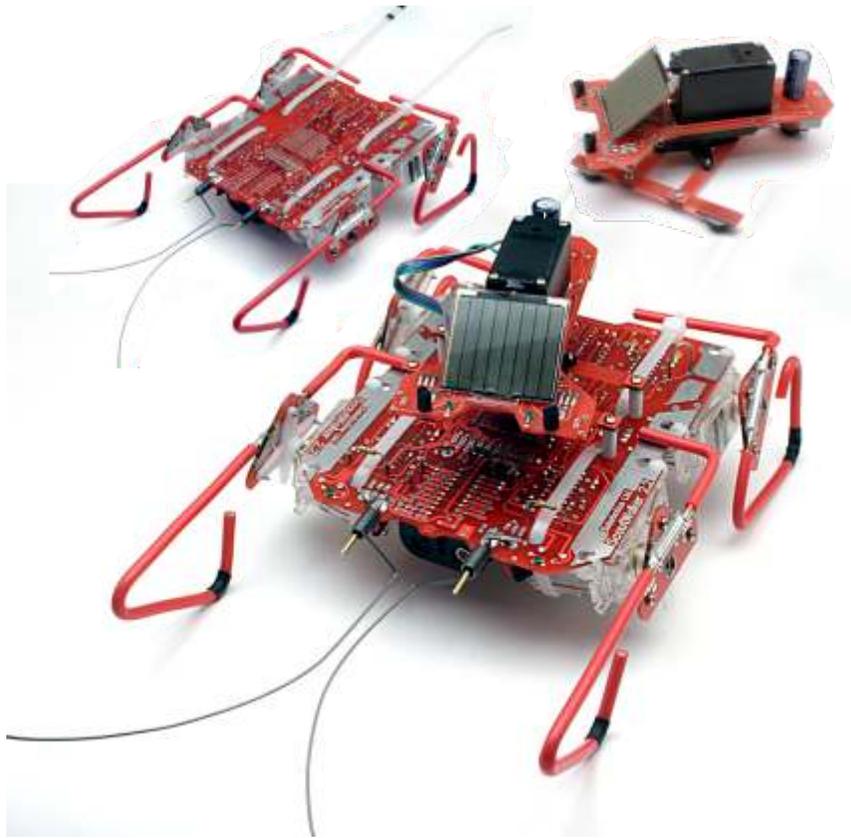


# SCOUTWALKER 2.2 (REV 'G') / SUNSEEKER ADAPTER KIT INSTRUCTIONS

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The ScoutWalker is essentially a blind robot with touch sensors, capable of bumping into things, and moving out the way to carry on its mission to....walk. The SunSeeker Head is a device that loves to look around, and lock onto the brightest thing it can find. What happens when we join these two separate robots together? A walking robot with a very interesting personality; something that moves around its environment, stopping occasionally to soak in the scenery!

We will be using the built-in capabilities of the ScoutWalker 2.2 to mount the SunSeeker on its back, give it power, and translate the signals from the head into information the robot can use to hunt out sources of light. By design, it will walk for several seconds, stop, look around for several seconds, then continue on its way. If you have ever watched crawling insects, you will notice that they follow a similar pattern of behavior. The stop/look/continue strategy allows it to analyse its environment without the additional "noise" that the walking motion introduces. Ever try to read a book while sitting at the back of the bus? Lot harder than while sitting at your desk!

## Parts List:

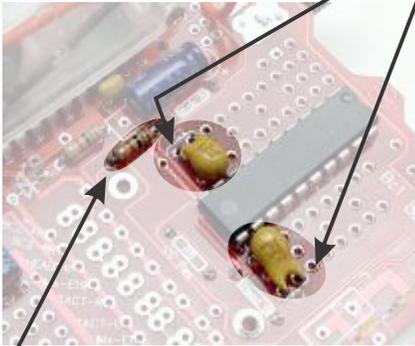
3 x diodes	2 x 240kOhm (Red/Yel/Yel)	1 x 1.0M Ohm (Br/Blk/Grn)	2 x 1-1/2" Length Solid Core Wire
4 x nylon standoffs	1 x 2.2M Ohm (Red/Red/Grn)	1 x 1.0k Ohm (Br/Blk/Red)	2 x 6.8 $\mu$ F capacitors
4 x #2-56 x 3/4" Bolts	1 x 100 Ohm (Br/Blk/Br)	1 x 6" Length 4 Conductor Wire	4 x Socket Pins
4 x #2 Nuts	1 x 2.0M Ohm (Red/Blk/Grn)	1 x 1-1/4" Length Rod	

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**Step 1: '+' side of cap to these locations at C2**



**Step 2: Install 1k resistor at R11**

**1**

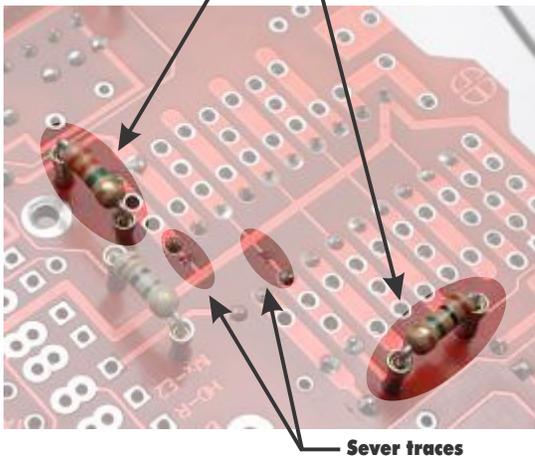
Start by removing the forward battery pack, revealing the 74AC240 underneath. Solder the 6.8µF tantalum capacitors onto the two locations marked 'C2', and BE CAREFUL of the polarity. The '+' mark on each tantalum capacitor has to be located like in the picture!

**2**

Solder in the 1k resistor at position 'R11'. This resistor overrides the enable tie-down signals and disables the ScoutWalker's motors.

**2.2M Resistor**

**1.0M Resistor**



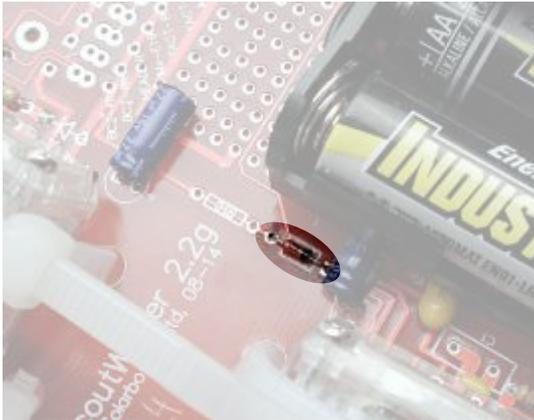
**3**

Install the 2.2M (Red/Red/Grn) resistor on the lower pin set, and the 1.0M (Brn/Blk/Grn) resistor upper pin set (closer to the front of the robot). The 2.2M resistor sets the amount of time the robot will spend in "walk" mode and the 1.0M resistor sets the amount of "seek" time.

**4**

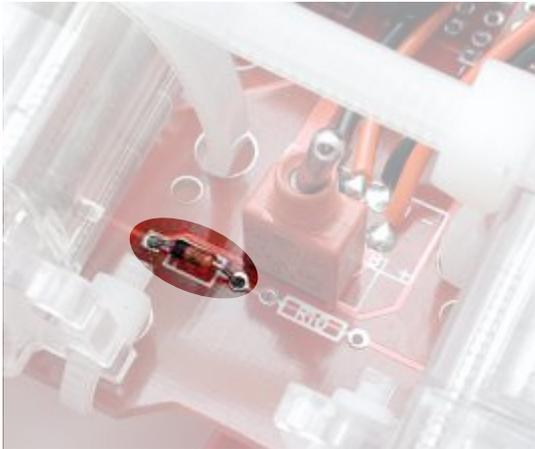
Cut the traces on the top of the board where shown. This lets two inverters from this chip operate as an oscillator (a Bicore) with the 6.8µF capacitors and resistors installed in step 3.

# SCOUTWALKER 2.2 (REV 'G') / SUNSEEKER ADAPTER KIT INSTRUCTIONS



**5** □

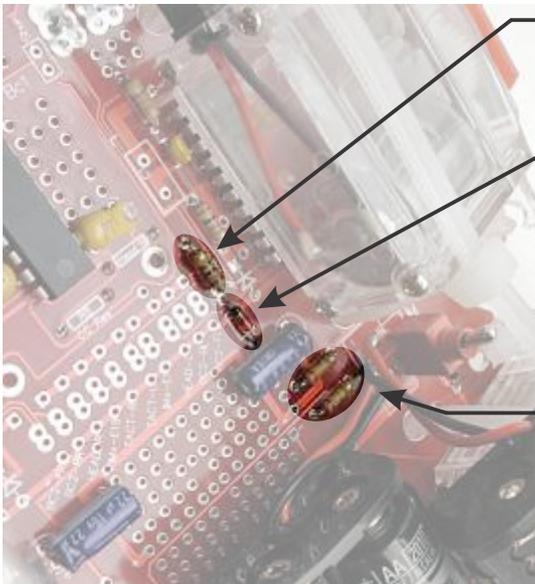
Install the first diode at position 'D1' near the "2.2g" text (there's two 'D1' positions). Note the polarity!



**6** □

Install the second diode at the second position 'D1' near the power switch. Again, note the polarity!

These last two diodes you just installed help correctly route the "Head Turn" signal back to the head so it self-centers after activation.



**7** □

Install the 100 ohm (Brn/Blk/Brn) resistor at location 'Hd R1'.

**8** □

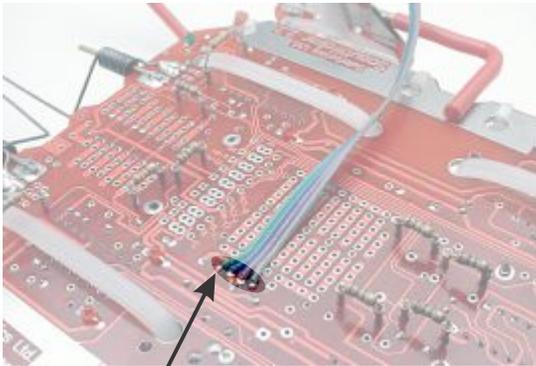
Install the diode at the location 'D1' just behind the resistor you just installed - don't forget to watch the polarity markings!

These two components feed the power to the SunSeeker head.

**9** □

Install the two 240k resistors (Rd/Yel/Yel) in the two position labeled 'R12' next to the power switch. These limit the strength of the "re-center" signal fed back to the SunSeeker head.

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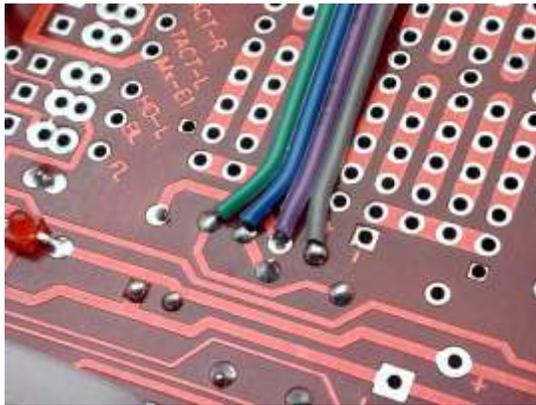


Key wire

## 10

Take your four-conductor ribbon cable, and separate/strip each of the wires 3mm (1/8") on each end of the cable. Pick one of the side wires to be the "key" wire (remember the colour for when we connect the ribbon to the SunSeeker head). This "key" wire should be soldered to the forward-most of the set of four pads.

Locate the interface pads on the ScoutWalker body (just to the right of the breadboarding space on the *top* of the body PCB), and solder the wires in place. Make sure they don't short out against each other underneath - it can be a pesky error to find later!



Interface wire installation close-up

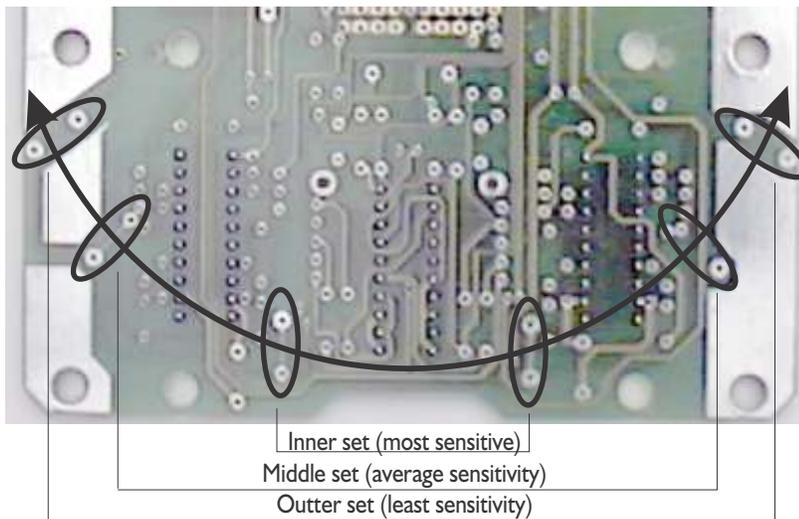
## 11

Now to the crux of the matter - exactly how do you get the SunSeeker Head to tell the ScoutWalker body when to turn?

We'll use neck limit switches to have the SunSeeker steer the ScoutWalker, much like how a horseback-rider uses reins to direct a horse's direction. We'll install a pair of wire loops on the ScoutWalker that will be touched by a pin mounted (yet to be done) on the SunSeeker when it rotates far enough to one side or the other.

We have made three ranges of sensitivity available to you at this point. You may want to start with the default position of using the middle set of gates, as we have found them to be quite effective at making the ScoutWalker go towards light, but still allow some leeway for general exploration. But do feel free to experiment with the other gate positions.

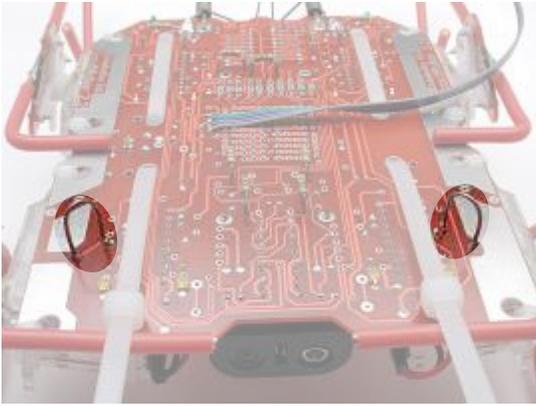
Note which set of loops you want to use below - we're going to install them next!



Path that the pin on the rear of the SunSeeker head takes across the body of the ScoutWalker

Inner set (most sensitive)  
Middle set (average sensitivity)  
Outer set (least sensitive)

## SCOUTWALKER 2.2 (REV 'G') / SUNSEEKER ADAPTER KIT INSTRUCTIONS



### 12

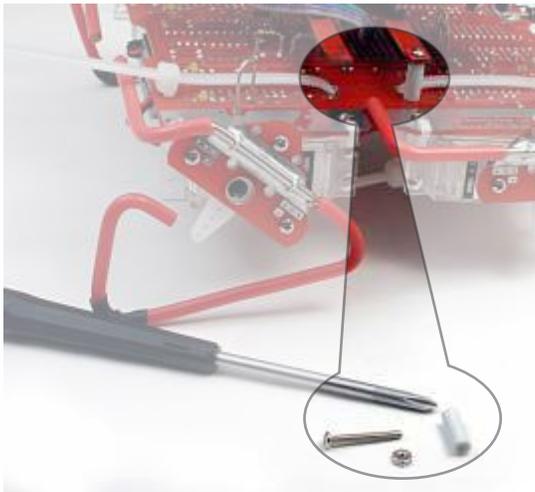
Use the included paperclips to make a fashionable set of “U” shapes 15mm (~9/16”) tall, and solder them into the positions you chose. We’re using the middle set of pads.



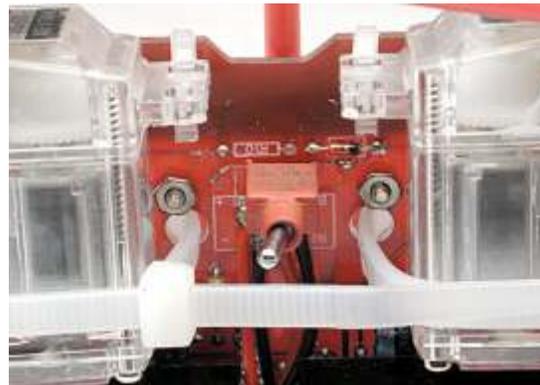
### 13

Time to prep the SunSeeker for installation! Start by removing the two sets of feet from the SunSeeker that have the rubber feet on them. This will leave you with a SunSeeker with just the cross-beams screwed to the servo output arm.

Using the short plastic tube standoffs with the nuts and bolts, secure the SunSeeker cross-beams to the ScoutWalker. You’ll find the mounting holes right next to where the large zip-tie holes are near the middle of the ScoutWalker PCB.



**Use Spacer, nut and bolt to secure SunSeeker to ScoutWalker**



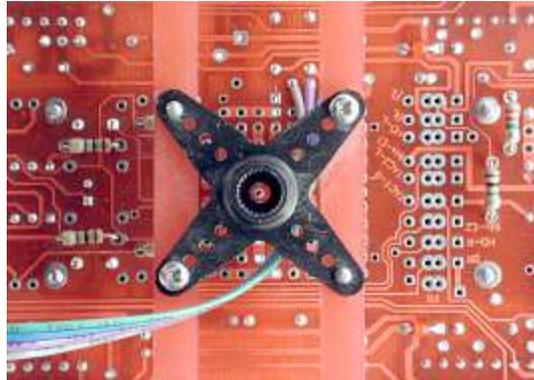
**View from underside showing nut installation of SunSeeker installation on switch side (do both sides!)**

# SCOUTWALKER 2.2 (REV 'G') / SUNSEEKER ADAPTER KIT INSTRUCTIONS

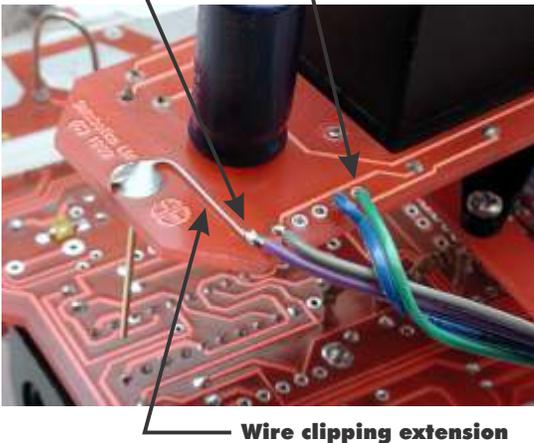


## 15 □

**Optional!** Um, did you forget to screw your SunSeeker servo horn down to the servo output shaft? Well, it's been known to happen around here, as we break down our robots for easier travel when we go to robot shows, so we put a pilot hole right in the middle of the ScoutWalker PCB. You can enlarge this hole to a suitable size so you can slip a screwdriver through and use it to tighten down the servo horn screw.



Anti Key wire      Key wire



## 14 □

Now that your head is connected to the body (or should I say “the *robot* head to the *robot* body”?), you're ready to continue.

Remember that “key” wire? That's how we're going to figure out the connections. Since the SunSeeker is an older design than the ScoutWalker, we couldn't arrange to make the wires mate the same way, so you'll have to split the ribbon wire a bit down the middle.

The key wire and the one next to it get soldered to the back two connections of the SunSeeker, with the key wire taking the *second* position.

Bend the other pair of wires in a half-roll so they mate with the farthest pair of wires, so the “anti-key” wire (the one furthest away from the key wire) goes to the pad in 6th position.

## 15 □

Finish the SunSeeker modifications by soldering in the brass pin and a resistor/diode clipping from the end of the first pad to the brass pin pad. This is how the signal gets transferred!

# SCOUTWALKER 2.2 (REV 'G') / SUNSEEKER ADAPTER KIT INSTRUCTIONS

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## Where do I go from here?

Now that you have all the necessary components mounted as to make your robot light-seeking, you have a very interesting base to start performing experiments on.

When you first turn it on, you will see that it first looks around before starting to move. Use this opportunity to make sure that your SunSeeker head is still tracking true, and make any minor adjustments (if any) to make it look for sources of light.

When it does start turning towards a light source, you will see the rear pin contact a gate, and one of the front tactile sensor lights will come on. When this happens, the head is designed to 'back off' from the gait momentarily, so it doesn't send a continuous signal to the ScoutWalker body even when the head is in the "off" state. This 'back-off' behavior is governed by the two 240k resistors that are soldered to the head and the ribbon cable - try using different values if you want to adjust the 'back-off' distance.

Feel free to adjust the 'Walk R' and 'Head R' resistor values. These will let you change how long your robot spends walking versus looking around. The larger the resistor value, the longer it spends doing that particular activity. In fact, if you wish to lock your new robot into only one of the modes (looking or walking), just remove the associated resistor, and it will never progress to the other state. I.e.: Remove the 'Walk R' resistor to make it walk continuously, without stopping and activating the head ever again. This is useful for diagnosing leg problems, or for tuning the head light-seeking ability.

Other projects you may want to think about adding to your new light-seeking ScoutWalker include:

1) Keep the solarcell on the SunSeeker head, and figure out a way to route the power from the head indicator LEDs to the main walker storage batteries (assuming you've put in Nicads). This will make a robot with a light-tracking head that will try to keep the batteries automatically charged up all the time.

2) Relocate the optical sensors on the head to the underside of the head PCB, or build little light-shades around them so they aren't sensitive to overhead lighting. Or try twisting the eyes in different directions.

3) Figure out a way to mount your own little 'headlights' on the top of the SunSeeker, and turn them on when the light level falls below a certain threshold. Then it will be able to see and chase objects it sees at night! If you want to avoid hitting these objects, figure out a way to swap the 'left' and 'right' sensor connections from the head to the body.

(Other general robot modification ideas)

4) Use the general breadboard area in the middle of the robot body to build a circuit with a mercury switch so that the ScoutWalker automatically goes into reverse if it climbs too steep of a hill.

5) Try adding additional touch sensors to the leg-mounting pads right on the servos. There are extra pads there to facilitate experimentation.

6) Build a 'look-down' sensor that will keep the ScoutWalker from walking off the edge of a table.

7) Add 'active' light-seeking sensors to the SunSeeker, so it uses modulated IR emitters and detectors to scan it's environment for obstacles it can't see with the standard passive IR detectors.

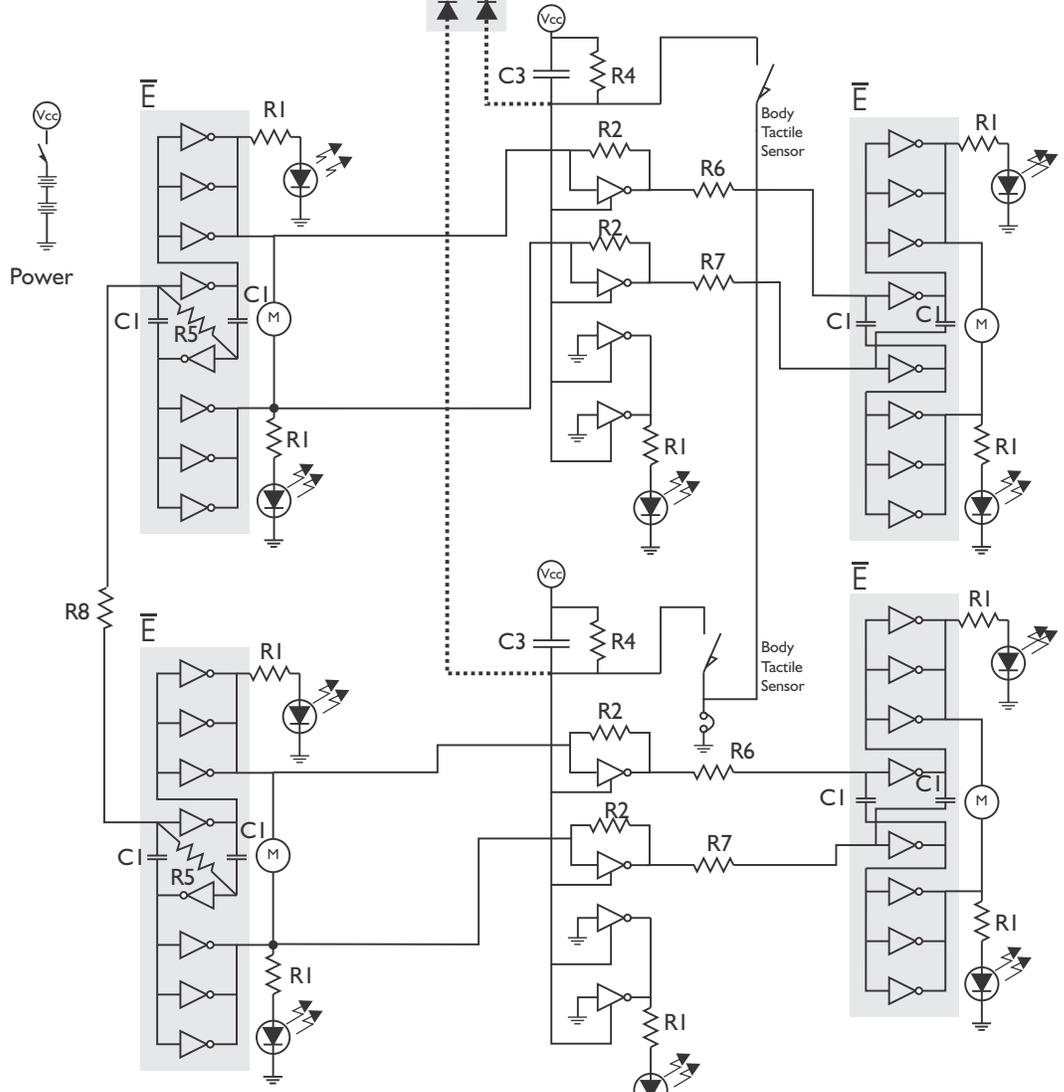
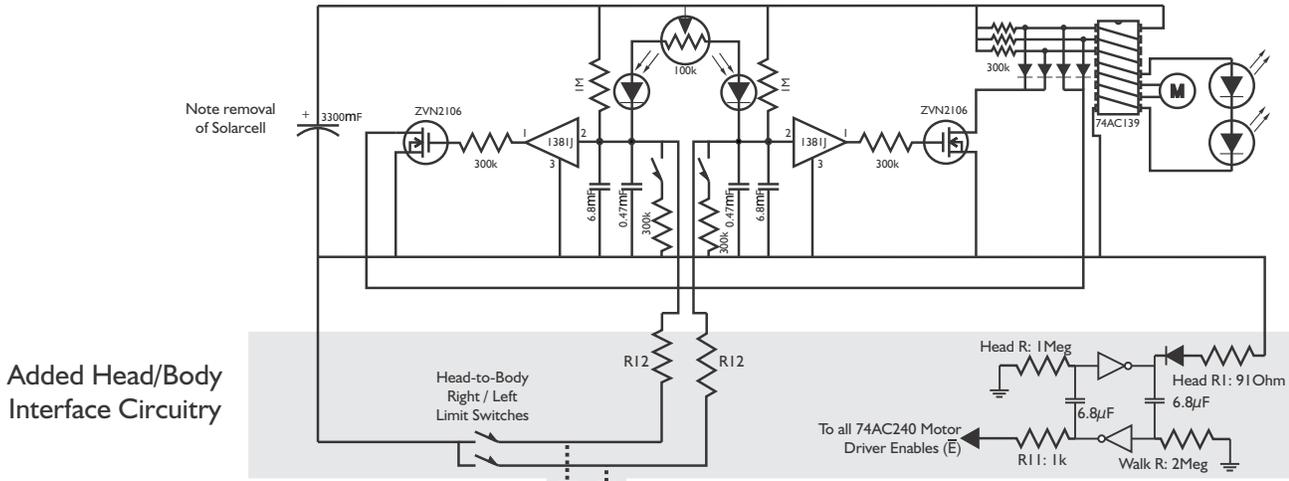
The breadboard in the middle of the ScoutWalker body is designed to easily facilitate at most another 20-pin chip of some sort (ie: like the other 74AC240's on the board). Power and ground connections are near to where they need to be to give such a chip power. Additionally, you have the extra logic gates on the 74AC240 chip at the top middle of the board - perhaps these can be used in some sort of clever manner. Come up with a new an clever idea, and let us know - we'd love to hear how you've hacked your ScoutWalker/SunSeeker combination!

Solarbotics Ltd.

Ph: (403) 232-6268 / Toll free: (866) 276-2687

[www.solarbotics.com](http://www.solarbotics.com)

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Master Bicore  
Oscillators & Front  
Motor Drivers  
ICI - 74AC240

Tactile-activated  
Multiplexor  
ICI - 74AC240

Slave Bicore  
Oscillators & Rear  
Motor Drivers  
ICI - 74AC240