is beyond the scope of this manual.

CONTROLLING THE POWER

If you are using a Rectifier, controlling the power will be a straightforward job of dialing up the amount required, depending on the size of the part to b e plated, and the amperage requirement. For example, nickel requires 1 amp per 15 square inches of surface area. So, a 45 sq. in. piece will need - 3 amps.

If you are using a battery or battery charger as your power supply, these units have no power control, and if you were to hook them up directly to the part and the anodes, plating would be fast and furious as the as the current virtually shorts across the tank. Of course, you would probably ruin the part too! To control this power, (to 'slow' it up) we have to place some resistance in the line. This can be done by using either light bulbs, or a rheostat. Whilst the bulbs may look a little amateurish, they really do an excellent job of plating, and should not be underestimated! If you decide on obtaining a rheostat, we have provided OHM's law below, to enable you to work out the resistance YOU require. We cannot do this for you here, because we don't know what you are plating. If you have any difficulty in doing this, get in touch with us and we'll be pleased to help.

For controlling large currents, as used in Chrome Plating, you may wish to use the Salt Water Rheostat (See this section). It is an economical unit to construct and is very reliable.
Most applications will use a 6 volt supply.

Choosing the right bulb

You will use different size bulbs depending on the surface area of the part to be plated.

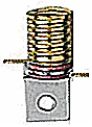
You need to consider the size of the largest part you are likely to plate when you construct your bulb rack. If you are only plating an odd item, you may not even want to bother with making a rack, just simply plug in a bulb and place the bulb holder into the circuit.

These 6 volt bulbs & sockets may be obtained from any motorcycle outlet, lawnmower repair, golfcart repair, & Radio Shack.

6 volt 100 ma bulb RADIO SHACK product # 272-1142 

6 volt 250 ma bulb RADIO SHACK product # 272-1130 


Radio Shack Part # 272-357

Threaded Bulb Base RADIO SHACK product # 272-360
Or # 272-357 

Most of our plating tanks, except chrome, zinc & Copy Cad, draw roughly the same amount of amperage, 1 amp plates approx. 16 sq. in.

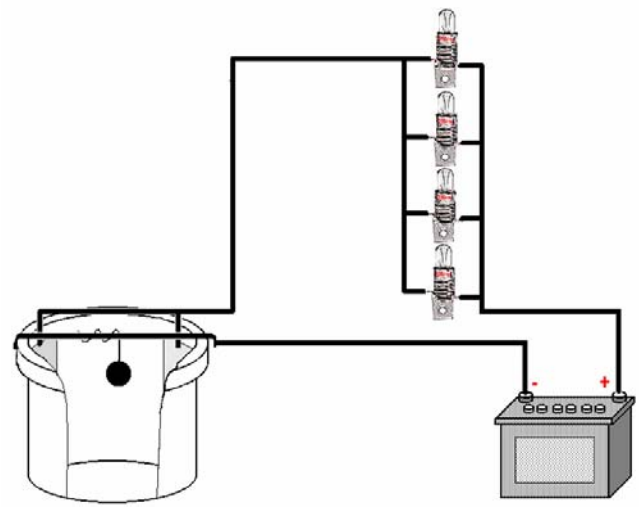
Here are two bulbs manufactured by United States Hardware Manufacturing Inc. Washington, Pa 15301

1. Product # RV 371B 12 volts 15 watts = 1.25 amps
2 Product # RV373B 12 volts 50 watts = 4 amps

These bulbs fit into a standard household bulb holder. You will need to use a 12 volt battery/charger. They are ideal for controlling the power to a chrome tank when plating mid sized parts.
Here is the setup for a typical bulb control system. There is no need to use an ammeter, because you already know the current draw from the bulb rating.

To increase the amount of current, simply add more bulbs

As an example, say we wanted to plate 90 sq inches of nickel. Nickel requires 1 amp per 15 or 16 sq inches. Therefore 90/15 = 6 amps.



This larger current could be obtained by using 24 x 250 ma bulbs, or by going to a 12 volt system and using 6 a 4 amp RV bulbs. Don't forget that you can use either 12 volt or 6 volt power supplies, but the bulbs must be rated for the same voltage.

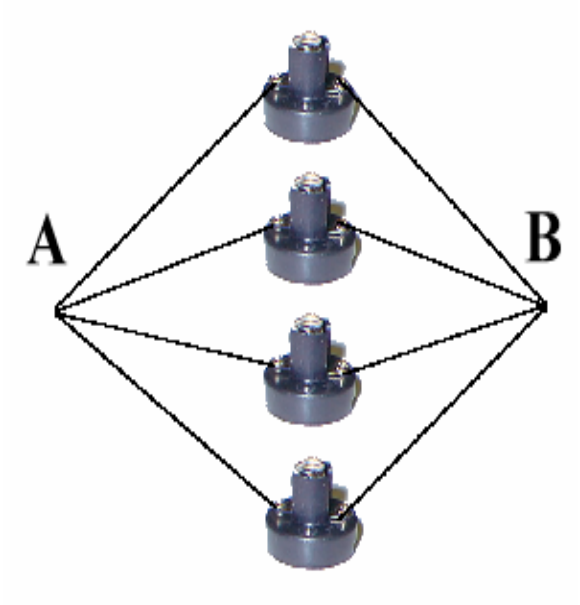
Chrome plate draws 1 amp per square inch of surface area, which is much more than the other processes.
As an example, lets imagine you were plating 24 sq inches of surface area. Then you would need to place 6 x 4 amp bulbs into the circuit.

For a better understanding of this procedure, go to www.caswellplating.com/movies/bulbcontrol.swf

There are many combinations of bulbs that can be used.
You could add many more larger bulbs to control even a chrome plating operation.
Check the bulb rating, and remember that amps = watts/volts
As long as you have the voltage and the wattage of the bulb, its pretty easy to calculate how much power it will draw.
eg: 12 volt bulb rated 15 watts = 12/15 = 1.25 amps

On larger parts you should use the Nichrome Wire Resistor.

Making a bulb holder



A bulb holder rack can be made from any small box, wooden or plastic. Radio Shack sell some inexpensive boxes ideal for this purpose.

Once you have determined the maximum size of part you are likely to plate, you can then obtain the necessary amount of bulb holders.

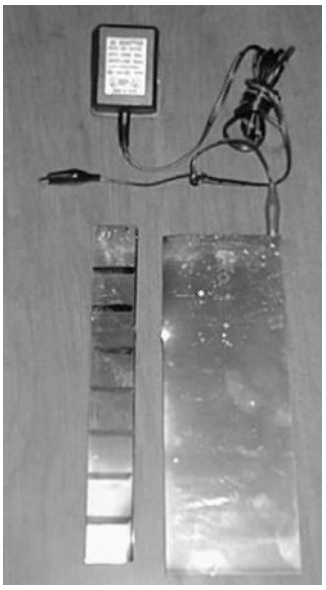
Use single filament bulbs & sockets wherever possible, as this is easier to set up. If you are electronically inclined, you will soon understand how to wire up double filament bulbs in parallel, thus saving on bulbs.

Mount the sockets in the box and solder a connecting wire to each bulb socket casing linking them all together. Run this wire to a bolt mounted on the box. This is your power terminal A

Join all the wires together and mount them on a bolt which is secured to the box. This is your other power terminal B. To test the box, connect both terminals to your battery and plug in the bulbs. They should all light brightly.

Controlling the Power From a PLUG 'n PLATE Power Pack
Or any a/c adapter

To best demonstrate the 'robber' principal, we are going to use thePlugNPlate kit instructions. Of course, you could use a battery charger, providing you know the amperage output, and adapt this method to almost any other situation.



Most parts requiring plating with COPY CAD are fairly small, so this power pack is designed to provide enough power to plate up to 15 sq. inches of surface area.

The output of the Power Pack is 300 ma (milli amps). The requirement for Copy Cad plating is 25 ma per square inch. Therefore, this unit will plate 300/25 = 12 sq. ". (In practice, it will actually plate a little more, about 15 sq. inches)

If the part to be plated were exactly 12 sq. inches, then it would simply be placed into the plating tank and connected to the negative Power Pack connector. The Anode would be connected to the positive connector, and plating would commence. The 300ma output would match the surface area, and no further adjustment would be necessary.

However, not all parts are going to be exactly 12 sq. inches, so we must 'rob' some of the power from the Power Pack. This is achieved by placing more surface area in the tank to be plated. As the output from the Power Pack is constant, we must adjust the surface area being plated to match the output. Too much current on the work piece will result in a dark, rough plate, and too little current will give us a patchy plate.

Let's assume we want to plate a part having a total surface area of 5 sq. inches. As the output from the Power Pack is for 12 sq. inches, we need to add enough surface area to make up the difference (12-5=7). This simple addition of surface can be accomplished in two ways.

1. Add more parts to be plated, until you have 12 sq. inch total surface area.

2. Add a 'ROBBER' to the parts to be plated.

You may use almost anything that has a surface area of 7 sq. inches, but that would be somewhat wasteful, so, a simple robber needs to be made from part of the anode supplied with the kit.

Cut a strip from the long side of the anode, which is 1" wide, and mark it off in 1 inch increments. This 'ROBBER' has a total surface area of 16 sq. inches.

Place the ROBBER into the Plating solution, so that 3.5" is immersed. (That gives you a total immersed surface area of 7 sq. inches) and then bend the ROBBER over the tank bar, ensuring it has good electrical contact. Now, you have 5sq" of part to be plated and 7sq" of ROBBER, making a total of 12 sq", so you should achieve optimum plating capability. The ROBBER may be used later as an anode, so no product is wasted.

Calculating Electrical values (For those who are technically inclined)

OHM'S LAW
This law expresses the relation in an active electric circuit of current, voltage and resistance. These three factors are always present in such a circuit. Its general statement is as follows:

"In an active electric circuit, the Amperes are equal to the voltage divided by the resistance"

In other words:-

1. The Amperes are equal to the volts divided by the resistance A=V/R

2. The Volts are equal to the Amperes multiplied by the resistance V=AxR

3. The Resistance is equal to the Volts divided by the Amperes R=V/A

4. The Amperage varies directly with the Volts and inversely with the Resistance.

5. The Resistance varies directly with the Volts and inversely with the Amperage.

6. The Volts vary directly with the Amperage and with the Resistance.

Resistance = Ohms = R

This law is the fundamental principle in most electric calculations., so, as long as you know 2 figures in the above equations, you can easily work out the third figure.

WATTS

The power value or Watt is calculated by multiplying the AMPS by the VOLTS:-

W = AxV or V = W/A or A = W/V

6 volts x 100 amps = 600 watts, 100 volts x 6 amps = 600 watts, 12 volts x 100 amps = 1200 watts
or 600 watts divided by 100 amps = 6 volts etc.

Making a NICHROME Power Controller

The use of lengths of Nichrome wire is an extremely inexpensive method of controlling larger current requirements used in chrome plating. Nichrome wire is often used in heating elements, such as electric fires.

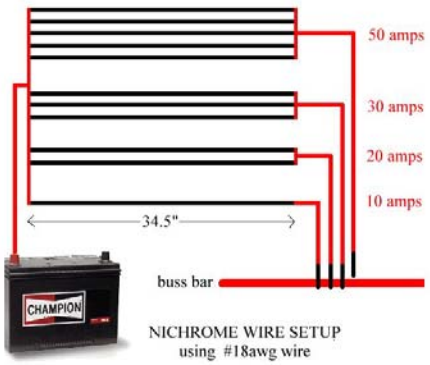
One 34.5” length of # 18ga Nichrome wire will give a resistance of 1.2 ohms

Using a 12 volt battery, one wire length will limit the current to 10 amps, 2 lengths will provide 20 amps, and so on. Using combinations of the sets of wires will give a good range of operation. For example: to obtain 90 amps, simply connect the 50, 30 and 10 amp connectors to the buss bar. To make a 5 amp resistor, simply take a length of wire TWICE the normal length of 34.5” (69”).

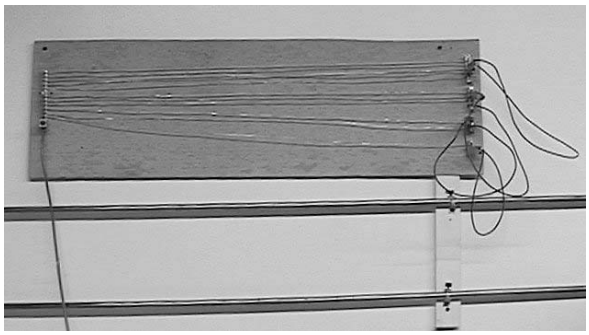
The wire can be ordered from:

Pelican Wire Company, Inc.
6266 Taylor Rd.
Naples, FL 34109-1839
Sales: (239) 597-8555 Fax: (239) 597-9783

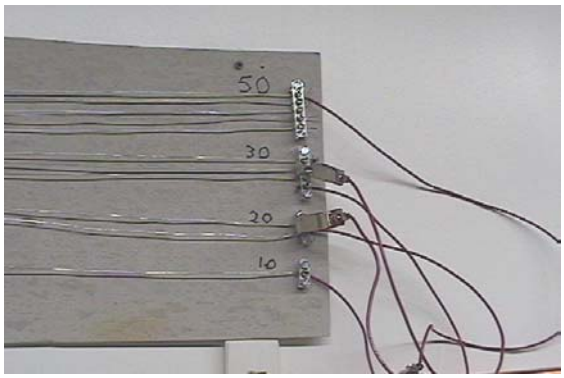
Or online at www.pelicanwire.com

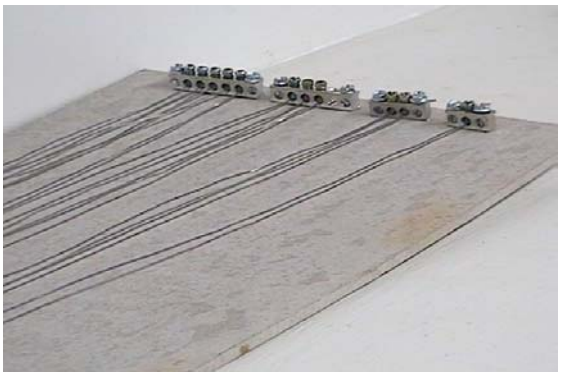


NICHROME WIRE SETUP
using #18awg wire



The installed panel, on fireproof cement board.
Mount the board on blocks, away from the wall.





Connectors cut up and bolted to panel

In the diagrams here, we have limited to total number of wires to five, giving 50 amps, but more banks may be added and theoretically, the quantity is limitless. However, bear in mind that these large currents develop extreme heat. These wires will run at around 800 degrees F, so left unattended there may be a fire risk.

A FINAL WORD ABOUT POWER

A simple way of explaining what we are trying to achieve by controling power, is to compare our battery and wires as to a water reservoir and pipeline.

The battery (or power supply, such as a rectifier) is our reservoir. The deeper the reservoir, the more pressure we have at the bottom of the reservoir (where we draw off the water) The water pressure is VOLTAGE in our electrical circuit.

Imagine we have a huge pipe, say 4 feet diameter, at the bottom of our reservoir, and we leave it open. It wouldn't take too long to empty that reservoir. In the case of the battery, if we had a very fat wire, such as a jumper cable, it wouldn't take too long to empty the battery if we 'opened' (or grounded) that wire.

Now imagine we have a 1/2" open pipe from our reservoir and we leave just that one open. Its going to take a LONG time for that reservoir to empty. This is a thin wire. Too much pressure from the reservoir can actually burst this pipe, (or melt your thin wire)

In the first example, we need a fair amount of that pressure, but we don't need the volume of water (flow or amps), so we need to place a valve in the line. If the valve is adjustable, we now have a 'rheostat' and we can control exactly how much water we let down the pipe.

Experience tells us that certain types of plating need specific voltages and amperages to plate nicely, so it is extremely important to control these flows of current.

There are two things to consider; is the pipe strong enough, and do we have the right valve (or rheostat) to correctly control the current?

Once this principal is mastered, controlling the power is relatively easy