

# Dangerbot !

Handmade Especially for You By: Michael Scharf

For Questions, Repair, or to order another Dangetbot!, please contact Michael Scharf at [ROBOBUGS.NET](http://ROBOBUGS.NET).

## Owner's Manual

### Overview

The Dangerbot! is a simple lifeform made not of organic compounds, but of silicon. Your new Dangerbot! should provide many tens of years of trouble-free enjoyment and conversation. There is very little involved in the care and feeding of your new creature. The basic need of your robot is light. There is no on-off switch and no need for batteries. This makes Dangerbot! a very low maintenance companion for your desk, windowsill, shelf, Robot Jurassic Park, or any other place where there is enough light for him to work. Dangerbot! has been specifically designed to work in low light conditions such as under a desk lamp. During the design and tuning phases of his construction, a 60 watt architect lamp was the primary light source. At approx. 18 inches from the light the robot "pops" about every 20 seconds while slowly turning towards the brightest source of light in the vicinity (i.e. your desk lamp). In order for Dangerbot! to work in such low light conditions, he has sacrificed the ability to operate in full sunlight. There are many reasons for this, which will be discussed later. Another important note is that it will require significantly more light to feed him if you are using fluorescent lighting. Fluorescent lighting doesn't feed solar panels very well.

### Cleaning & Regular Maintenance

The only thing Dangerbot ! should require to live a long happy healthy life is an occasional cleaning of his glass solar panel. Care should be taken so that he doesn't get knocked onto the floor or bumped too hard because the glass solar panel is very fragile and could break. To clean the solar panel use a very small amount of regular glass or window cleaner. The panel should be cleaned whenever there is visible dust accumulating on it as it will begin to lose efficiency. Over the lifetime of Dangerbot! , the frame and motor housing may rust slightly. This is normal and shouldn't affect the performance. To help slow or prevent this you can either paint the frame and motor housing with a small brush and Rustoleum paint or you can use a little oil on him. Never use WD-40 or other spray oil, but use 3-in-1 oil, sewing machine oil, or other light oil. Also, be sure to keep him in a dry location. Remember that close to windows, dew and humidity can cause rust.

Something you may want to do for Dangerbot ! is to occasionally polish his plastic dome covering his "brains". To do this, use a very small amount of "Cleaner Wax" which is used on cars and sold in most auto parts stores. The wax should be the cleaner wax type because the cleaning additives in it will help remove fine scratches from the plastic. Another Excellent cleaner is to get plastic, polycarbonate, or lexan polish from the auto parts store. Be sure to get the kind that removes fine scratches and not the heavier grit which will require the finer polish anyway.

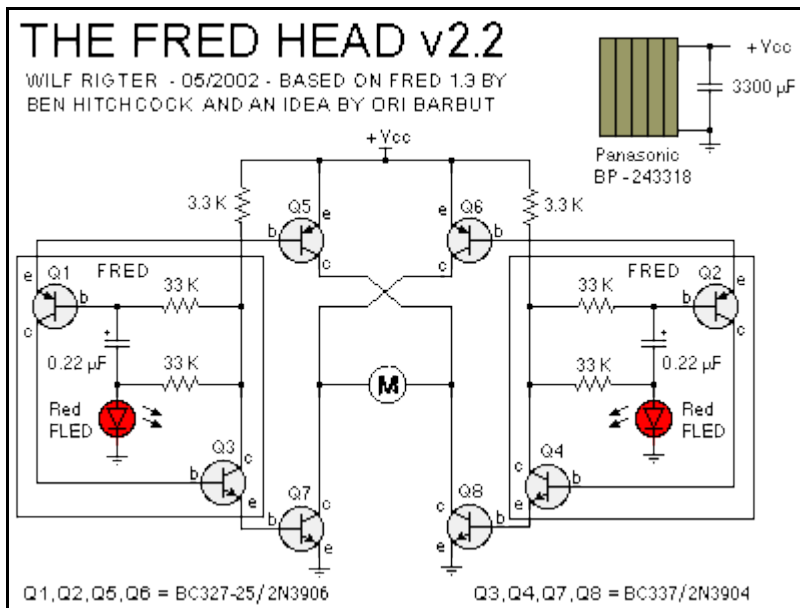
If your Dangerbot! becomes wet, you should Immediately remove the plastic dome and the small rubber belt and use a hair dryer to GENTLY warm him up. DO NOT hold the hair dryer any closer than about 12 inches or as far away as you can comfortably hold your hand in front of it. Treat him as you would your own flesh and blood. Even when he feels and looks dry, continue for several minutes warming the motor as water can become deeply embedded in the fine copper windings of the armature. A VERY SMALL amount of oil can be applied directly to the motor shaft where it exits the motor housing to lubricate the bushing and prevent friction.

Another issue is the small rubber belt. This belt will eventually become dry rotted or otherwise compromised due to the natural wearing of rubber. To obtain a new belt, simply contact me or salvage one of similar size and tension from an old microcassette recorder. Sometimes similar belts are available through electronics repair suppliers or the local hardware store. In a pinch, you can substitute a small diameter O-Ring that fits the groove of the pulleys. Do not get a belt with too much tension or he will not work. Dangerbot! operates on extremely small amounts of power and belt tension is critical to proper operation. Of course, one way to insure the belt lasts a long time is to clean it with Armor-All every 3-6 months. This will replenish the natural oils in the rubber and prevent rotting. Following a good 20 minute soak in Armor-All, wipe away all excess from the belt to avoid making it slip on the pulleys.

## How Dangerbot ! Works

Your new pet uses a circuit called the “FRED HEAD v2.2” circuit. This circuit is a dual FLED (flashing light emitting diode) solar engine.

Here’s the Schematic:



The main differences in Dangerbot! are the solar panel and power storage capacitor. Other than that, he’s identical to this schematic. For a very technical description of this circuit, contact me and I’ll send it to you. It involves learning about several previous incarnations of this circuit and a firm grasp on the operations of analog circuits. But... I can simply say to watch the FLED “eyes” to see when its about to “pop”. This may

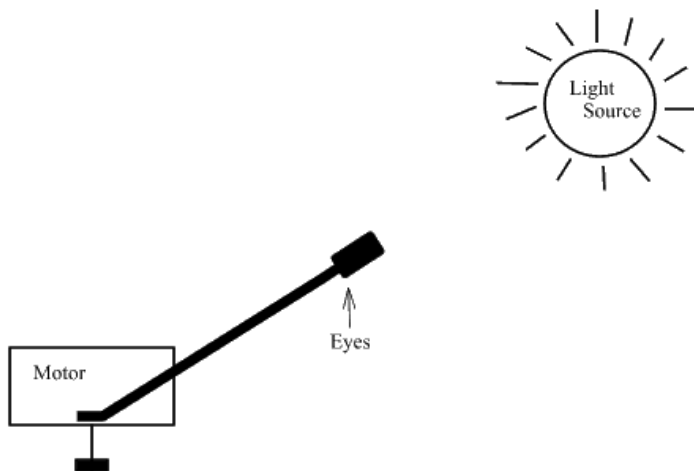
seem strange at first to use FLED’s as light sensors, but LED’s not only produce light, they actually produce a small voltage when exposed to light. This holds true for FLED’s however, the FLED’s are carefully matched and produce distinct pulses. When one is exposed to more light than the other, its internal resistance is changed due to the photovoltaic behavior of the LED section. When the pulse is strong enough and the resistance low enough, one side of the FRED HEAD will “fire”. This is due to either Q1 or Q2 reaching a threshold and quickly turning on and back off again. This causes the motor to either turn left or right depending on the side activated. This is not an exactly measurement of light, and as such can sometimes cause chaotic and unpredictable behavior. This could be compared to “fuzzy logic” and helps make Dangerbot! more interesting.

Unfortunately, this circuit draws a fair amount of power just prior to firing the motor. This means Low efficiency. It’s an very cheap circuit though, and can be built with a wide variety of available components from junk electronic devices. In fact, the solar panel is the most expensive part of the whole circuit and costs more than all other components combined! The solar panel used is one of very high quality and is used by NASA as well as other major companies. An interesting note about these cells is that they’re the most efficient panels available and their efficiency is only about 3%. That means that 97% of light energy hitting the panel is lost as heat or reflected.

## Tuning & Set-Up Notes

The Dangerbot! circuit has been tuned to work under a desk lamp. If it is placed into direct sunlight, there are a couple of possibilities. One is that he will “pop” very often while looking around frantically for the brightest light source. The other, and more likely, possibility is that he will “lock-up”. The FLED’s will be far too distracted by all the excess light and will cause the circuit to stop working. If the FLED’s don’t cause it to stop working, the larger than usual solar panel could possibly overpower the circuit causing a similar lock-up effect. Don’t be afraid however to experiment! Sometimes a little black tape over the solar panel or wrapped around the eyes as shields could make all the difference! It is possible in this way to “tune” him in yourself for the environment available for him to live in.

During my tuning sessions, I have uncovered some points to pass on to you. First, the FLED’s have a magnifying lens tip on them. You can clearly see this when looking into them to see if he’s about to fire or not. Therefore, the “eyes” are very directional and can only see what’s nearly directly in front of them. In future versions of Dangerbot ! the eyes will be modified by shaving off about ¼” of the plastic at the tip. This will remove the focusing lens part of the FLED and may cause it to be less focused resulting in much better sensitivity and peripheral vision. If this is discovered to help Dangerbot ! you will be contacted and the modification to your robot will be free. For now just remember that to track light effectively, the light must be in-line with the eyes as in the diagram below.



The eyes are mounted to the robot using heavy paper-clip wire and ARE adjustable. You can point the eyes in any direction needed to fine tune reaction to light. It is best to keep them pointing slightly away from each other so they have a wider field of view. When tuning your creature, set him up on your desk when you can check on him often. I have found that checking on him every 3-5 minutes or so you can tell if he’s going to one side or the other. If you find him turning away from the light adjust one of the eyes slightly, point him towards the light, and wait 3-5 minutes to check again. Make sure the angle of elevation points the eyes at nearly the exact level of the light and keep the eyes spread slightly away from each other. I haven’t made any accurate measurements but I think about 15 to 20 degrees apart is about right. Remember not to get frustrated and to give him plenty of time to settle in. In about 3-5 minutes wait time if he’s still pointing in the general area of the light you’ve probably been successful! Careful adjustment and patience will reward you with a robot that will look right at the light and will wag slightly back and forth over time for your enjoyment. I really enjoy how he catches my eye when I’m working on other things. It is a constant reminder that he has a mind of his own, well, kinda! ☺

REMEMBER, if you need help or have any questions, feel free to contact me at [mike@robobugs.net](mailto:mike@robobugs.net)!

End.