GoGo Board

Making Output Devices

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Please visit **http://www.gogoboard.org** for the latest version of this document.

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Knowing how output ports work on the GoGo board

Power is the key

When you connect an output device such as a motor or a light bulb to an output port, you have to make sure you feed it with the right amount of energy. If you don't get this right, your output device will either not work or get burnt. The output ports on the GoGo board is designed to put out 5 volts, but it will pass though what ever voltage you power the board (more info **here**). The output ports usually have plenty of power, which means it can burn a lot of things. **It is best to use output devices that uses the same voltage as the output voltage (5V)**. But if you plan to use a low voltage device (relative to the output port), you will need to block some of the this output power. This can be done easily with a resister.

Reducing Power with a Resister

You need to insert the resister in series with your output device, as shown in the figure above, to reduce the output power. But before you do that, you need to know how much resistance to use. To know exactly, you will need to do some math. But in general, you can tinker around by staring with a large resistance (like 10k) and then reduce it down until you are satisfied with what you get. Using a potentiometer (a variable resister) would make this process easier. In many cases, the lower the voltage rating of the device, the higher the resistance value you will have to use. The following table shows some examples (assuming the output voltage from the GoGo board is 9V):

Device	Rating (Volts)	Resistance (ohms)
Small Light bulb	9-10	None
Small Light bulb	3-6	10-30
LED	5	1000
Small DC Motor	9	None
Small DC Motor	5	50

Note: The resistance you need may be very different from the values in this table, as there are other parameters that affects the amount of resistance needed. I am showing these numbers to you just to give you a rough idea.

Caution: When a low resistance is used (i.e. 10 ohms), the resister often heats up. So you should make sure you:

- Properly wrap it with tape and avoid touching it.
- Use a resister that has high power ratings. Normal resisters are 1/4 and 1/8 watt. Some times you need 1/2 watt resisters, which are a bit fatter.

Using Motors

You can find motors everywhere, at electronic stores, radio repair shops, or even in you old broken tape player. Most of these motors can be used with the GoGo board.


Different kinds of motors you can find

The important thing to know is the motor's rated voltage. As I've mentioned in the previous section, it is best to match this voltage with the output voltage from the GoGo board (9V). If you buy motors, you should obviously ask for the 9V ones. But if you have motor that is impossible to identify the voltage, there is no reason not to try it. Here is what you should do:

Tinkering with Your Found Motor

Follow these steps if you use a motor that needs less voltage than what the GoGo board gives (9V) or if you don't know how much voltage your motor needs.
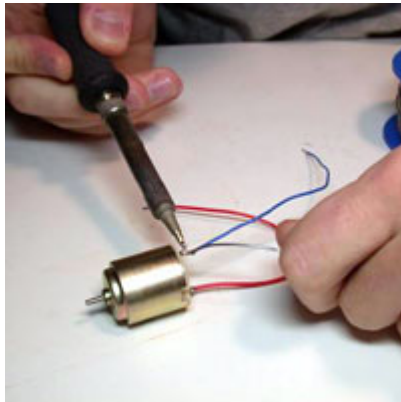

Solder leads to the motor
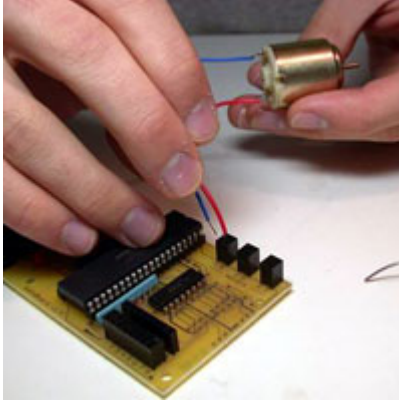
Connect the motor to the output port on the GoGo board.

Turn on the motor for a short amount of time and see how the motor works.

Caution: Don't leave the motor on for too long, as the motor could burn if its operating voltage is much lower than what it is getting.

If the motor doesn't turn, that means it requires more voltage than that the GoGo board can give. In this case, I would suggest you find another motor (unless you want to drive it with a **relay**).
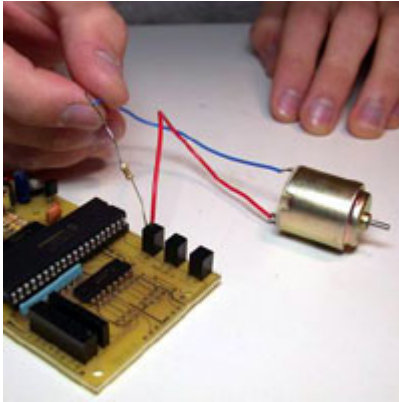
If the motor turns too fast, that probably means we are giving it too much voltage.

In this case, run one of the wires through a resister.

You should start with a resister value in between 100-1000 Ohms.

Observe again, and reduce the resistance until you are satisfied with what you see. The resistance can go down to as low as 10 Ohms. Resisters can heat up. So, be careful.

Note: you can use a potentiometer (variable resister) instead of the resister to speed up the process, as you can change the resistance without having to physically replace the resister.

Once you have determined the right resistance value, you can solder everything properly.

Example of a motor with a power limiting resister

Bypass capacitors

When driving an inductive load such as motors, the load sometimes generate noise back to the board. This noise can mess-up the power of the board causing it to halt or reset. If this happens, you need to add a small capacitor across the motor leads.

A typical bypass capacitor size is 0.1uF (0.1 Micro Farad). Don't use polarized capacitors (i.e. ones that have one lead longer than the other).
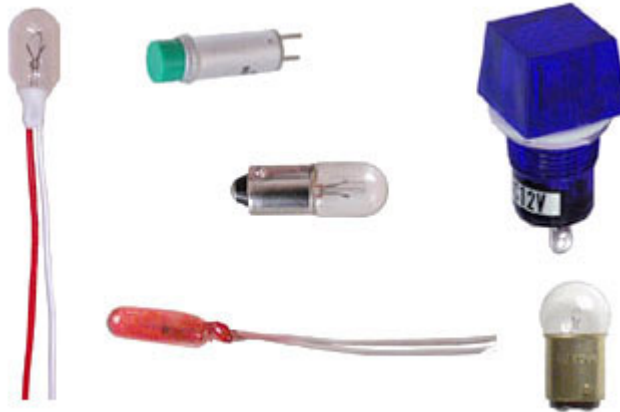
*Note that GoGo board 1.5 and higher has built-in bypass capacitors on board.
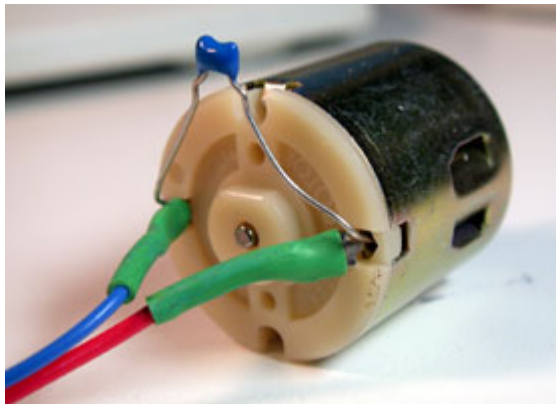
A motor with a bypass capacitor (blue).

Using Lamps

First of all, lamps in this case are much smaller than the ones you see on the ceiling or in your desk lamp. If you want to control those high power devices, you need to use **relays**. Here we are going to focus on small light bulbs and LEDs.

Lamp examples

Lamps

in the same way as motors, you should try to use lamps that are rated at the same voltage as the output from the GoGo board (9V). If they uses less voltage, you need resisters. Unlike motors, lamps are more fragile than motors. So, you should never test a lamp without a resister.
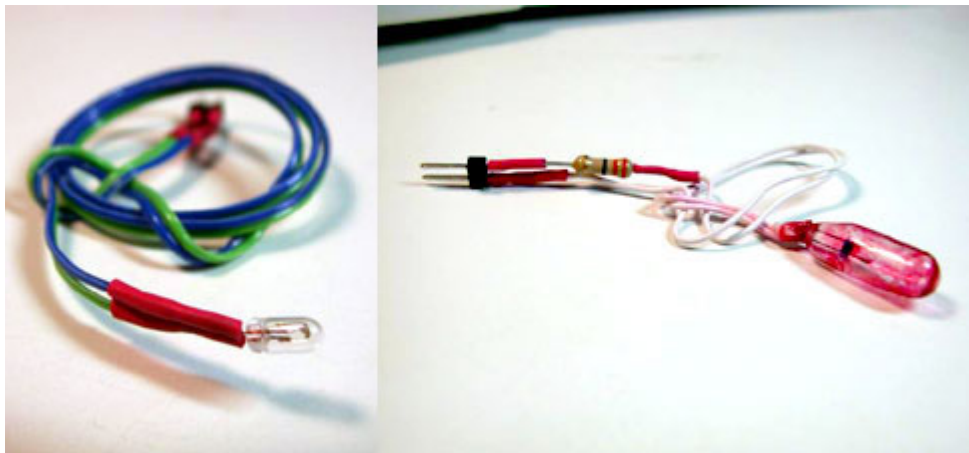
LED (Light Emitting Diode)

LEDs are similar to lamps but the light you get is much more directional. LEDs also consumes less power. Thus, they definitely need a resister to reduce the power from the GoGo board. You should try something between 500-2000 Ohms.

LEDs

Summary: thinker with you lamps and LEDs the same way you do with motors, but **NEVER** try your lamps without a resister.

Future of Learning
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