

# Assembly Instructions for UBW PTH kit

Document version : 1.2 (for PTH v1)

Last update : 09/14/07

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## Description:

The UBW is a very simple board that you plug into your computer. It allows your computer to interface to the 'real world', by allowing for input and output of analog or digital signals. You can use the UBW to connect up to motors, sensors, buttons, or just about anything you can think of. You can write a simple program to send commands to the UBW, or you can even type commands in a terminal emulator. The UBW works with Windows, Linux and Mac OS X systems.

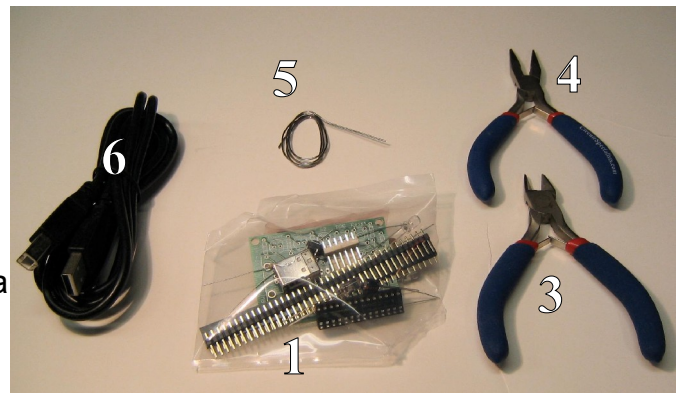
The UBW is available from SparkFun ([www.sparkfun.com](http://www.sparkfun.com)) in two varieties. The first is completely assembled, and is very small. The second is the kit you have now. You have to solder it together yourself and it is larger than the first version.

If you are experienced in assembling electronic kits, this kit will go together very quickly (probably less than 10 minutes). You can simply follow the schematic and populate the board. Please see the note below on step 13 for an important tip about the LEDs.

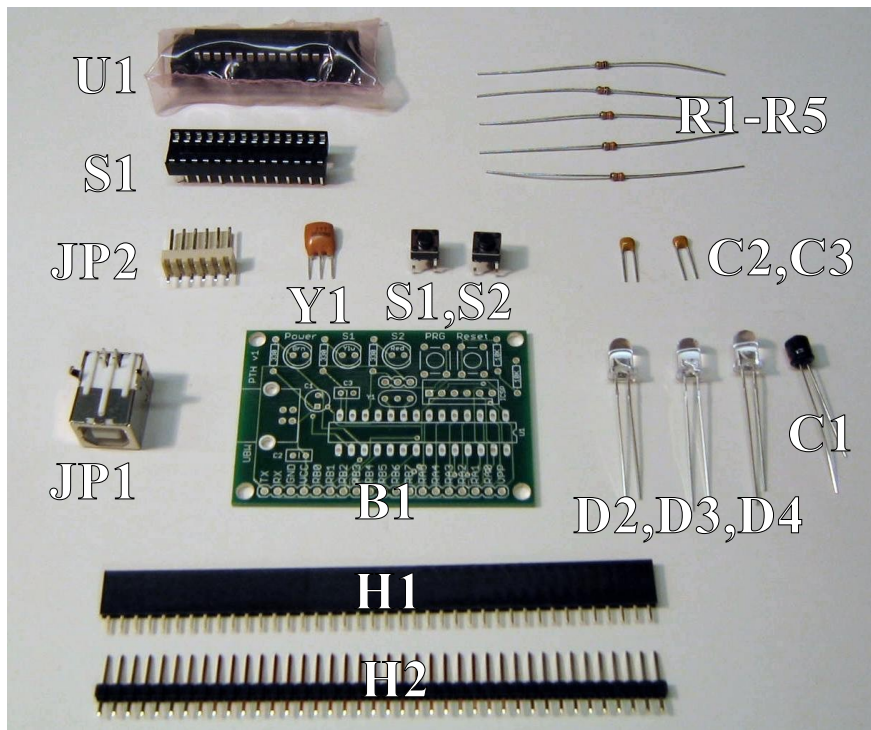
If you want to follow a step-by step approach to building the UBW use the step-by-step instructions below. Please refer to the schematic and board layout at the end of this document as you are assembling your UBW.

## Supplies needed to build the kit:

- 1) The kit from SparkFun with everything in it.
- 2) A soldering iron (almost any will do, as long as it is made for electronic assembly – not shown in illustration)
- 3) A side-cutting pliers (for cutting off extra part leads that stick below the board).
- 4) Needle nose pliers (optional)
- 5) Some solder. (use solder that is specifically for electronics)
- 6) A USB cable (not included with the kit, but any A to B cable will do)
- 7) The UBW website (<http://greta.dhs.org/UBW>) has the software for your PC.



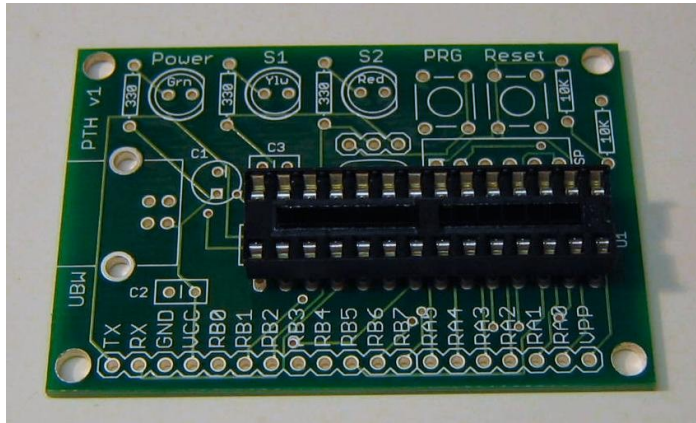
*Necessary Supplies*



*Step 1: Identify Kit Contents*

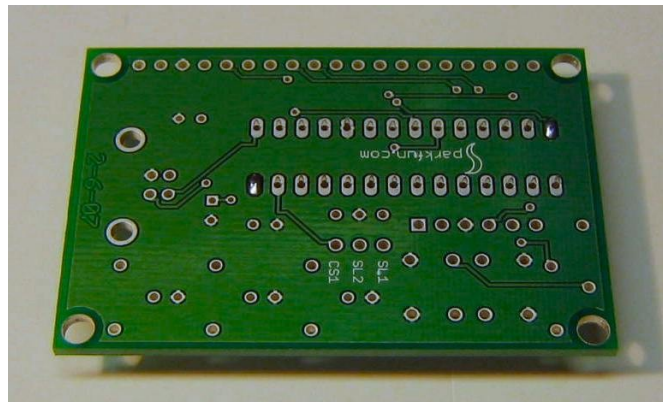
- Step 1:** Open up the kit bag, and make sure you have all of the parts shown here.
- 1 x PIC 18F2550 – preprogrammed with UBW Firmware D (U1)
  - 1 x 28 Pin DIP Socket (S1 – not on schematic)
  - 1 x 10uF Capacitor (C1)
  - 3 x LEDs (probably a red, amber, and blue) (D2, D3, D4 – all clear when off)
  - 2 x Momentary Switches (S1, S2)
  - 1 x Breakaway Female Header (H1 – not on schematic)
  - 1 x Breakaway Male Header (H2 – not on schematic)
  - 2 x 10K Resistor (R4, R5 – brown black orange)
  - 3 x 330 Ohm Resistor (R1, R2, R3 – orange orange brown)
  - 2 x 0.1uF Capacitor (C2, C3 – they probably say 104 on them)
  - 1 x 20MHz resonator (Y1)
  - 1 x ICSP Connector (JP2)
  - 1 x USB B Connector (JP1 – not labeled on schematic)
  - 1 x UBW PTH v1 board (B1)

**Step 2:** Take the DIP socket, and place it in the board. Note that there is a small notch (or U shape) on one end of the socket. By convention, this get inserted into the board on the same end as Pin 1 of the chip. (on the right in this image)



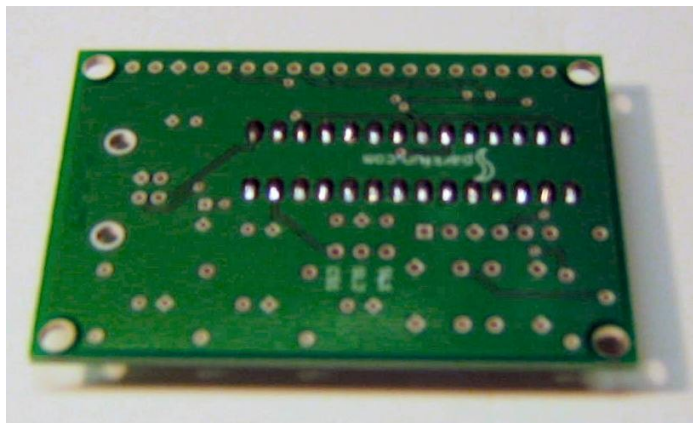
*Step 2: Place PIC socket into board.*

**Step 3:** Flip the board over, holding the socket in place. Set the socket and board down on your table. Solder opposite corners of the socket. Then look at the front of the board to be sure the socket is seated completely flush on the board. If not, re-heat the corner pins while pressing down on the socket to get it fully seated.



*Step 3: Solder corner pins on back of board.*

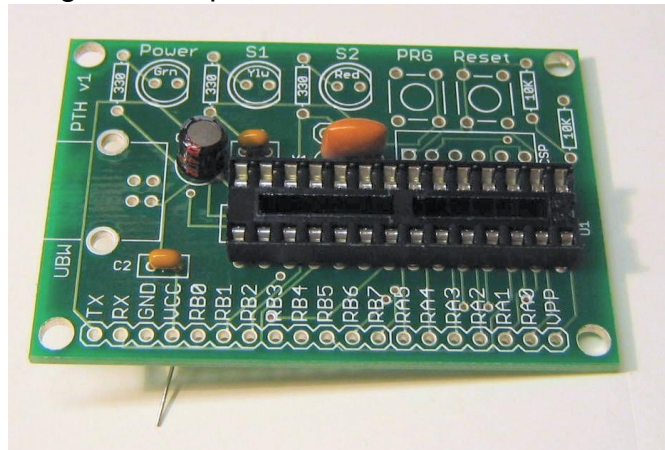
**Step 4:** Solder all of the rest of the socket pins.



*Step 4: Finish soldering all socket pins.*

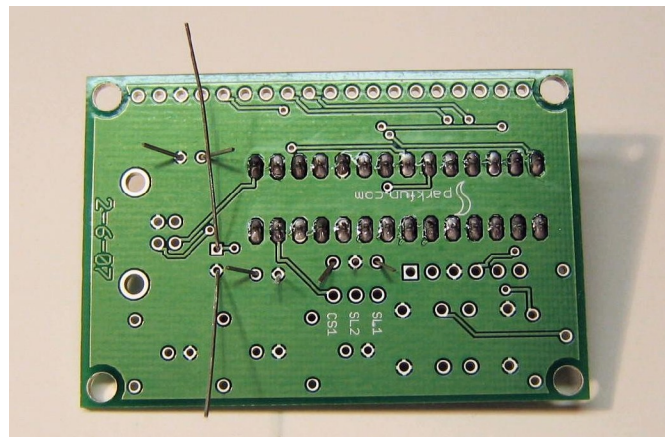


**Step 5:** Flip the board over to the front side, and insert the three capacitors and the 20MHz resonator. Note that the 10uF cap needs to go into the board the right way, with the negative lead in the hole that has a minus sign “-” next to it. (The top hole in the picture below.) You can tell which leads is the negative lead because it will have a white bar with minus signs on it on the outer plastic covering of the capacitor.



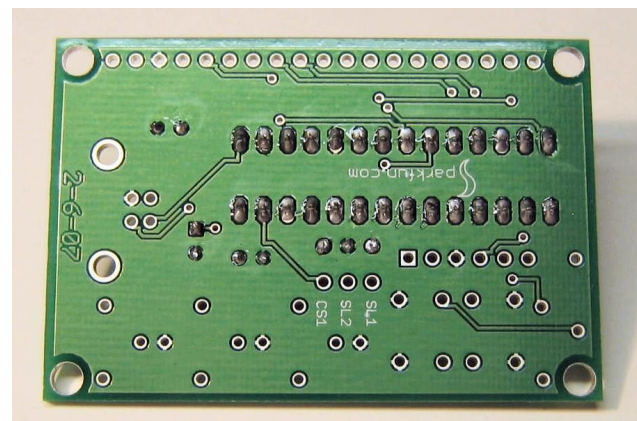
*Step 5: Insert capacitors.*

**Step 6:** Bend the leads of the capacitors and the resonator outward so they all stay in as you flip the board over.



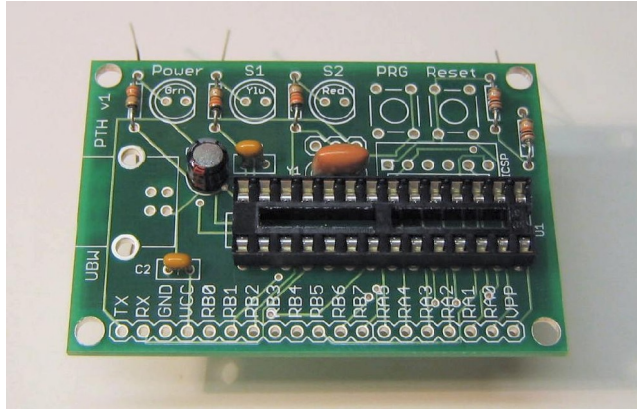
*Step 6: Bend capacitor leads so they stay in the board.*

**Step 7:** Solder the capacitors and the resonator, then use the side-cutting cutters to clip their leads.



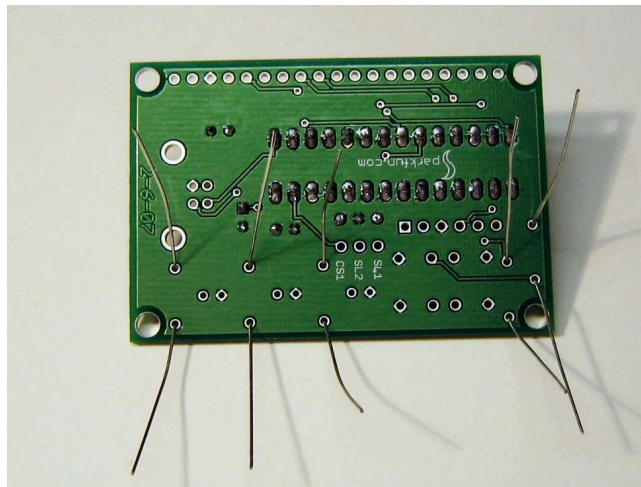
*Step 7: Solder and clip capacitor leads.*

**Step 8:** Inert the five resistors into their proper places on the board. R1, R2 and R3 are the three current limiting resistors for the three LEDs, and they are all 330 Ohms (orange, orange, brown). R4 and R5 are the pullup resistors for the two buttons, and they are 10K Ohms (brown, black, orange).



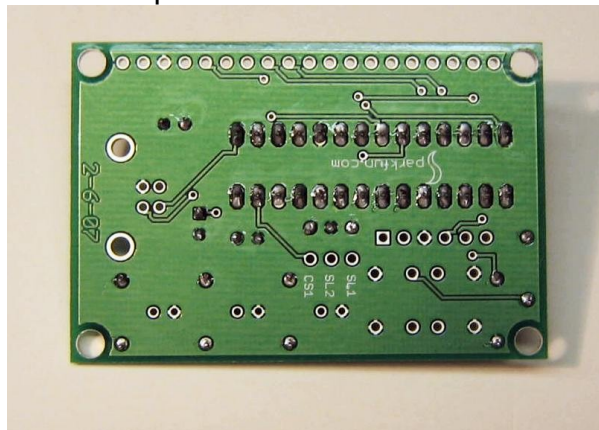
*Step 8: Insert resistors into board.*

**Step 9:** Bend the resistor leads on the back side of the board and flip it over.



*Step 9: Bend leads so resistors stay in the board.*

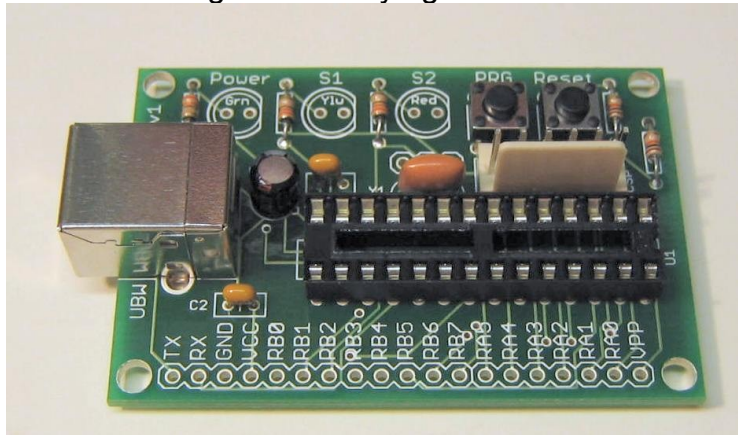
**Step 10:** Solder the resistors and clip their leads.



*Step 10: Solder and cut resistor leads.*

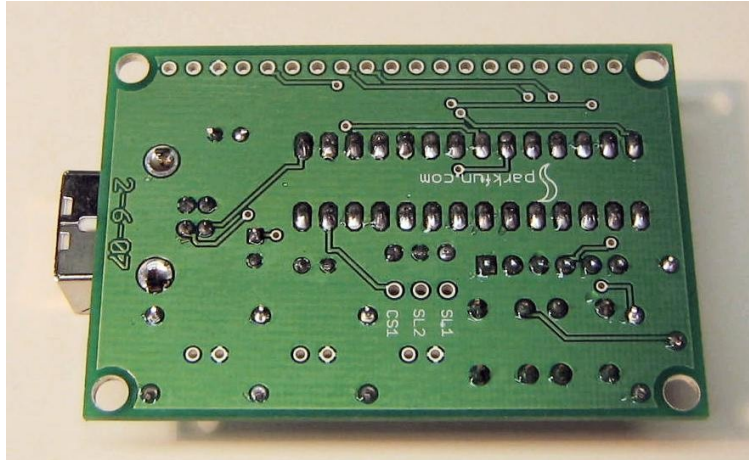
**Step 11:** Insert the USB connector, the two push buttons (S1 and S2) and the programming connector JP2. The USB connector will snap into its holes, as will the two push buttons. But you will have to hold the programming connector in as you flip over the board for the next step. Note that the programming connector is only needed if you plan to completely erase and re-program the PIC chip. If you are only going to use the built-in bootloader to re-program the PIC, then the programming connector is not needed and can be left off of the board.

NOTE: The two push buttons are NOT square. If you really force them, they can be inserted the 'wrong way' in their holes. This is a bad thing. If a switch is not going in smoothly and easily, pull it out and rotate it 90 degrees and try again.



*Step 11: Insert switches, USB socket and programming header.*

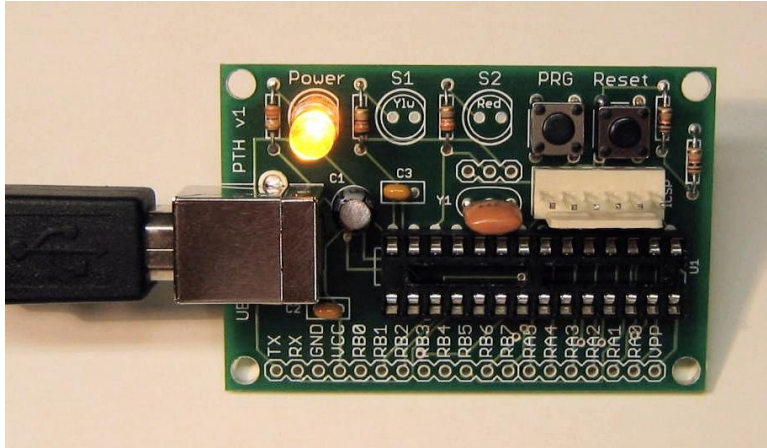
**Step 12:** Flip the board over and solder the USB connector, switches, and programming connector.



*Step 12: Solder switches, USB socket and programming header.*

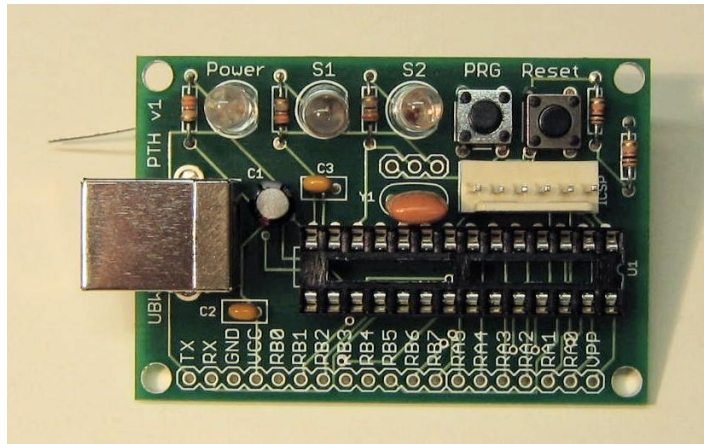


**Step 13:** Now you need to test each one of the three LEDs to see what color each one is. You do this by plugging a USB cable into the partially assembled UBW board and then into your computer. The USB cable will supply +5V to the Power LED. You can gently place each LED in turn into the Power LED holes and note the color of the LED. Also note that some LEDs are manufactured incorrectly, and they need to be rotated so that the flat on the LED does not match the flat on the UBW board. In the picture below, you can see that the Amber LED is being tested.



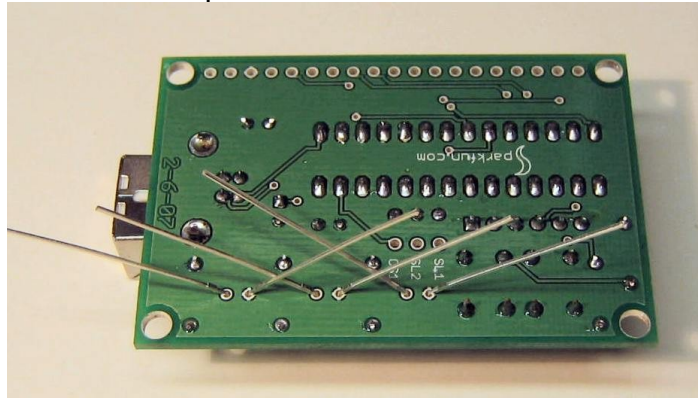
*Step 13: Test all 3 LEDs using 'Power' LED holes.*

**Step 14:** Insert the three LEDs into their proper locations now that you know what color and polarity each one is. S2 should be the Red LED, and S1 should be the Amber or sometimes Yellow LED. The Power LED will be either Green or Blue, depending upon what color of LED was included in your kit.



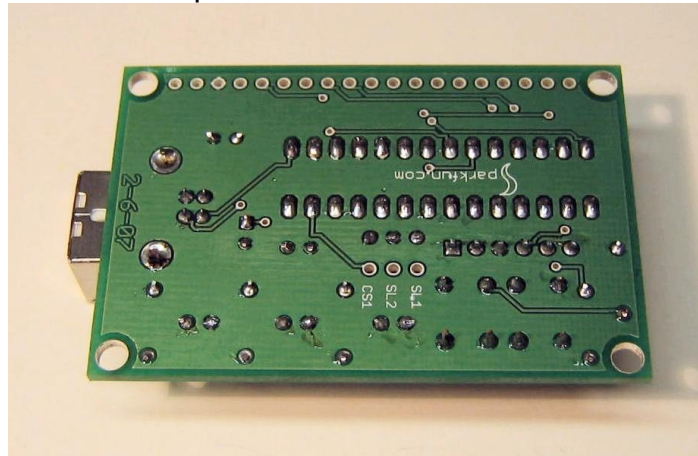
*Step 14: Insert LEDs.*

**Step 15:** Bend the LED leads and flip the board over.



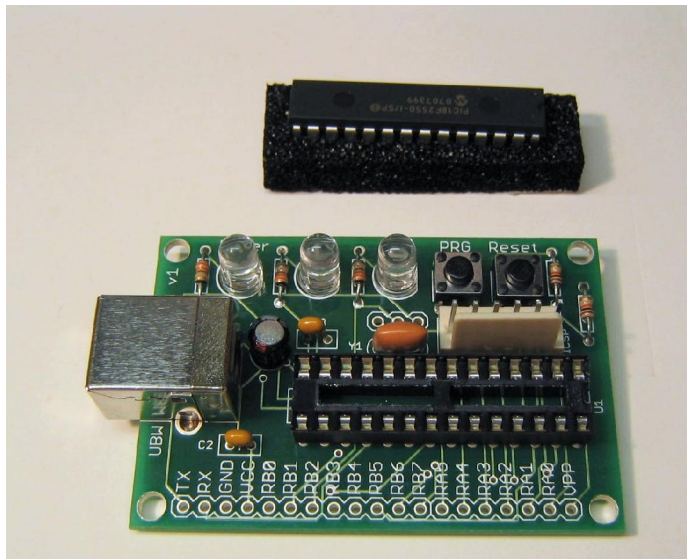
*Step 15: Bend LED leads so they stay in the board.*

**Step 16:** Solder the LEDs in and clip their leads.



*Step 16: Solder and cut LED leads.*

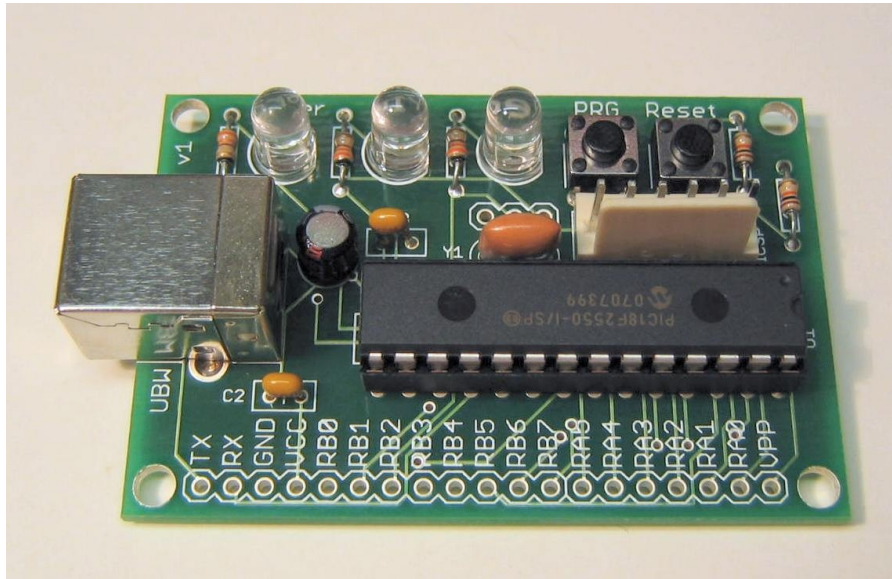
**Step 17:** Remove the programmed PIC chip from its protective bag if you haven't already done so. Note that there is a U shaped notch on one end of the PIC, and a small dimple or dot next to one of the corner pins on that side. This is Pin 1. Orient the PIC chip so that the U (the Pin 1 end) matches the U on the socket and the U on the UBW Board, all see on the right in the picture here.



*Step 17: Remove PIC from bag and identify pin 1.*

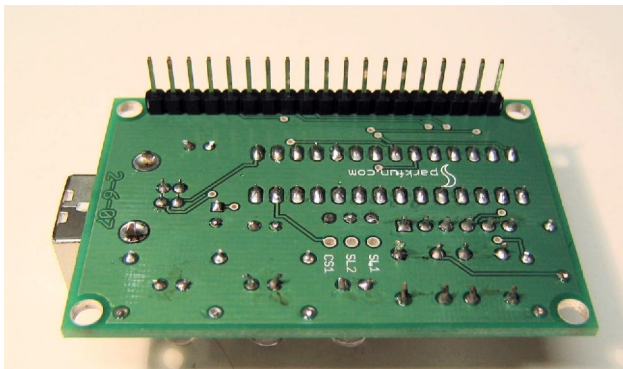


**Step 18:** Remove the PIC from its protective foam, and very gently insert it into the socket. Insure that no pins curl underneath the chip, and no pins flare outside of the socket. When you are sure all pins are in the proper holes (in the socket), push down to completely seat the PIC against the socket.

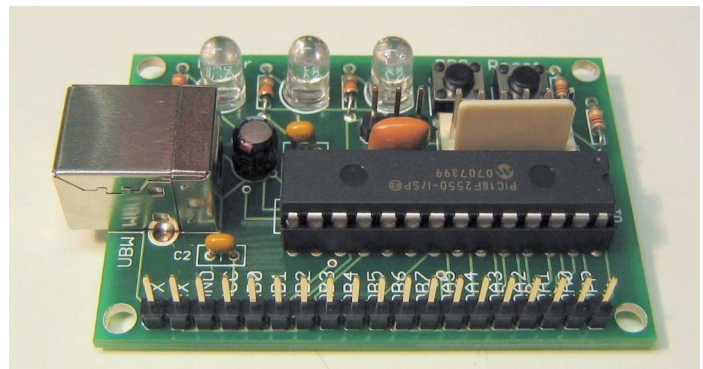


*Step 18: Insert PIC into socket.*

**Step 19:** You now have some choices about what headers (if any) you wish to place in your UBW. SparkFun includes enough female and male headers that you can create any combination of the two, and still have headers left over. If you want, you can leave all of the rest of the holes on the board empty, and directly solder wires into the holes as you hook up your UBW. Or you can use the following pictures as ideas for ways to combine the headers on the board.

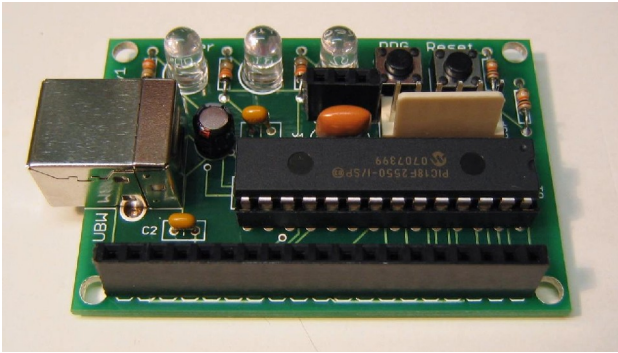


*Male headers pointing down.*

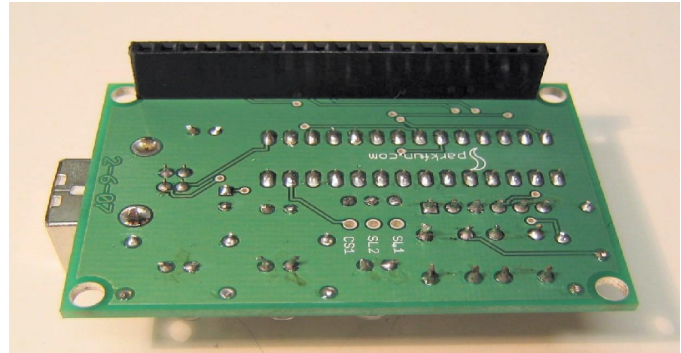


*Male headers pointing up.*

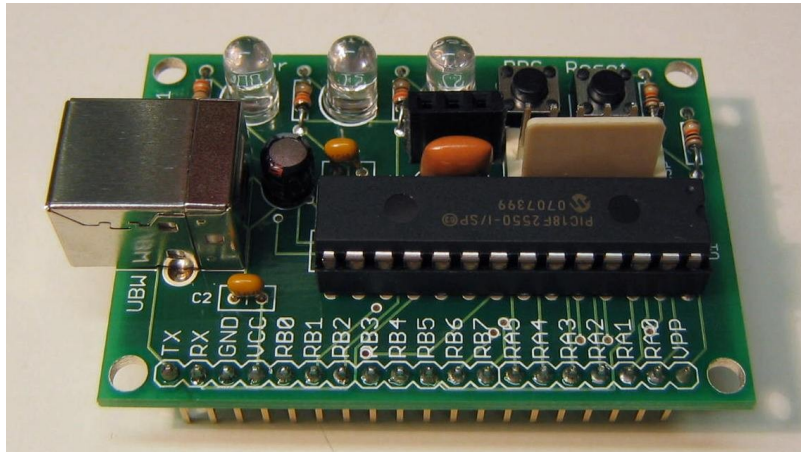
For this particular UBW, we wanted to plug it into a breadboard, so we put male headers pointing down for the row of holes on the side of the board, and female headers pointing up for the three extra pins in the middle of the board.



*Female headers pointing up.*



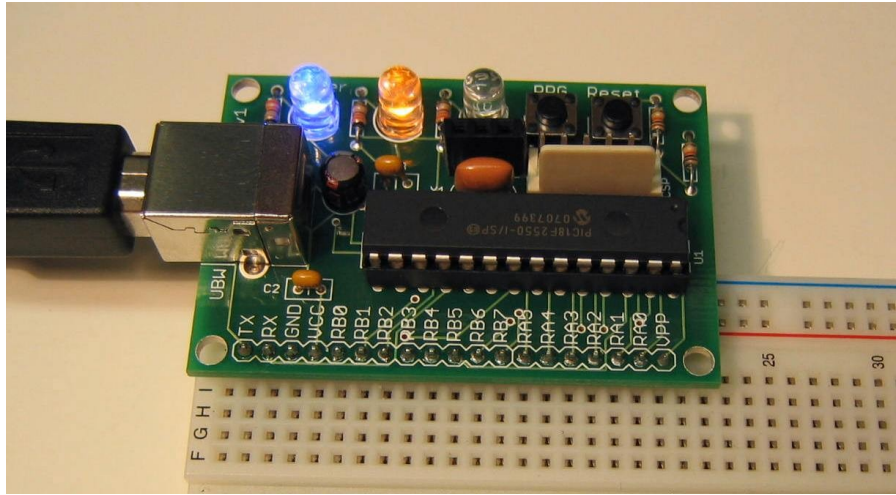
*Female headers pointing down.*



*Mixed headers.*

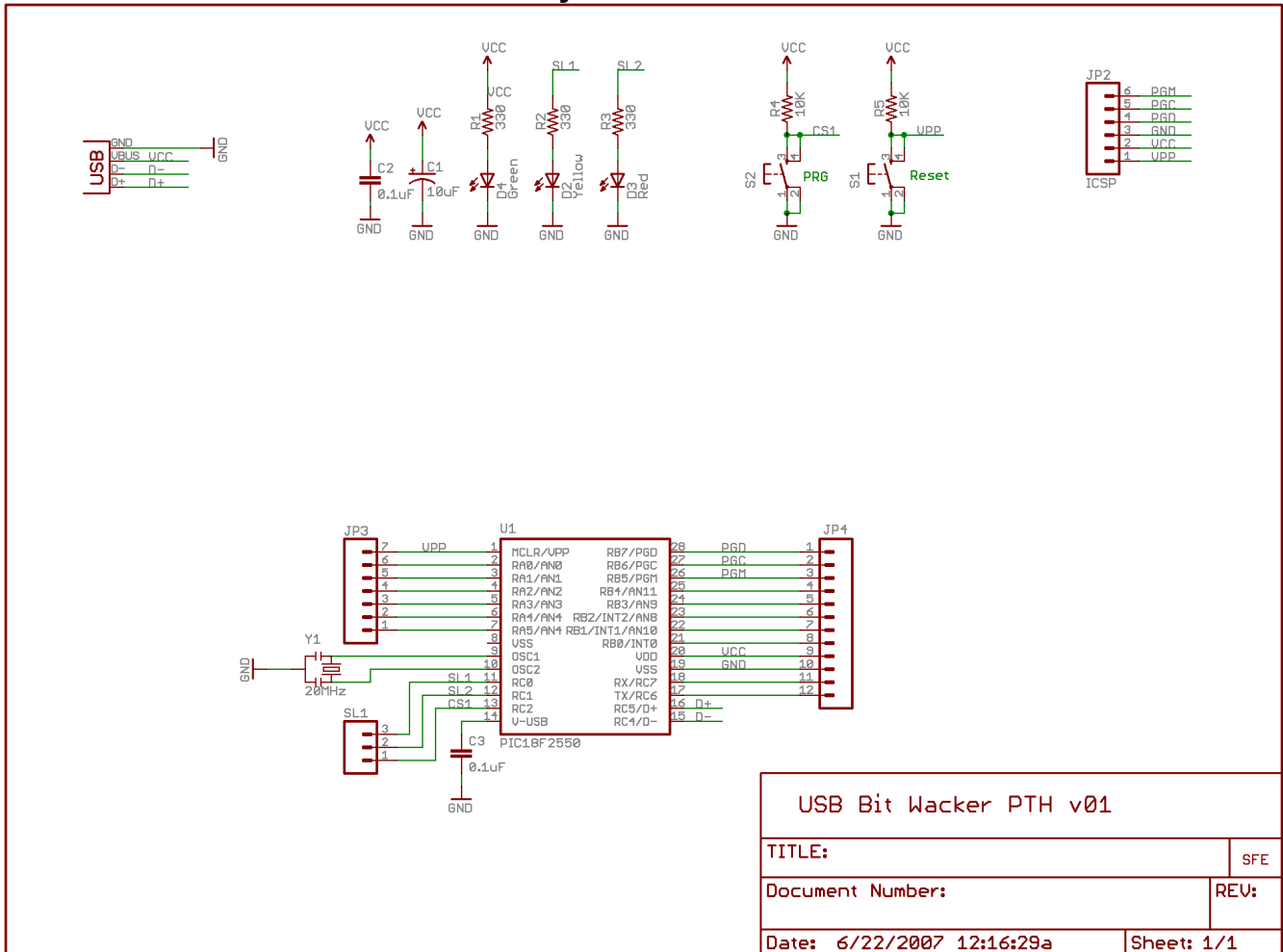
**Final Step:** The last thing to do is to plug your UBW into your computer. If you are using a PC running Windows, you will be prompted for a 'driver'. You need to download the mchpdcd.inf file and point Windows to it the first time you plug your UBW in. For Linux and Mac OS X, this step is not necessary. If all goes well, you should have the yellow LED blinking with two shorter blinks and then a longer pause. This indicates that the UBW is fully recognized by the computer, and you can open your favorite terminal emulator and type a "V" command (you will not see it on the screen as you type it) to the UBW, and you should get back something like "UBW FW D Version 1.4.1".

For complete software instructions, including complete source code, instructions on how to use the built in USB bootloader to download new firmware to your UBW, a complete command reference and sample Liberty Basic PC application code, and many additional documents, please see the UBW website at <http://greta.dhs.org/UBW>.



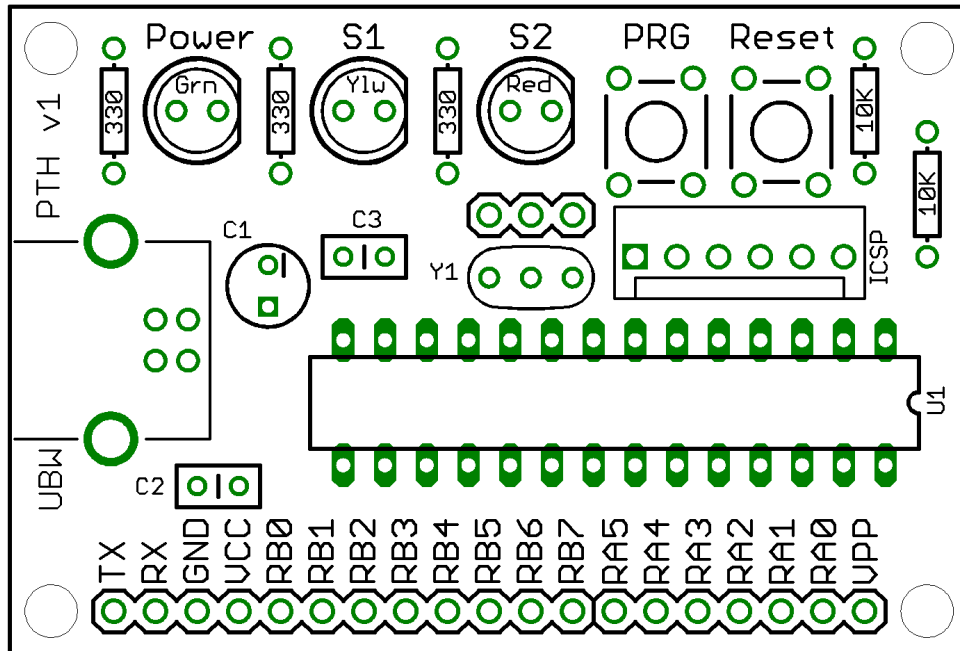
UBW Running and waiting to be built into some amazing project.

### UBW PTH v1 Schematic and Board Layout:



Notes on the Schematic: The schematic has an ICSP connector (JP2) which is the 6 pin connector located next to the two push buttons. You can use any PIC programmer to program the PIC using this connector if you want to replace the bootloader and put your own code on the PIC. Also, to simplify the schematic, the one long row of header holes along the side of the board are divided into two 'connectors' in the schematic (JP3, JP4). Don't let this fool you – there are not really two separate connectors, just one long row of holes.





Change List:

- 1.0 Original Release
- 1.1 Added note to push button assembly and schematic note.
- 1.2 Fixed some typos.