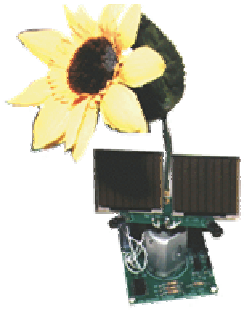
CYBUG Sunflower Power-Plant



This unique kit is both ornamental and instrumental! The SUNFLOWER will continually rotate, looking for the brightest light source it can find, much like a flower rotates to face the sun. Forever twisting and twitching, the CYBUG SUNFLOWER gathers the maximum solar energy which may be sent to a feeding station for nourishing SOLARFLYS and SCARAB CYBUG's

They also make a very cool desk accessory for the executive who has everything!

ASSEMBLY NOTES

Caution:

Building an electronic project is enjoyable, but please resist the temptation to hurry ahead and omit instruction steps. Please be sure that you:

- Read all instructions carefully.
- Read the entire step before you perform each operation.
- Be careful when handling hot soldering iron. Tip temperature may approach 700° F.
- Make certain that you **WEAR APPROPRIATE SAFETY GLASSES AT ALL TIMES** and work in a well ventilated area.

Please follow all instructions carefully, and be very careful that you use safety glasses at all times when building your kit! Be careful when handling your soldering iron… the tip is very hot!

Check your kit

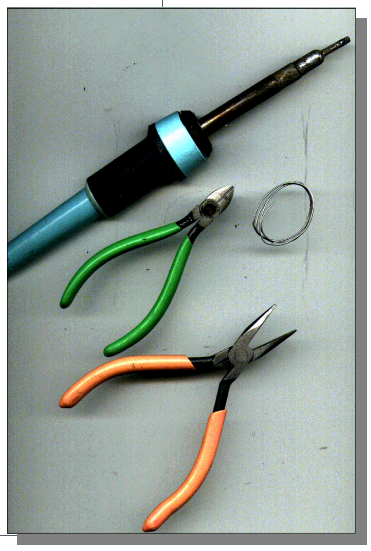
Before we begin assembly, it's a good idea that you inspect the kit's contents, and make sure you have the necessary tools to put this project together.

This kit should take a novice about 2 hours to assemble.

Tools

You will need the following tools not included in this kit...

- Soldering iron with fine point tip (electronics grade soldering pencil 35W, or solder station preferred. The better the iron, the easier the build.
- Needle nose pliers
- Side cutters
- Tape (Preferably black electrical tape)
- Solder
- Clean work surface in bright well ventilated area.
- Butane lighter (such as BIC lighter)
- Hot glue gun stick
- **SAFETY GLASSES**



Parts

Check the following list to make sure your kit is complete

☐	1	6-15V dc Motor
☐	1	1000 uF (Radial 5V)
☐	5	100k (1/4W) Resistor
☐	1	220K (1/4W) Resistor
☐	1	MPSA12 NPN Darlington
☐	1	34164-3 Micropower undervoltg Sensing (3V)
☐	2	pnp Transistor 2n3906
☐	4	2n3904 Transistor npn
☐	1	TLC27L2 Low Power op-amp
☐	2	Infrared LED Transmitter
☐	2	Sunceram BP-243318 1.8V Solar Cell
☐	1	Sunflower Power Plant PCB
☐	1	Artificial Flower
☐	12”	38 Gauge transformer wire 12"
☐	1	Documentation

Safety notes

Please read the following information concerning safety...

- Where **safety glasses** at all times.
- When clipping wires, **do not direct clippings toward any person.**
- Be careful when handling steel guitar string: the ends are quite sharp.
- Exercise caution at all times when handling soldering iron. The end is very hot.
- Work in a well ventilated area: avoid breathing solder fumes.
- Wash hands after each session. (Solder has a lead content)

Soldering

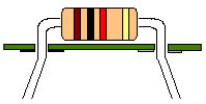
Soldering is the most important operation you will perform while constructing this kit. A good solder connection will ensure a solid electrical connection between the part and the circuit board. A bad solder joint can prevent an otherwise well assembled kit from functioning properly.

It is simple to make a good solder connection if you follow a ***few simple rules:***

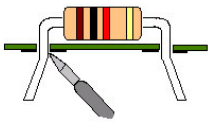
1. Use the right type of soldering iron. A 25 to 40 Watt pencil type iron intended for electronic work with a 1/8" pointed tip works best. Use a rosin-core solder on diameter approximately .0.081 mm and a 60/40 lead/tin ratio.
2. Keep the soldering tip clean by wiping it frequently on a wet sponge or cloth: then apply solder to the tip to give the entire tip a *wet* look. (Tinning the tip) When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and re-tinned.

How to Solder

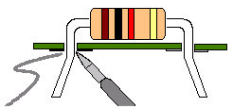
- Install the component on the board, flaring the leads on bottom side slightly (so the part does not fall out when the board is flipped!) Flip the board upside down.



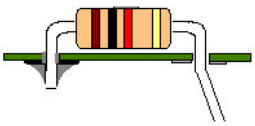
- Touch the freshly tinned solder to the point where the component wire meets the board. Hold for 1 second!



- Touch the solder to the opposite side of the component wire/board junction and allow solder to melt and surround pad entirely.

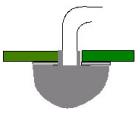


- Remove solder and soldering iron by dragging iron up the component wire.
- Clip off excess component wire

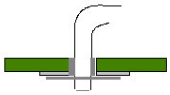


How do you know when you made a good connection?

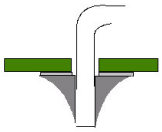
Too Much Solder? Solder will ball up like an igloo.



Too Little Solder? Solder will lie flat like a pancake.



Just the right amount? Solder will look like a volcano!



Always be on the watch for solder splashes or sloppy connections which can short against it's neighbor. These will certainly effect the operation of your kit

Start here...

It's time to start putting together your new kit! Please follow all instructions carefully, and in sequence. Remember: Soldering irons are **hot**! Work in a well ventilated area and avoid breathing fumes. Wear **safety glasses** at all times to avoid eye injury by flying clippings or solder splashes. Take your time, and have fun. Once built, your CYBUG Sunflower will last for years!

1

Insert Resistors

- R1,R7,R8,R10,R11 = 100K ohm (Brown, Black, Yellow, Gold)
- R12 = 220K ohm (Red, Red, Yellow, Gold)

Gently bend leads 90 degree's with needle-nose pliers and insert in hole. (There is no polarity)

2

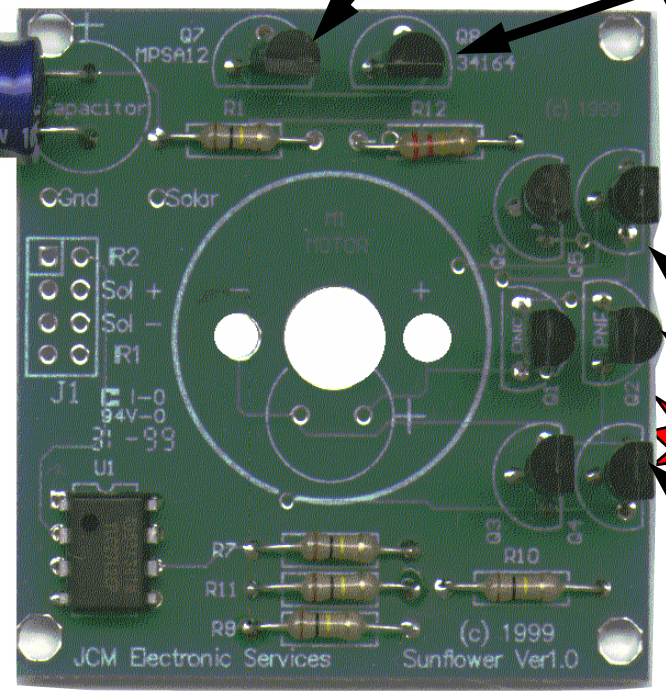
Caution: Polarity Sensitive Device

Insert the 1000uF capacitor with the positive side of the capacitor in the holes marked with the + sign. (The capacitor clearly identifies the negative lead. The **other one** is the positive lead!) You may install this part either laying down (as shown) or standing straight up, flush with the printed circuit board

3

Caution: Polarity Sensitive Device

Install U1: The 8 pin operational amplifier (TLC27L2). BE CAREFUL. The notch at the top of the silkscreen must match the notch at the top of the chip. Solder. *If there is no notch, then it should have a small circular mold mark by pin 1... This should go to the upper left .*



4 *Caution: Polarity Sensitive Device*

Note: This transistor looks just like the MC34164 ! Don't mix them up!

Insert the MPSA12 transistors (Q7) in the location marked on the PCB. Leave a 5mm gap between the parts body and the circuit board. Make sure the flat side of the package is adjacent to the flat side of the silkscreen as shown

5 *Caution: Polarity Sensitive Device*

The MC34164 (Q4) voltage monitor is placed here!. **Note the direction of the flat side corresponds to the flat side of the silkscreen.** Leave 5mm of lead length between the bottom of this part and the printed circuit board. Solder and clip off excess lead

6 *Caution: Polarity Sensitive Device*

There are two types of transistors used in this part of the SUNFLOWER. The PNP's are called 2n3906's, and are to be placed in locations marked Q1 and Q2.

The NPN's are called 2n3904's and are to be placed in the locations marked Q3, Q4, Q5, and Q6. Place these transistors in the correct location on the circuit board.

Leave 5mm of lead length between the bottom of this part and the printed circuit board.

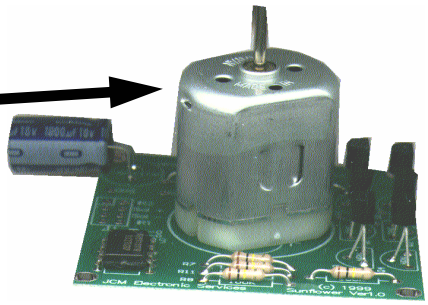
Solder and clip off excess lead

7

Installing the motor...

Polarity Sensitive! Install the motor so that the side with the red stripe on the motor body is toward the large capacitor.

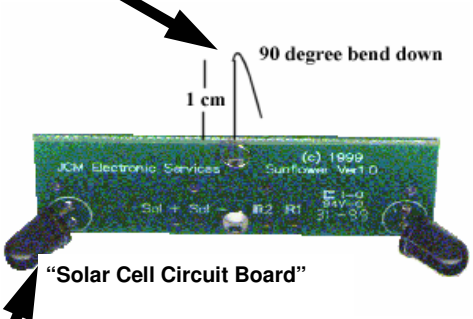
Flip the board upside down and solder the motor's metal tabs to the + and - pads on the circuit board.



8

Making the Solar Cell Support Wire...

Solder a small 2 cm piece of scrap wire to the large top hole of the "solar cell circuit board" extending rearward for 1 cm and down 1 cm .



"Solar Cell Circuit Board"

9

Caution: Polarity Sensitive Device

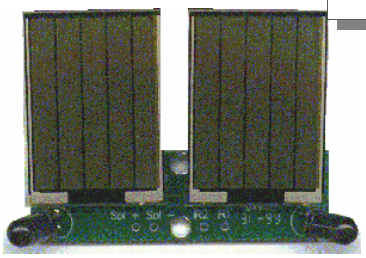
Insert both IR (Infra-red) receivers with the camphor (flat spot) on the base to the bottom as shown. Leave 1 cm of lead remaining and bend these IR receivers to face forward and outward at a 45 degree angle as shown. Solder and clip excess leads.

10 Attach Solar Cells...

Find 4 short pieces of wires (perhaps the cut ends from the resistors we soldered in earlier). Carefully solder the wire to the solar cells + and - solder pads of each solar cell.

Place the two solar cells on the solar cell circuit board, with the wires going into the holes marked - and +. Attach the solar cells to the PCB using sticky foam tape along the underside of each panel to the printed circuit

Solder wires onto circuit board.

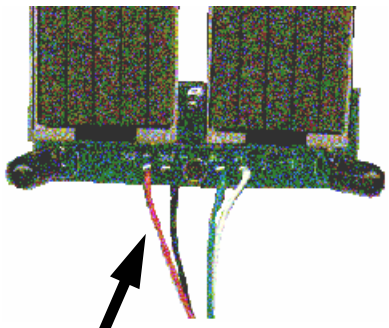


11

Be very careful when handling the 38 gauge enameled wire. They are very fragile.

Cut the wire into 4 equal pieces, each 8cm long.

Using the blue portion of the flame from a butane lighter, burn 5 mm of insulation off of each end of the wires. You should only hold the wire in the flame until it begins to glow orange (not so long that the wire melts) Wipe off the burnt insulation by pulling the wire between your thumb and finger. The uninsulated ends should have a bright copper colour.



12

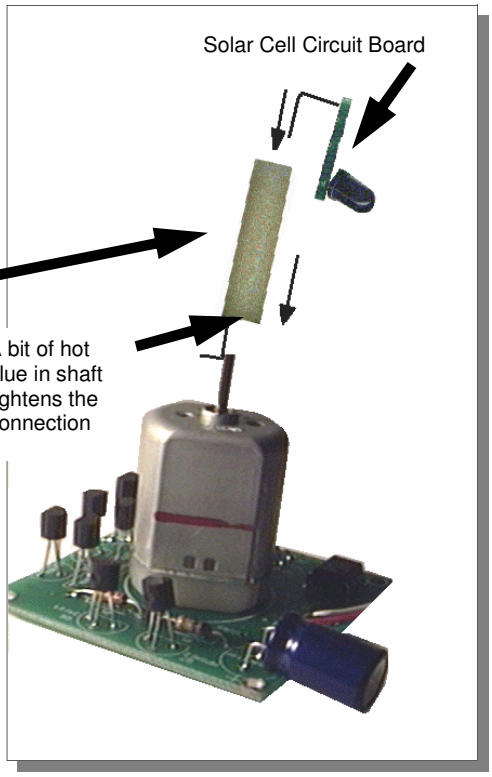
Solder one end of each 38 Gauge wire to the solar cell circuit board to the pads marked Sol+ , Sol-, IR1, and IR2. *NOTE: The wires shown are thicker and coloured for illustration only. Your wires are as thin as hair!*

13 Attach flower support shaft to motor...

The flower support shaft must now be placed over the motor shaft. Don't push this shaft down so far that the motor can't freely rotate.

If the flower support shaft is too loose, a bit of hot glue inside hollow shaft or a thick wire wedged in will tighten things up.

Put the solar cell circuit board's wire support into the top of the flower support shaft as shown



Note:

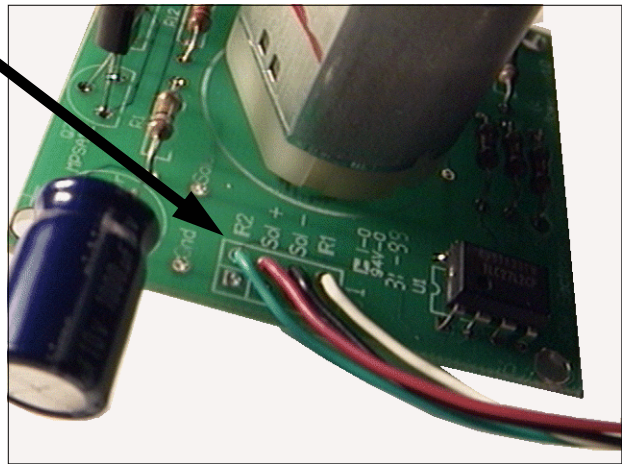
Wires are shown here, much thicker than your Sunflower wires for clarity. Your kits wires must be very thin, like a thick hair.

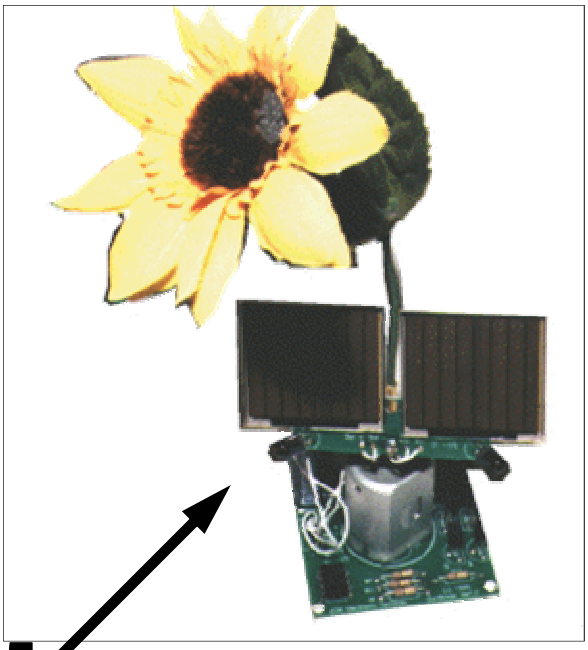
14 Connect wiring from solar cell pcb to main pcb...

Make sure that the loose end of each enamel wire has had the insulation removed as described in step 11.

Carefully solder on the four enamel wires from the solar cell pcb to the printed main printed circuit board in the pads marked IR1, IR2, Sol+ and Sol-. *(remember: Sol1 on the solar pcb must go to Sol1 on the main pcb don't mix them up!)*

Be very careful when handling these wires as they are very fragile.





15 Adding the flower...

Press the stem of the artificial flower firmly into the top of the flower support shaft. Some of the plastic coating on the flower stem may have to be softened with a lighter flame or cut away to make the flower fit better.

Bend the flower stem in a fashion which will move the flower's center of gravity close to directly over the motor shaft. This will allow the flower to rotate more freely!

Make sure none of the flowers leaves or petals are blocking the sun on the solar cells!

All done!

Operation

Using your Sunflower couldn't be simpler! There is no on/off switch, no programming, and it is 100% Y2K compliant.

Simply put your CYBUG SUNFLOWER POWER_PLANT in a sunny spot and wait a few moments. Your sunflower should begin twitching left and right, looking for the sunniest direction it can find. It is normal for your sunflower to occasionally make a large turn to the left or right: it is checking it's environment for a possibility of a brighter light source.

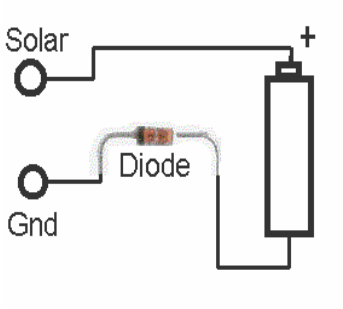
Charging 1.5V batteries

You can use the Sunflower to charge ni-cad rechargeable batteries.

You will need the following items:

- Two lengths of wire about 6 inches long.
- Small diode such as a 1n914 or 1n4148

If you look closely on the main circuit board you will see two pads labeled "SOLAR" and "Gnd". These are the main power take-offs the SUNFLOWER. Connect the one wire to the "SOLAR" pad and directly to the positive end of the 9V rechargeable battery. Connect the "Gnd" pad to the cathode of the diode (the side marked with a "bar" on the packaging as shown in the diagram below.



Building a feeding station

The SUNFLOWER POWER-PLANT can act as a source of energy for your robot colony. An easy to build feeding station may be fabricated out of the following materials:

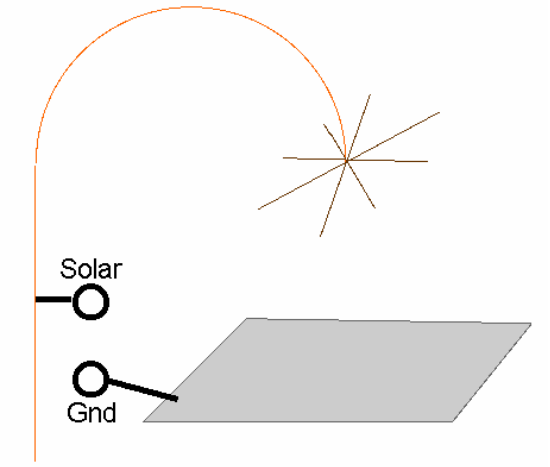
- Coat hanger wire or heavy gauge copper ground wire
- 0.010" steel guitar string wire
- Sheet of aluminum

Use the coat hanger wire to create a large inverted J-shape and device a support system to hold the structure vertically as shown below. The end of the "J" should be roughly 6 cm above the surface of the table or floor.

Using 4 or 5 pieces of 16 cm long steel guitar string wire, create a star-shaped array of wire as shown below and suspend it horizontally over the surface at the end of the "J" structure

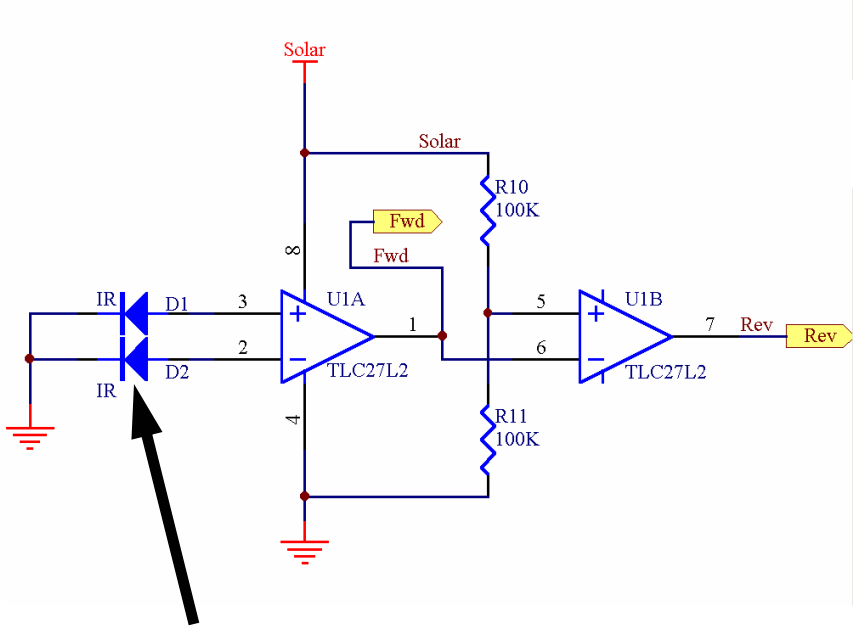
Lay the aluminum foil on the ground and tape it's edges down to the surface.

Connect the "Solar" pad on the SUNFLOWER to the star shaped array and the "Gnd" pad to the aluminum foil.



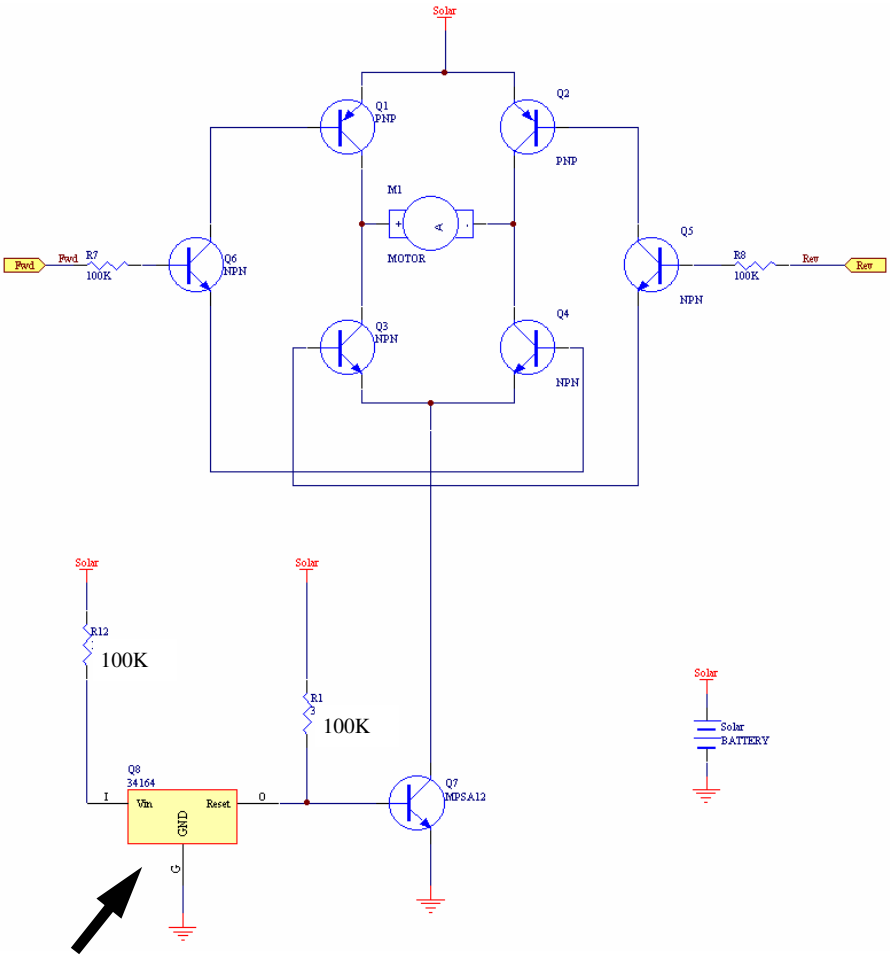
Several

Theory of operation



IR Led's D1 and D2 are photovoltaic by nature (That is, they produce a voltage when light falls upon them.) The comparator (U1A) inputs (+ and -) determine which voltage is greater, and it's output will swing to 5V or 0V depending on this decision.

The outputs of these opamps go to the flowers H-bridge motor controller to determine direction of rotation.



The Chloroplast (bottom left) is the heart of your Solarfly. It monitors the voltage across the 1000uF capacitor as the solar cell slowly charges it. When the voltage reaches about 7 volts, the 34164 voltage sensor turns on Q7 and allows the current to flow through the motor H-bridge controller.

The H-bridge controller (Q1, Q2, Q3, Q4) determines the direction of the motor spin as controlled by the sub-circuit shown on the facing page.

When the Chloroplast circuit senses the voltage across the capacitor has dropped down to a minimum threshold (around 5 V) it turns off the MPSA12 and stops the motor from turning.

Turning it loose!

Place your SUNFLOWER POWER PLANT in a sunny spot and you should immediately notice it turning toward the light. The action of the sunflower is quite animated! It does **not** track the sun slowly and accurately since this would be visually uninteresting! Rather, it moves in large twists which always turn in a direction toward the sun.

Make sure that you do not place your SUNFLOWER on a conductive surface such as metal or the circuitry will short out and your sunflower will not work!

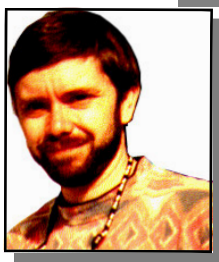
If you want your Sunflower to make smaller more accurate movements, reduce the size of the 1000uF capacitor until a satisfactory movement is achieved.

Be careful that your fine wires connecting the solar cell circuit board to the lower base printed circuit board do not become over-twisted or tangled.

You may place more powerplants in series with each other if you wish a larger voltage, or in parallel with each other for more current!

For help or troubleshooting, or an electronic colour version of this manual, please visit our home page " CYBUG SPACE " at:

http://www.jcminventures.com



I hope you enjoy watching the new behavior of your solar powered CYBUG Sunflower Power Plant as much as I enjoyed designing it. If you have any questions or comments, please contact me: I'd like to hear from you! Also... try out my web-page for some new interesting idea's for your CYBUG, and check out our other cool kits and robot accessories!

We would love to see you and your robots at the WESTERN CANADIAN ROBOT GAMES in Calgary, Alberta this year!
(http://www.robotgames.com)

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