

Truth Wristband Kit

v5.100

by Dr. Sean M. Montgomery

<http://www.produceconsumerobot.com/truth/>

The Truth: The Truth Wristband is a wearable device that dynamically reflects the wearer's psycho-emotional response to the world. Measuring the galvanic skin response (a marker of emotional arousal commonly used in lie detector tests), this device's lights turn from blue to red as the wearer becomes aroused. Ask the wearer an evocative question and reveal his or her inner Truth.

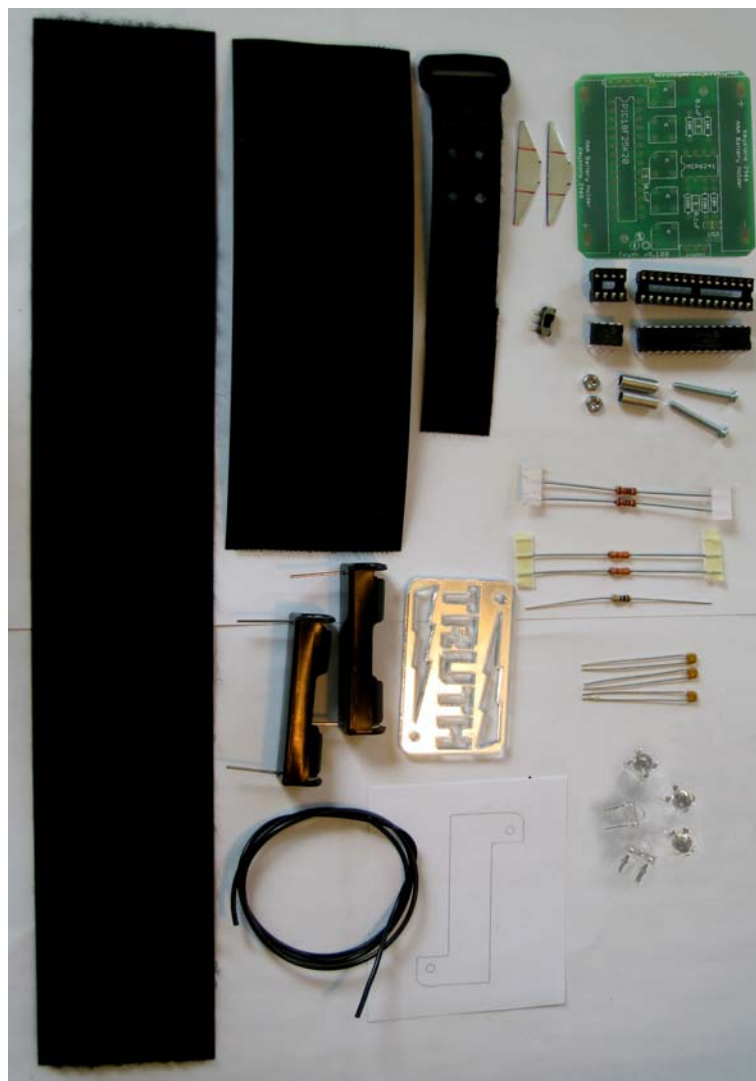


How it works:

The sweat glands in your palms are tied into the arousal systems in your body (e.g. adrenaline) causing micro-bursts of sweating on your palms when you experience a stressful or arousing stimulus. Because sweat is electrically conductive, this leads to an increased skin conductance that can be measured and displayed by the Truth Wristband. The Truth Wristband measures stress/arousal which commonly accompanies lying. But, ask the right question and it doesn't matter what answer you get!

Bill of Materials:

1	PCB
1	Laser cut plexi face plate
1	SPDT switch
2	10K resistors
2	330K resistors
1	10M resistor
3	0.1uF capacitors
5	5mm 8K mcd 120 degree common anode RGB LEDs
2	3/4" 2-56 screws
2	3/8" spacers
2	2-56 nuts
2	Sterling silver finger contacts
1	20" 24AWG hookup wire
1	Velcro finger strap
2	AAA batteries
2	AAA battery holders
1	2"x6" hook Velcro strap
1	2"x10" loop Velcro strap
1	PIC18F25k20 - microcontroller
1	28 pin DIP socket
1	MCP6241 - op amp
1	8 pin DIP socket
1	Paper cutout (last instruction page)



Required tools:

Soldering iron, solder, pliers, wire cutter/stripper, flat head screwdriver, scissors, rubbing alcohol and a toothbrush (for cleaning circuit board after soldering), clear tape (e.g. scotch tape).

Assembly Instructions: (see <http://www.produceconsumerobot/truth/> for color and updated details)

- 1) Position DIP sockets so notches match the PCB diagram (see arrows).
- 2) Solder the DIP sockets, resistors, capacitors and switch in appropriate locations.

- Practice good soldering technique, heating the PCB solder pad with the iron and melting the solder onto the pad instead of directly onto the iron. Google "soldering technique" for lots of good advice.

- Cut off the excess wire leads after soldering in place.

- **NOTE:** save one of the excess wire leads for step 6.

3) RGB LEDs:

- Carefully check orientation so that the cut corner of the LEDs matches the diagramming on the PCB.

- Solder LEDs in place

- **BE CAREFUL**, too much heat on the led leads can damage the LEDs.

4) Connect finger strap wire to the board:

- Strip 1/2 inch of wire end.

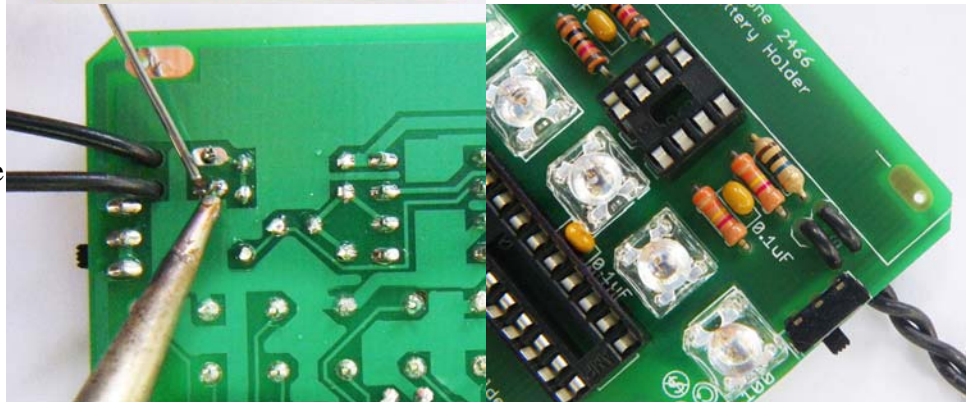
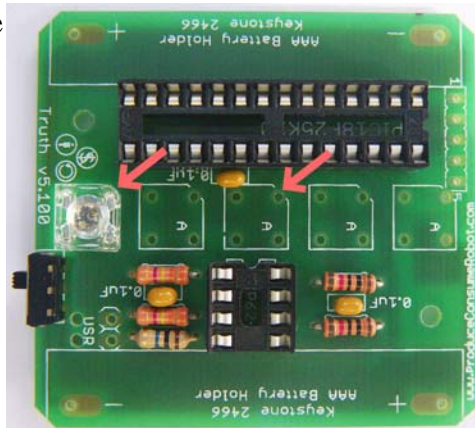
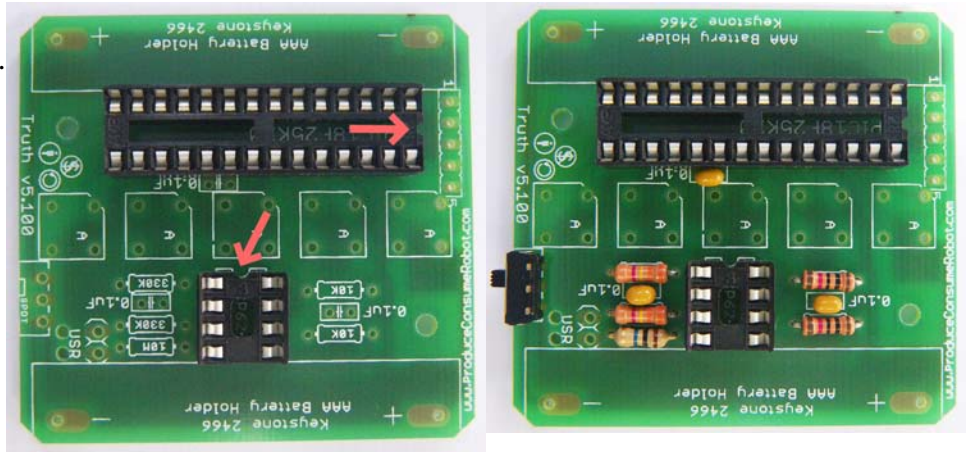
- Feed the wire + insulation up through holes near the switch and the stripped end of the wire down through the holes marked 'USR'.

- Solder in place.

- Twist the wire leads together.

- Cut the wire in the center of the remaining loop.

- Strip 1/4 inch of the ends.



5) Battery holders:

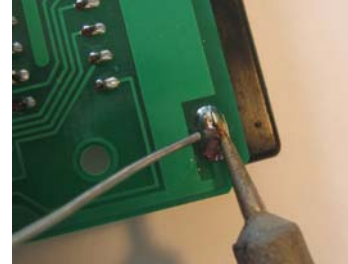
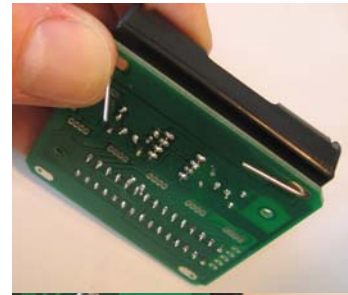
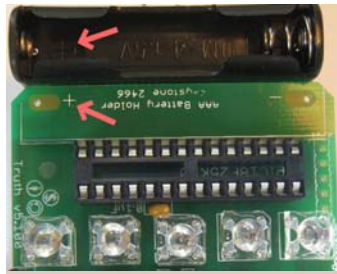
- Carefully check orientation (+,+) and insert into holes on board.
- Bend leads onto solder pad for added strength.
- Cut leads to size of solder pad.
- Solder battery holders in place.

6) Connect MCLR and VDD:

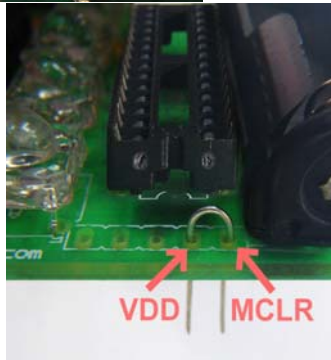
Choose **ONE** option:

(A) If you **DON'T** know how or don't wish to reprogram the microcontroller, solder a piece of wire to short-circuit the MCLR and VDD pins (first two pins near battery holder).

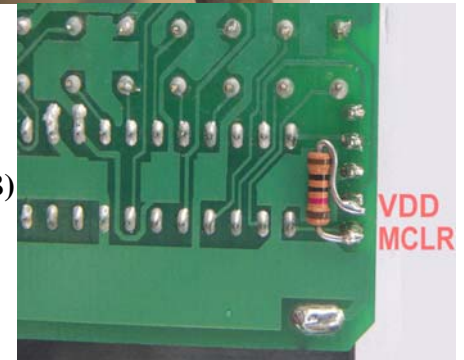
(B) If you **DO** want to alter the code and reprogram the microcontroller, you can instead connect MCLR and VDD with a 10K resistor (not included in kit). I also recommend soldering a low profile socket (e.g. Mouser 517-984-01-05, not included in kit) in the five holes. See optional step 16 for more details.



(A)



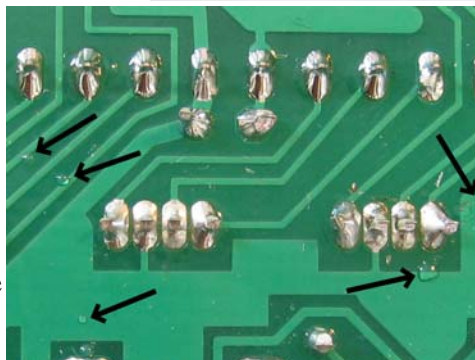
(B)



7) Clean the flux/rosin off the board:

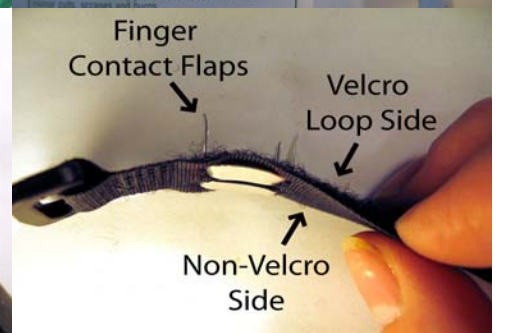
Flux and rosin-core solder (almost all solder) always leaves conductive residue (arrows) on the PCB.

- Using rubbing alcohol and a toothbrush, scrub down the soldered side of the board.
- **DO NOT** insert batteries before the alcohol is **COMPLETELY DRY**.



8) Finger strap:

- Bend the silver finger contact along the red lines to a 90 degree angle.
- Insert the contacts through the holes in the finger strap so that the 2 contacts sit flat on the **NON-VELCRO** side of the strap and **DO NOT TOUCH** each other.



- These contacts are the "sensors" and it's **CRITICAL** that they are attached correctly.



- Bend the contact flaps flat on the loop side of the Velcro.

- Solder the flaps together.
- **BE CAREFUL** not to melt the velcro loop with the soldering iron.

- With the velcro-loop side facing up, feed the wire leads up through the plastic buckle, down through the wire hole and back up through the contact holes.

- Solder one wire to each contact.
(NOTE, solder on the flap side, not the flat finger side ... **BE CAREFUL, HOT!**)

9) Seat the chips into the sockets:

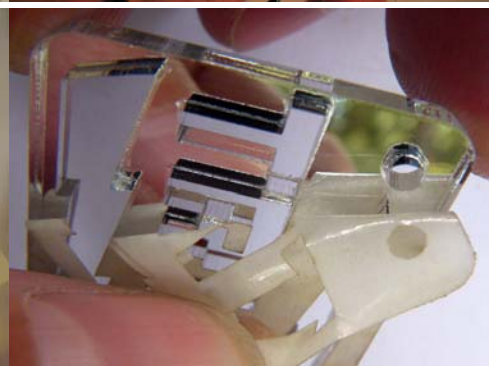
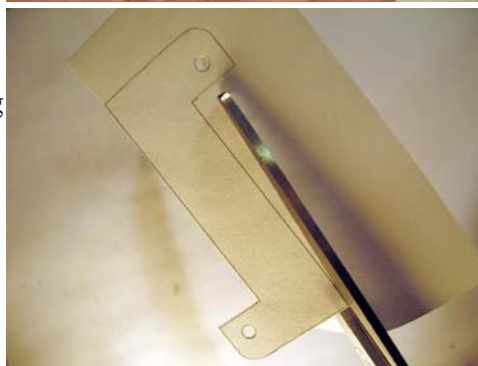
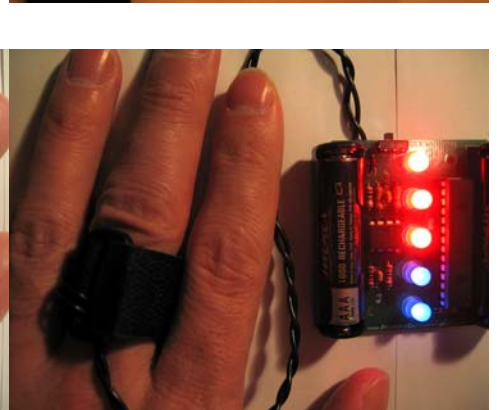
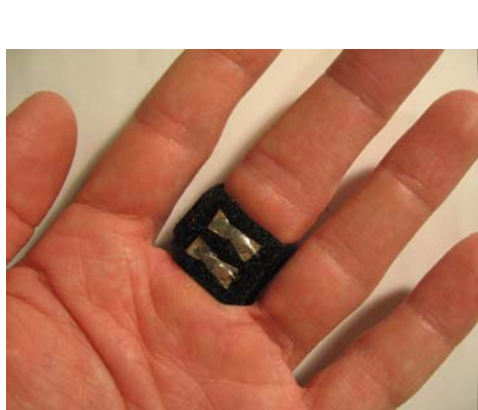
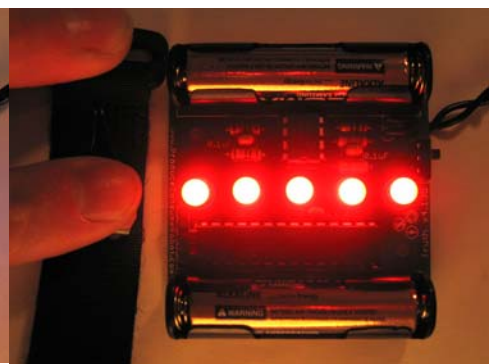
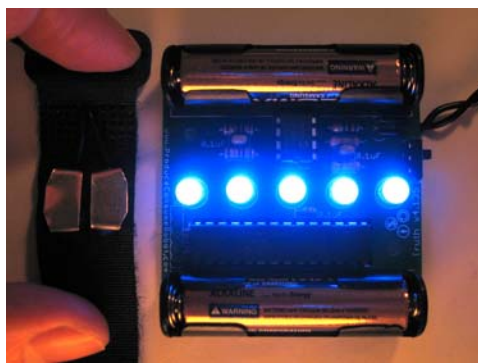
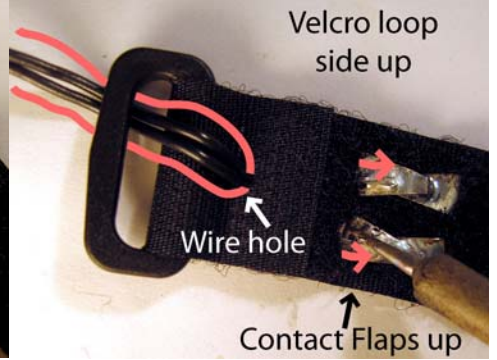
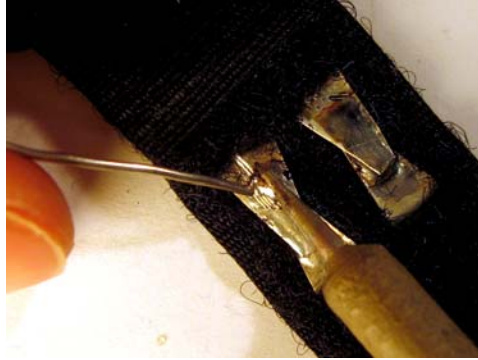
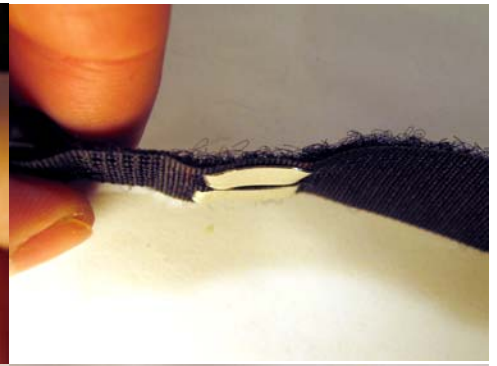
- Start with the 8 pin chip.
- **CHECK ORIENTATION** (see step 1).
- **BE CAREFUL** not to bend/break the pins.

10) Test the circuitry:

- Insert batteries (correctly).
- Flip the switch.
- LEDs should turn all red for a few seconds and then all blue.
- If you touch the finger contacts, the LEDs should turn red.
- Put the strap on any finger so that the contacts sit on the palm-side of the finger.
- Make sure the strap is comfortably snug on your finger.
- Strap position/fit is **CRITICAL**.
- It may help to massage the strap (esp. Hook/loop weld) for proper fit.
- Distressing/exciting thoughts, pain, or sudden physical exertion should turn some of the lights red depending on the magnitude your response.

11) Cut out the paper diffuser (template on last page of instructions). Cut just inside (smaller than) the lines.

12) Carefully peel the plastic protector off the plexiglass face.



13) Assemble the wristband:

- Insert the screws through the plexiglass and paper diffuser.
- You may want to use a small piece of clear tape (e.g. scotch tape) to affix the paper to the back of the plexiglass, but do not overlap the lighting bolt holes (it will collect dirt and ugliness).

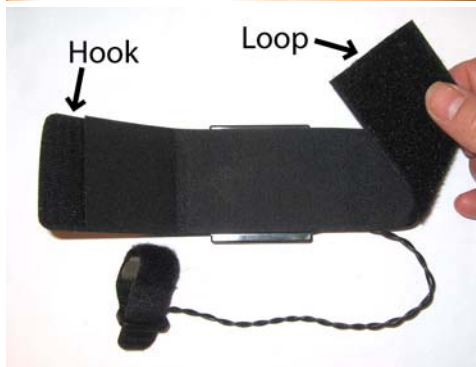
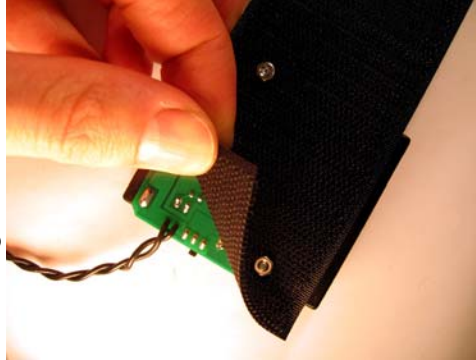
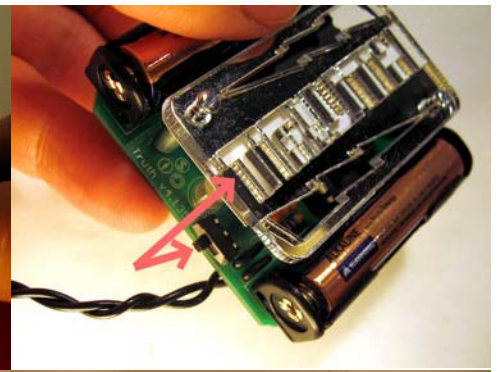
- Insert the screws through the aluminum spacers and into the holes in the PCB.

- **BE SURE** the 'T' and the switch are on the same side or 'TRUTH' may be upside down on your arm

- Put the hook velcro wrist strap onto the bottom of the PCB (hook-side facing away from the PCB) so the screws poke through the holes.

- Tighten the nuts onto the screws.

- Stick the hook to the loop wrist strap so that the hook overhangs the loop by approximately 1 inch.

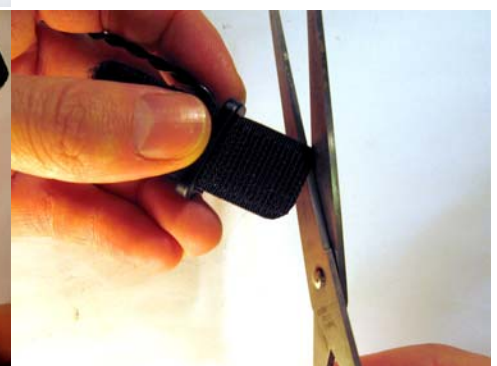


14) Battery removal:

- Removing the batteries is difficult with these holders. Use a small screwdriver or other to pry them out.

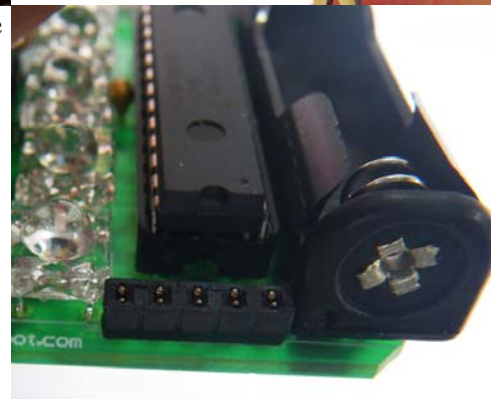
Optional Step 15) Trim the velcro to round the corners.

- You may want to shorten the wrist/finger strap if you have small wrists/fingers. **BUT REMEMBER** that you might want other people with larger wrists/fingers to try on your truth wristband.



Optional Step 16) Reprogram the Truth! The 5 holes on the PCB near the PIC are set up to reprogram the microcontroller. All you need to do is put a 10K resistor between MCLR and VDD (see step 6). I also recommend soldering a low profile socket (e.g. Mouser 517-984-01-05) in these five holes to easily connect your programmer with a 90 degree header. In order, from the pin nearest the battery: 1-MCLR; 2-VDD; 3-VSS; 4-PGD; 5-PGC. Find the datasheet here

<http://ww1.microchip.com/downloads/en/DeviceDoc/41303D.pdf> **NOTE** that the operating voltage range is **1.8-3.6V!** Download the source code from <http://www.produceconsumerobot.com/truth/> Send me your code improvements and I'll share it with others!



Voila!

You are now a proud owner of the Truth... Wear it around. See what happens if someone asks you a question, when you laugh or get surprised. Note the response has a 1-2 second biological delay. Everyone responds differently. See if you can turn it red with your mind. Try it on your friends, acquaintances, enemies... great way to get to know someone!

Troubleshooting:

- Nothing works: Flip the switch. Make sure you connected MCLR and VDD (step 6). Check that the microcontroller is seated properly in the correct orientation. Check battery orientation. Check orientation of the LEDs.
- When I flip the switch only one letter lights up: Occasionally this occurs. Turn the Truth Wristband off and back on. Repeat as necessary.
- One LED doesn't work: Could be that you put the LED in the wrong way. Check the orientation.
- Red works, but blue doesn't: Likely due to low batteries.
- My finger turns blue: The finger strap cannot be too tight or it will cut off circulation and lose responsiveness.
- There is a 1-2 second delay in the galvanic skin response. This is due to the normal biological delays.
- If you touch the finger contact flaps with another finger (or anything conductive) the lights will turn red. This can be used as a "manual override" if the truth gets too tough to handle.
- Do not get any part of the truth wristband wet. If the finger contacts get wet or if your hands are wet (e.g. from washing) the readings will be inaccurate until fully dry.
- Extreme cold can reduce the truth wristband's sensitivity (because your sweat glands stop responding).
- Your responsiveness may vary with your psychological state. This is normal and may reflect natural (or induced) fluctuations in your psyche.
- Some people with very dry or chronically cold hands may tend to show low responsiveness. However, sometimes you just didn't find the right question to get a rise out of them... keep trying.

Send me your comments:

Do you have any comments on how to improve these instructions or how to improve the Truth wristband for the next version? What was the most interesting question/comment you heard while wearing the Truth?

Send me an email <http://www.produceconsumerobot.com/>

All text and images by [Sean M. Montgomery](#) are licensed under a [Creative Commons Attribution-Noncommercial-Share Alike 3.0 United States License](#).

Based on a work at www.produceconsumerobot.com.



Paper Diffuser Cutout:

