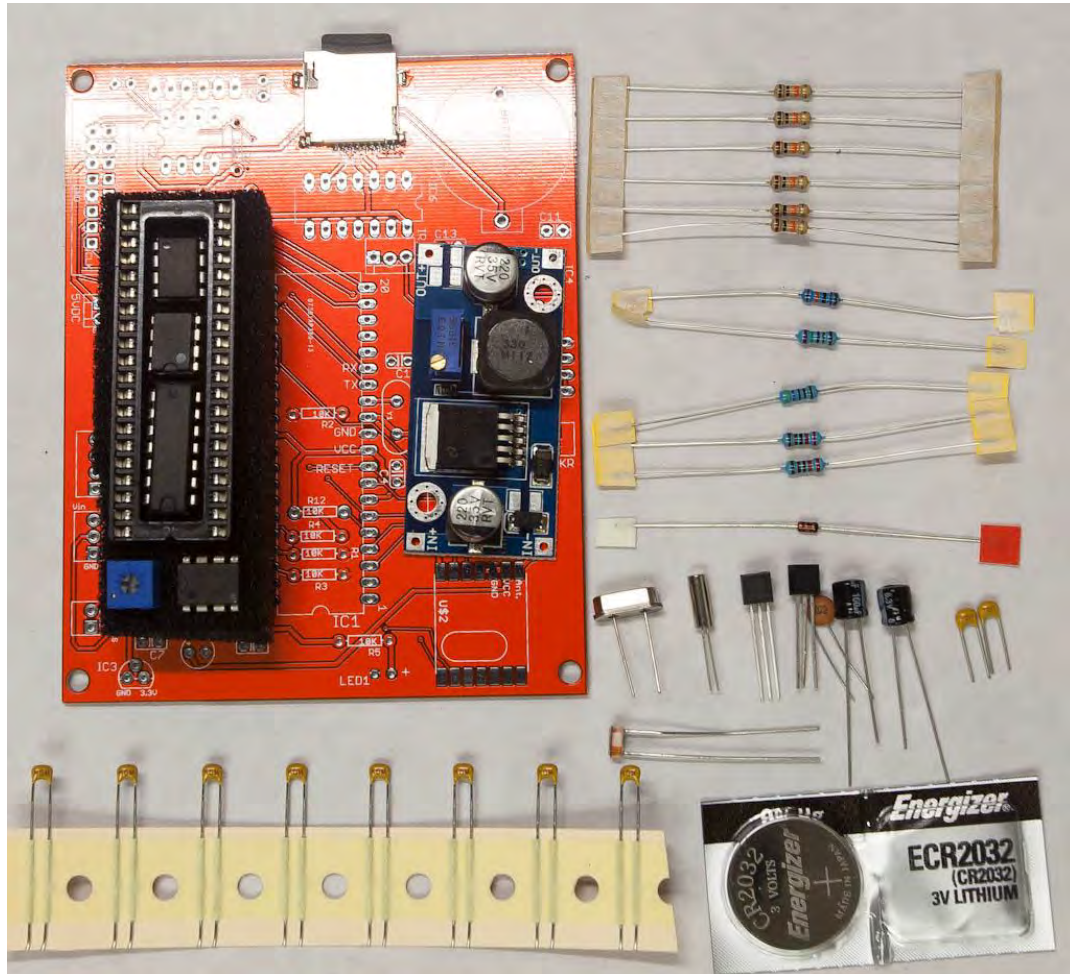
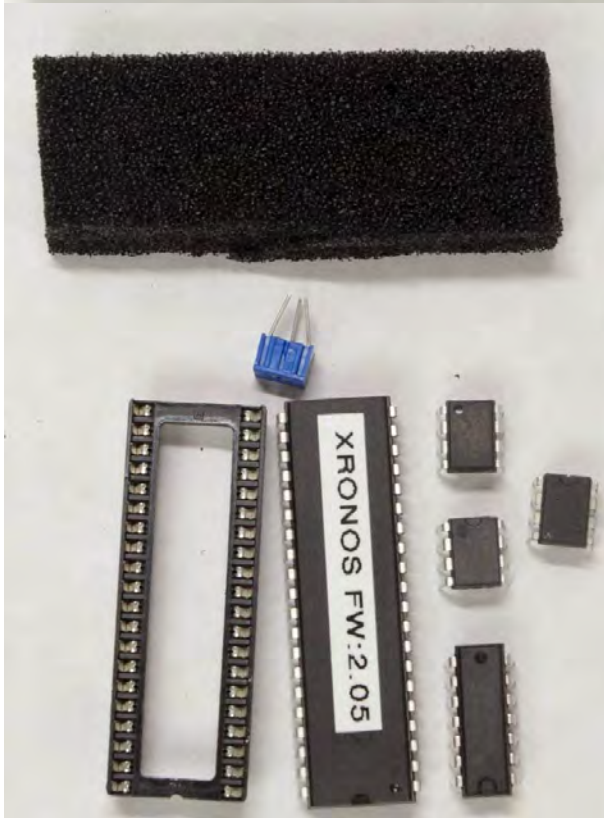
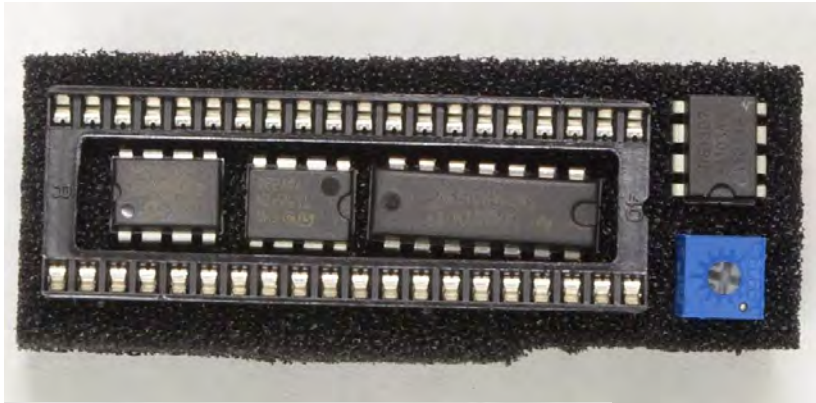


What's included:



- Antistatic bag contains:
 - ICs on foam block:



- ATmega1284p microprocessor w/ firmware (40 pin)
- 40 pin IC socket



- SN74AHC125N Quad buffer(14 pin)



- DS1308 RTC (8 pin)



- MCP4921 DAC (8 pin)



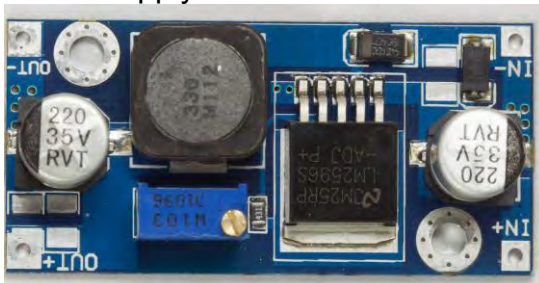
- TS922IN OpAmp (8 pin)



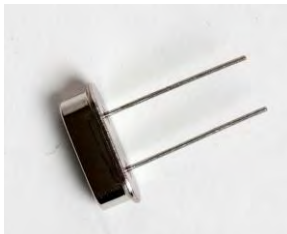
- Trim pot (10K)



- PCB Board w/ soldered microSD socket and 256Mb microSD card
- CR2032 3 V battery
- Power supply module



- 16 MHz Oscillator crystal



- 32.758Khz Oscillator crystal



- 2x100uF electrolytic Capacitors



- DS18B20 temperature sensor IC

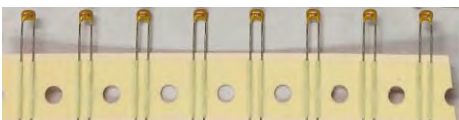


- 3.3V volt reg IC (Yes looks almost identical to DS18B20)



- 8 pcs 0.1uF ceramic caps (104)

Can be two types. Either yellow “dipped”



or orange:



- 2 pcs 22pF ceramic caps

Can be two types. Either yellow “dipped”:



or orange:



- 0.01uF ceramic capacitor (103)



- Photoresistor



- Diode 1N4148



- 6 pcs 10K resistors (ceramic)



- 2 pcs 2.2K resistors (metal film, bluish color)



- 100K resistor (metal film, bluish color)



- 1.5K resistor (metal film, bluish color)



- 4.7K resistor (metal film, bluish color)



- **Bag with headers:**



- Battery holder



- 2x8 IDC box header



- DC jack



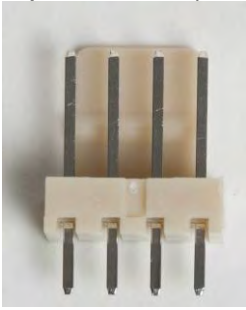
- 6 pin male pin 90 degree header (FTDI)



- 3 pcs 2 pin headers (for power, spkr, photo sensor)



- 4 pin header (for buttons)



- 3 pin header (for temperature)



- Small button (reset)



- **Bag with nuts and bolts (hardware)**



- 4 pcs 8-32 3-1/2" machine screws (longest screws in package)
- 4 pcs 8-32 Acorn nuts



- 9/16" 4-40 machine screw (longest of 4-40 screws)
- 4 pcs 1/2" 4-40 machine screws (slightly shorter than 9/16")
- 10 pcs 4-40 5/16" machine screws

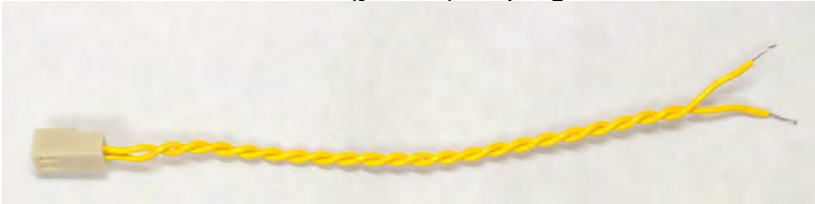
- 10 pcs 4-40 3/16" machine screws (shortest of 4-40 screws)
- 6 pcs 1/4" 4-40 alum hex standoffs (shortest)
- 4 pcs 3/8" 4-40 alum hex standoffs (longest)
- 5 pcs 4-40 hex nuts

- **Cables:**

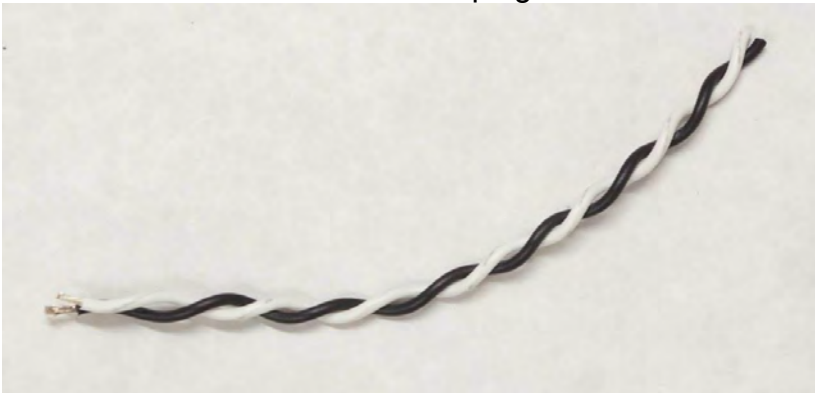
- 2 pcs two color (polarized) 2 wire cables w/ plug (wires of various colors, one always striped)



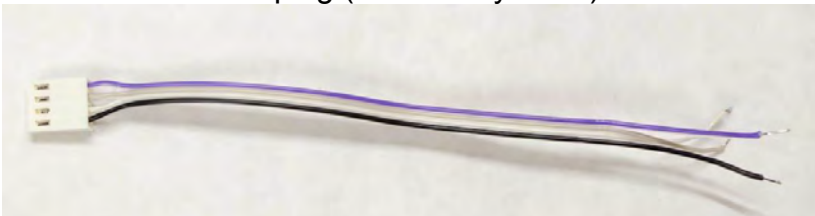
- 2 wire same color cable (yellow) w/ plug



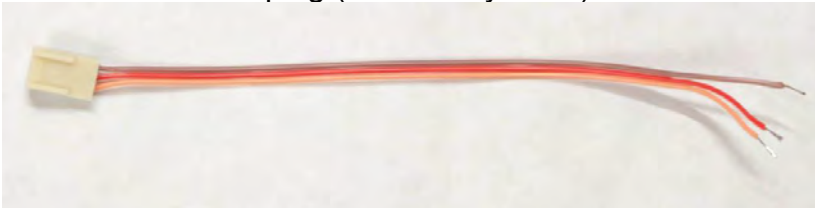
- 2 wire 2 color thick cable without plug



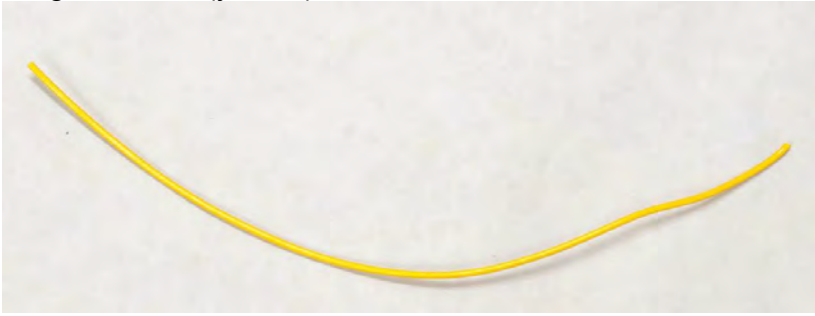
- 4 wire flat cable w/ plug (colors may differ)



- 3 wire flat cable w/plug (colors may differ)



- Single 6" wire (yellow)



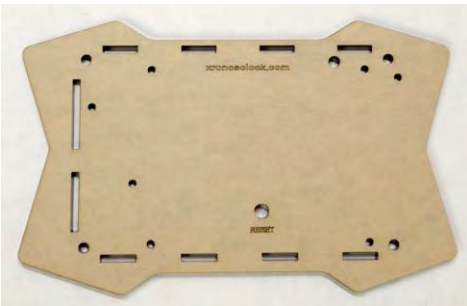
- Speaker (8 Ohm)



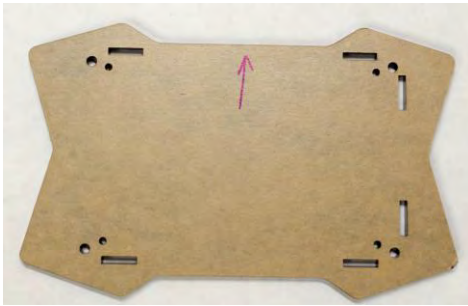
- 3 Arcade buttons



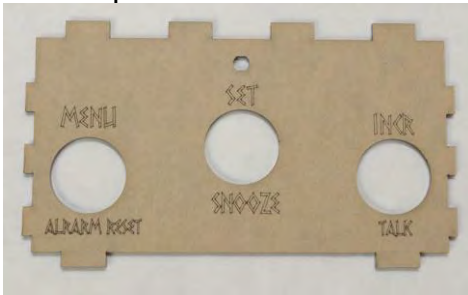
- Enclosure:
 - Back



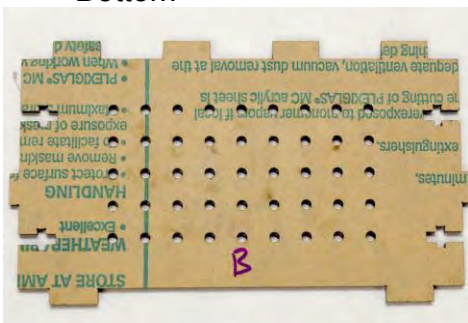
- Front



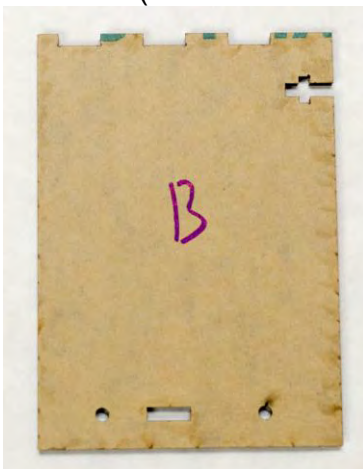
- Faceplate
- Top



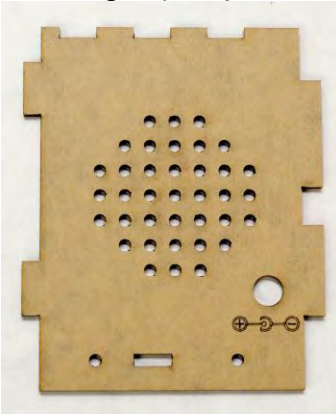
- Bottom



- Left (maintenance door)



- Right (w/ speaker holes and DC jack hole)



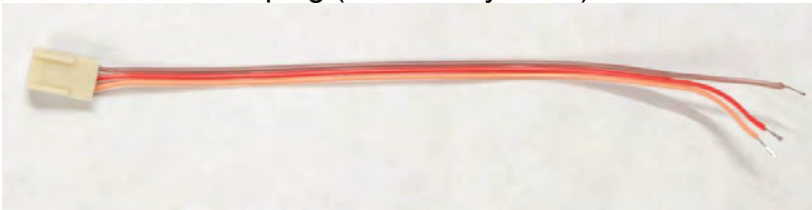
- 16x32 LED Display
- DC Wall power supply
- Q-tips

Infrared Kit (Optional)

- 3-pin header



- 3 wire flat cable w/plug (colors may differ)



- IR Receiver (38kHz)



- Remote control



RFM Kit (Optional)

- RMF12B Receiver (915Mhz)



- SN74AHC125N Quad buffer(14 pin)



-

- 10K resistor



- Wire antenna

PCB Assembly

Note: Some components (diode, electrolytic caps, ICs) are polarized and have to be inserted/soldered right way. Failure to do so will result in board damage!

Resistors and ceramic disk capacitors are not polarized and doesn't mattered which way solders.

Parts:

- All parts contained in antistatic bag (see “what’s included section for all parts descriptions and pictures)
- All parts contained in headers bag (see “what’s included section for all parts descriptions and pictures)

Required tools/supplies:

- Good Soldering iron with small tip
- Resin core solder (thin diameter, i.e. 0.032”)
- Small Diagonal cutters (Xcelite are best!)



Recommended tools:

- **Locking metal tweezers.** I HIGHLY recommend getting one if you don’t have it! One of the most useful tools during assembly. It will hold tricky components in place and take damaging heat away from ICs.



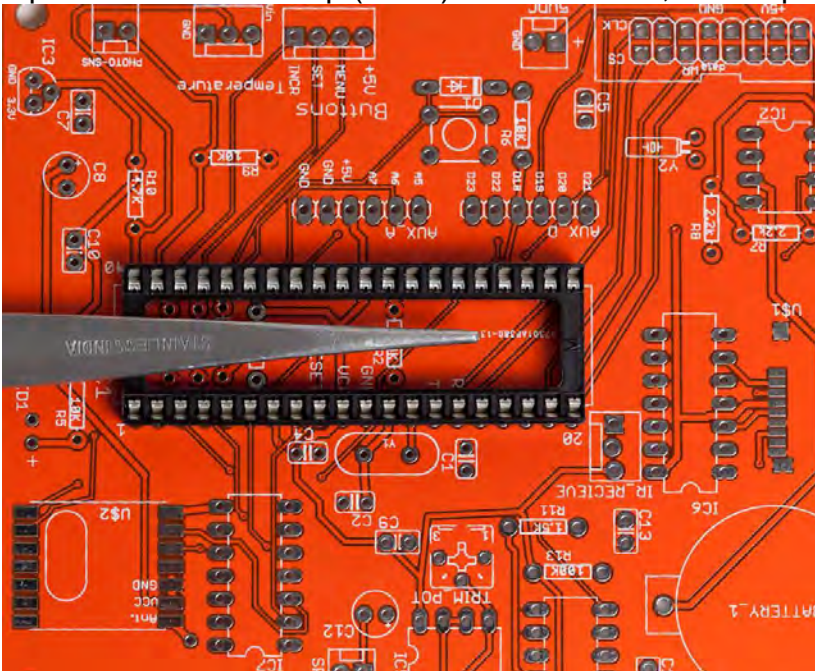
- Safety glasses/goggles. I wear them every single time I solder. Hot flux will splatter and can damage your eyes. You cannot replace your eyes!
- Wire stripping tool for small gauge wire (AWG24-30)
- Needle nose pliers
- Soldering vice or 3rd hand tool
- FTID Adapter (to check if your board is working in step 1)
- Fumes extractor

Assembly process

Order you assemble board is up to you. I've organized in parts to make it easier to check your work and troubleshoot before you go too far. For example Part I describes minimum number of components needed to get microprocessor going which you can check with FTDI Adapter (not included). There's nothing worse than spending 2 hours soldering everything and then finding out that you put a capacitor wrong way in Part II. *Note: Only one 40 pin IC socket is included, however it's totally ok to use your own IC sockets for other chips, as it will make soldering process safer and you'll be able to reposition ICs in case you inserted it wrong way.*

Part I: Microprocessor

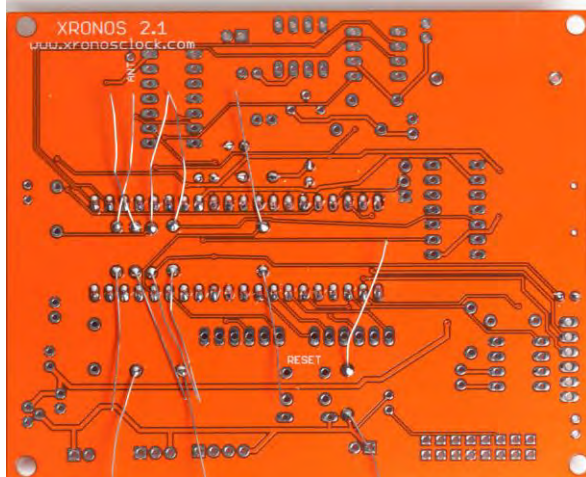
1. Align 40 pin socket notch and insert into PCB. Flip around and making sure all pins are fully in solder 2 from opposite ends. Insert into wise and solder rest
Tip: Set iron to hot temp (374C) Solder in rows, clean tip after each row (20 pins)



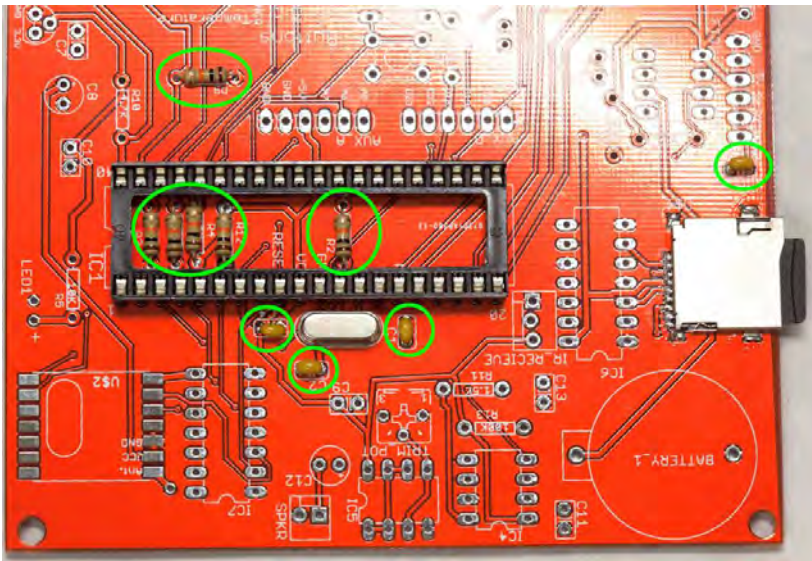
2. 10K Resistors
 1. Unpackage 10K resistors
 2. bend legs at base to straight angle
 3. insert to R1,R2,R3,R4,R9, R12 bending leads outwards after each so they stay in.

Note: It's difficult to see R1 location because label is blocked by IC socket. R1 is located between R4 and R3. To make things easier ALL resistors that fit inside IC socket are 10K resistors!

4. Turn PCB around and solder all



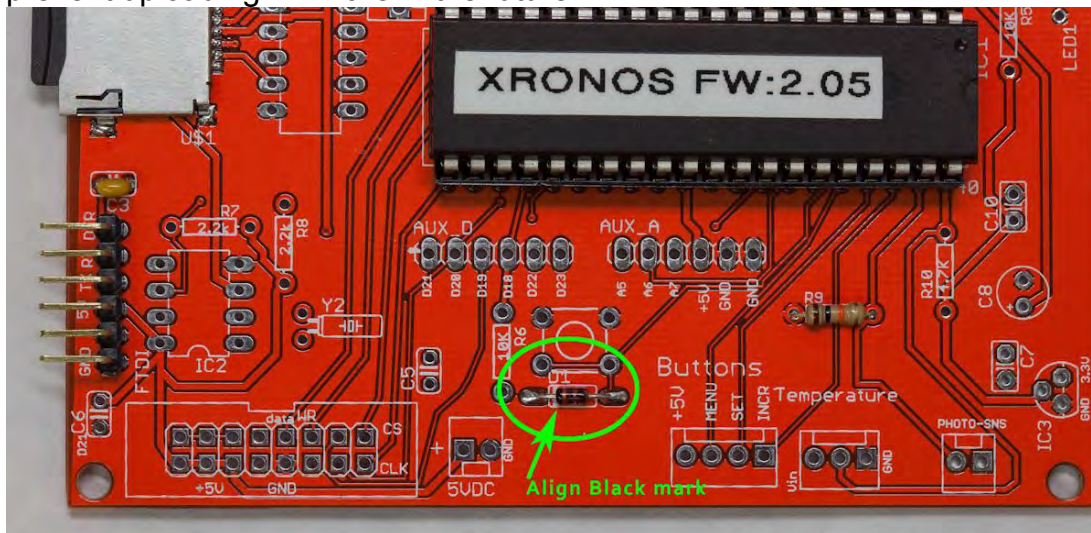
5. Trim leads
3. Insert Y1 16Mhz OSC
4. Insert C1 and C2 22pF ceramic capacitors (marked as 22 or 220)
5. Insert C3 and C4 0.1uF ceramic capacitors (marked as 104)
6. Solder above and trim leads



Picture above shows R1-R4,R9,R12, C1-C4 and Y1 soldered.

7. Take diode D1 and note which side has black ring! Align it as marked on D1 silkscreen image, insert, bend leads, solder, trim. Failure to align it right way will

prevent uploading firmware in the future.



8. Insert FTDI header from top, hold with tweezers, flip over and solder
Tip: Use very high temp setting on iron, especially for ground pins.
9. Take microprocessor chip and bend all pins slightly inward so it will fit 40 pin socket. I usually hold it by edges, press one side of pins flat on the table and push slightly until the bend, just a tiny bit. Make sure you keep pressure even. Do this on the other side until chip's leads align with socket holes.



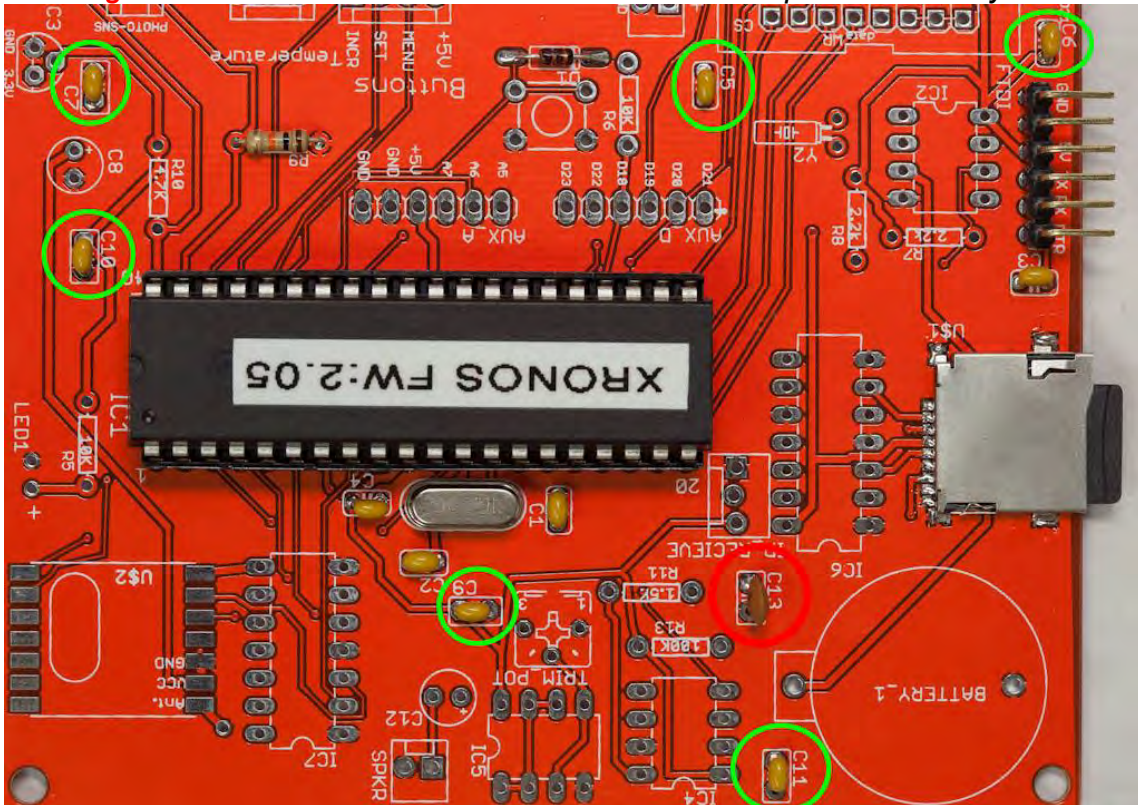
VERY IMPORTANT, align chip correctly, first pin is where notch is, it should resemble outline on the PCB board. Now carefully insert chip and press evenly until it slides in. Look close to see if any pins bent or came out of socket (if you find any remove chip with chip extractor or flat screwdriver and straighten pins).

10. If you have **FTDI adapter** now is good time to check if board is working at this point. Connect it to computer and using serial monitor from Arduino IDE, or any terminal emulator program (set to 115200 baud and correct COM port) you should get message on the screen (i.e. RTC set system time. SD card error.). Don't worry about SD Card error, we didn't assemble all components for it yet :)

If you don't see any message, and you sure your FTDI adapter is working, check if chip is aligned correctly. Check all components. Refer to schematic on xronosclock.com site. Or ask us on forum for help.

Part II: microSD reader and Audio

1. Solder C13 0.01uF (code103) ceramic capacitor. Please note this one is different from the rest of ceramic capacitors!!!
 2. Solder 6 remaining 0.1uF capacitors (code 104) to C5, C6, C7, C9, C10, C11
- Warning!** C13 IS Different value! Do not solder 0.1uf capacitor there by mistake.

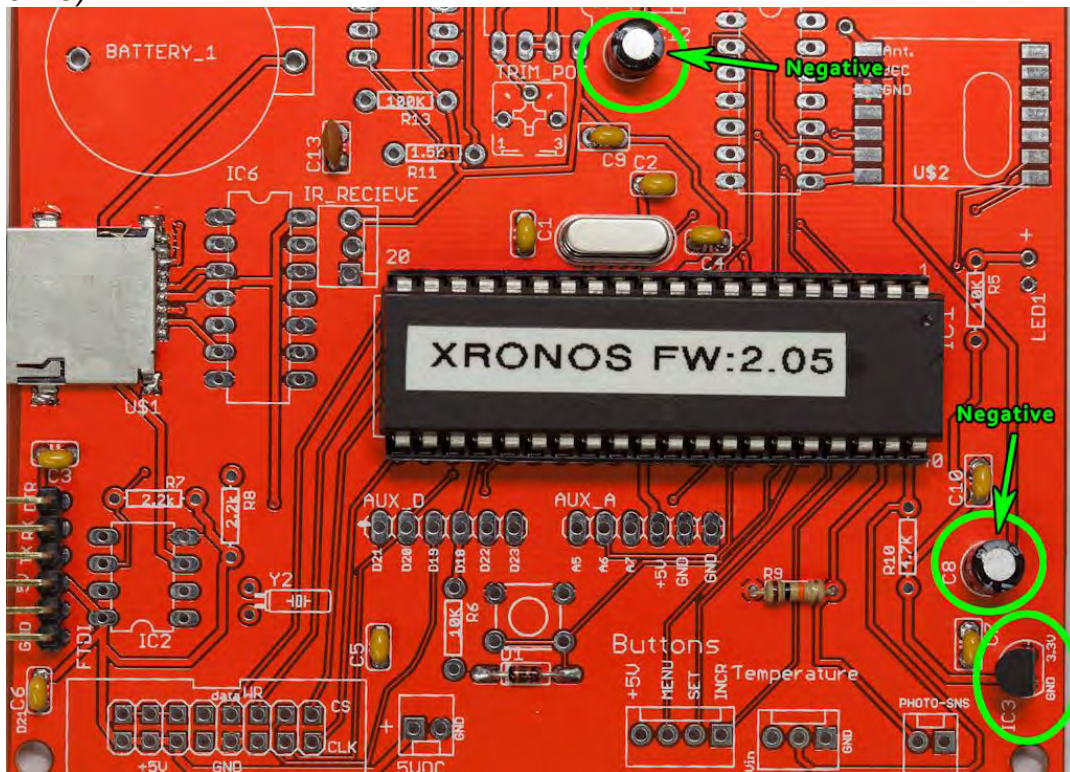


3. Now we'll solder 2 cylindrical electrolytic capacitors C8 & C12. **They are polarized** so make sure you put them right way. Longer leg is positive, insert into hole marked +. Negative part also has white stripe on the body. See picture below:
4. Now solder 3.3V voltage regulator to IC3. It looks identical to temp sensor, so read marking, it will say 1700. It's important to insert it right way, follow outline on PCB.

Warning: IC3 is sensitive to static, wear antistatic wrist band!

Warning: Do not overheat! Use lower setting on soldering iron (no more than 360

5. C)



6. Take Quad buffer chip IC6 (SN74AHC125N) and bend its legs slightly inward (just like with main microprocessor) until they parallel to each other so it will fit the board. Pay attention to orientation notch, it's very important!

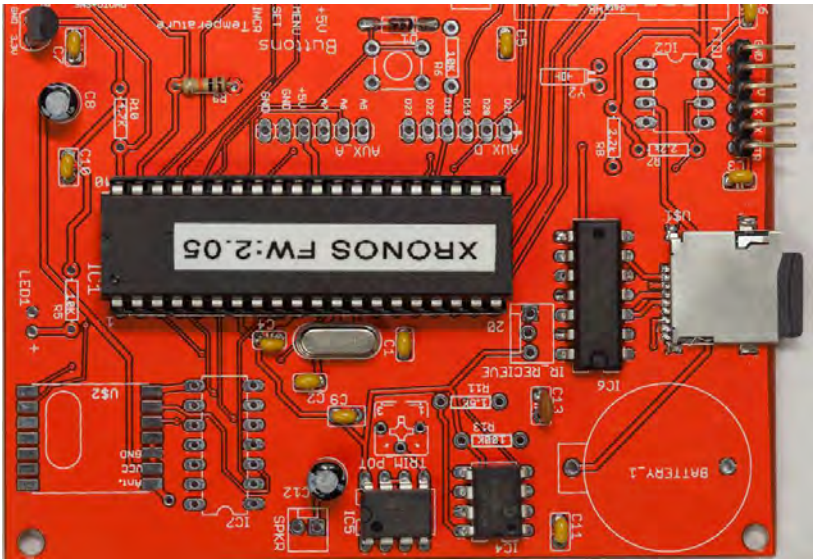
Note: It's ok to use IC Sockets for all chips, but we don't include them in the kit.

Warning: IC is sensitive to static, wear antistatic wrist band!

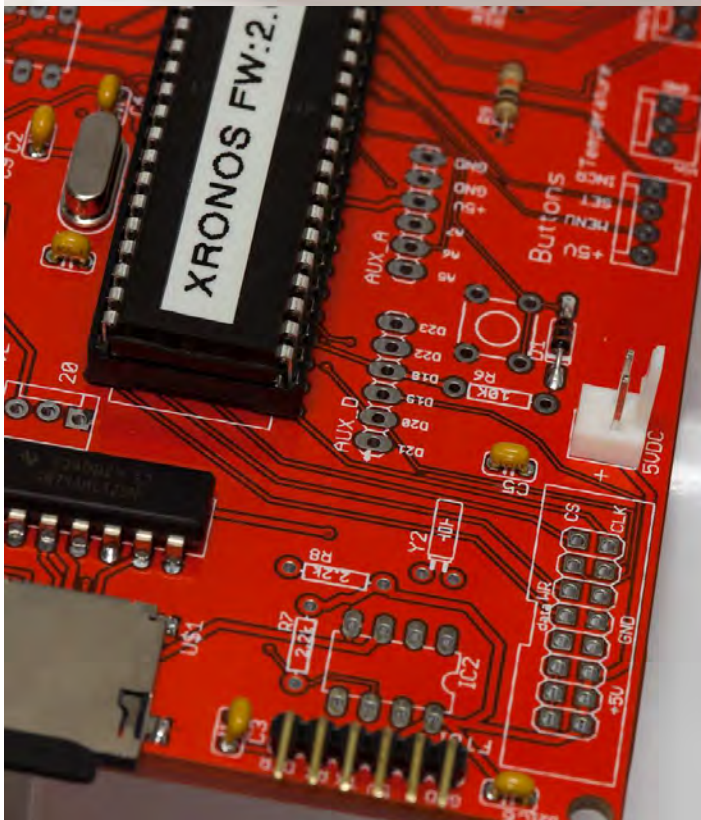
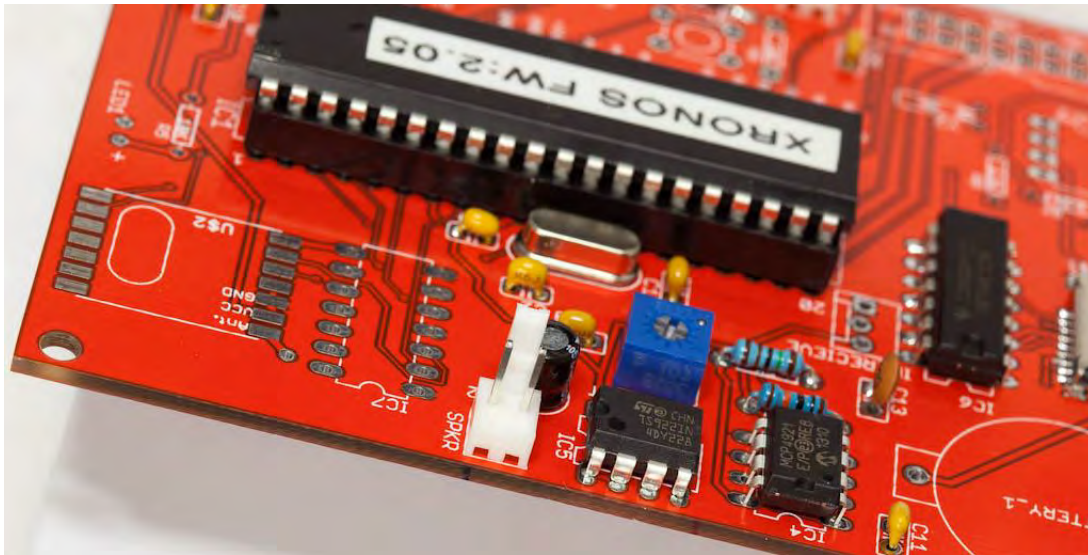
Warning: Do not overheat! Use lower setting on soldering iron (no more than 360C) and/or use locking tweezers to hold it and conduct heat away.

7. Solder IC5 (TS922IN). Use same precautions as with above.

8. Solder IC4 (MCP4921). Use same precautions as with above.



9. Insert and solder 3-pin blue trim pot
10. R13 and R11 are blue colored resistors. R11 is 1.5K (Brown, Green, Black, Brown, Brown) and R13 is 100K (brown, black, black, orange, brown). Solder these.
11. Next we will solder 2 pin header for speaker, and one for power (both marked on PCB). **Take special attention at polarity of these, especially power connector!** Smaller rectangle indicates plastic long back of the header. Note how power header faces way from edge of the board, and speaker go other way. See picture.

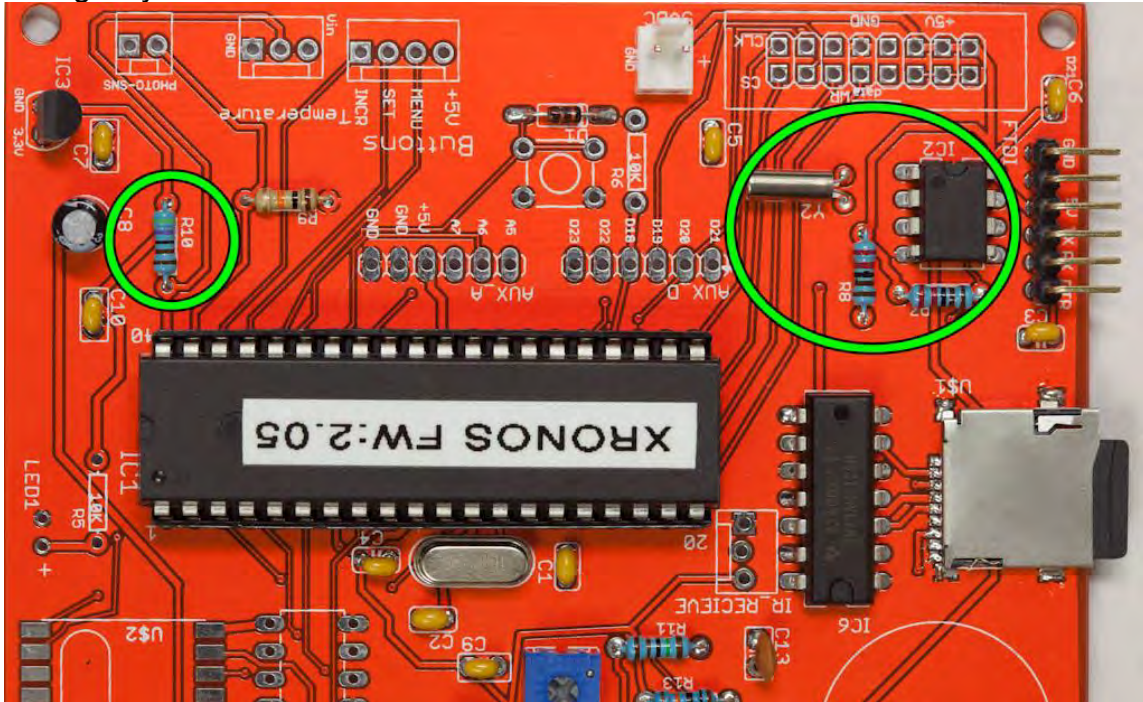


You can now test Audio! If you soldered connector to speaker and assembled power supply board (or you can power via FTDI) connect them and you should hear startup sound! **Adjust volume by turning trim pot (clockwise for louder)**. Ideally bring it to full volume.

Part III: RTC and rest

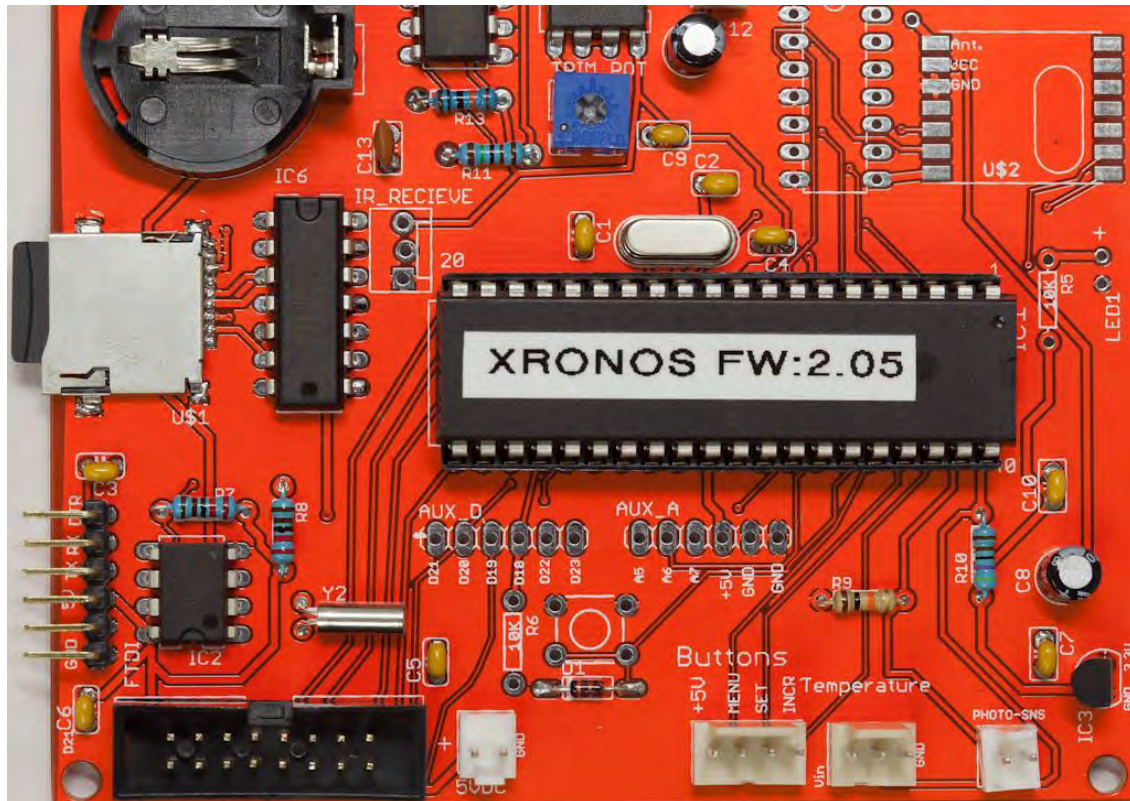
1. Solder remaining 3 blue resistors:

1. R7 & R8 2.2K (red, red, black, brown, brown)
2. R10 4.7K (yellow, violet, black, brown, brown)
2. Solder Y2 socillator (small metal cylinder)
3. Solder IC2 (DS1307) RTC chip. Orient it correctly! I made mistake of soldering it wrong way once and it started to smoke!

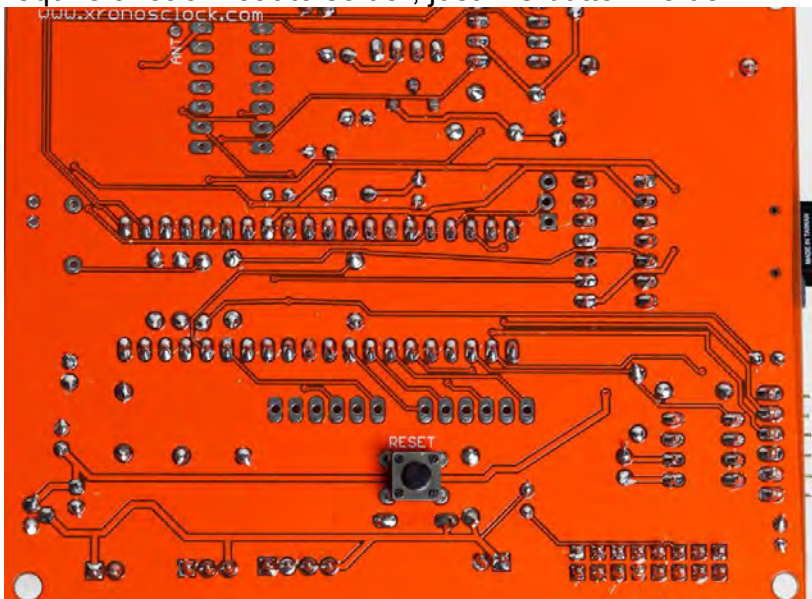


4. We'll finish up with headers. These are polarized, so solder them right way!!! Set soldering iron temp right, as these (especially IDC header) can be tough to solder. Also use locking tweezers to hold them in place.

1. Start with 2-pin Photo-sns header
2. Then do 3-pin (Temp) and 4-pin (buttons) headers next to it.
3. Solder big 8x2 IDC header
4. Solder battery holder. Negative terminal will require a lot of heat so set your iron to 390C



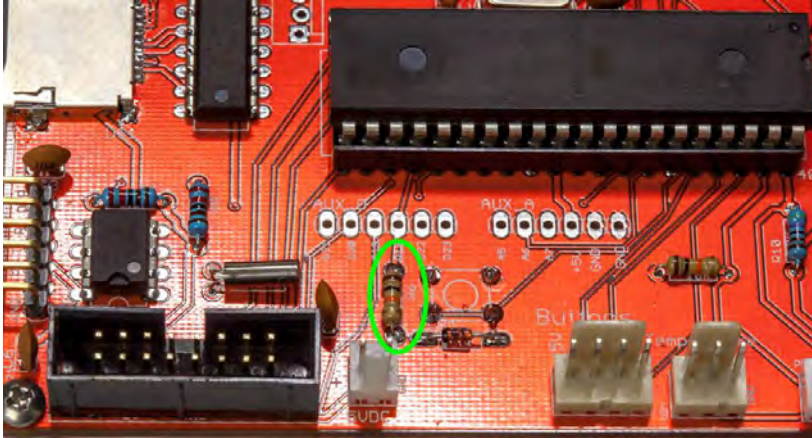
5. Finally last piece is reset button. Remember you need to insert it **from the back** of PCB unlike all other components. This is so it can be pressed from outside of clock enclosure. Its rectangular so should only insert one way. Negative pins will require a lot of heat to solder, just like button holder.



Part IV: OPTIONAL RM12B receiver and IR receiver

Please note: You must have Firmware version 2.06 or later in order for these accessories to work!

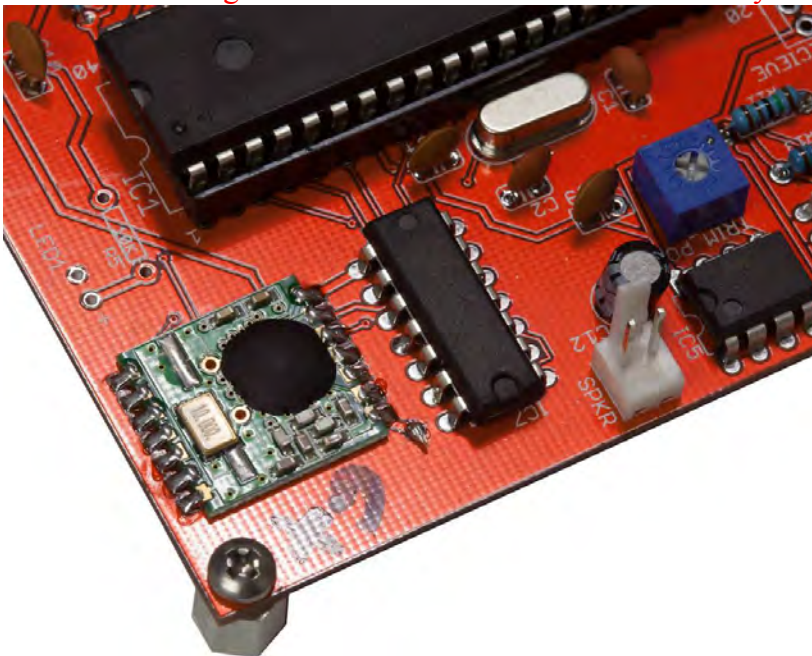
1. Solder R6 (10K) resistor



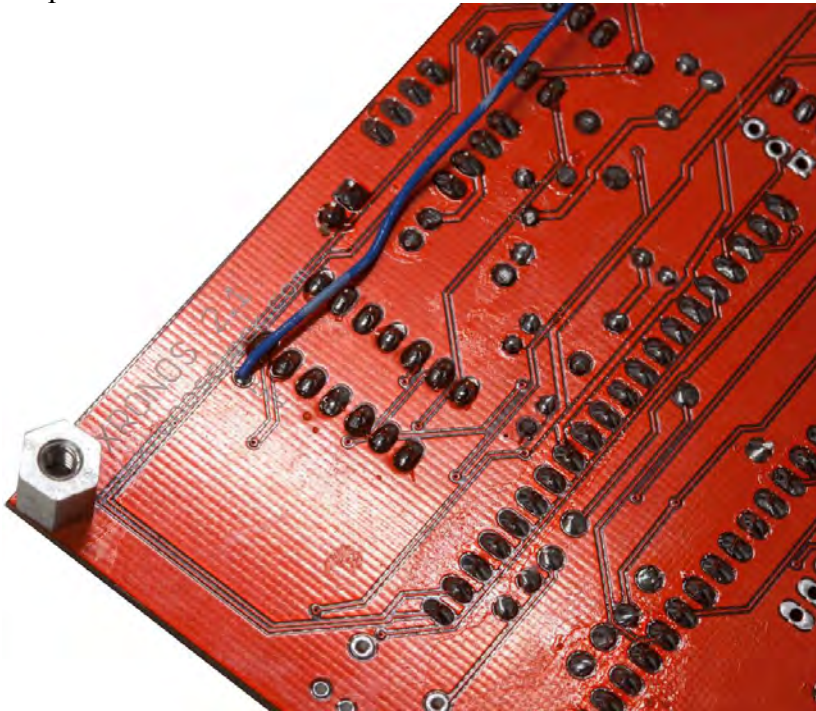
2. Note how bottom of RFM12B module will have an oval outline that matches one drawn on the PCB. You will follow that outline.
3. Do not place module on board yet. First put drop of solder on one of the pads on the PCB
4. Now place RFM12B module on board (following outline). Melt solder that you applied in step two and adjust module at the same time so all pads are aligned. Solder will hold it in place.
5. Now solder all pins.
6. Take Quad buffer chip IC7 (SN74AHC125N) and bend its legs slightly inward (just like with main microprocessor) so it will fit the board. Pay attention to orientation notch, it's very important!

Warning: IC is sensitive to static, wear antistatic wrist band!

Warning: Do not overheat! Use lower setting on soldering iron (no more than 360C) and/or use locking tweezers to hold it and conduct heat way.



7. Strip wire antenna from one end and solder it thru “antenna” hole on PCB



8. Finally if you purchased IR kit, solder 3 PIN header to IR_RECIEVE following board outline.



Temperature sensor

1. Find black 3 pin cylindrical IC that's marked DS18B20. Note that it looks identical to 3.3V regulator in your kit so don't mistake one for another!

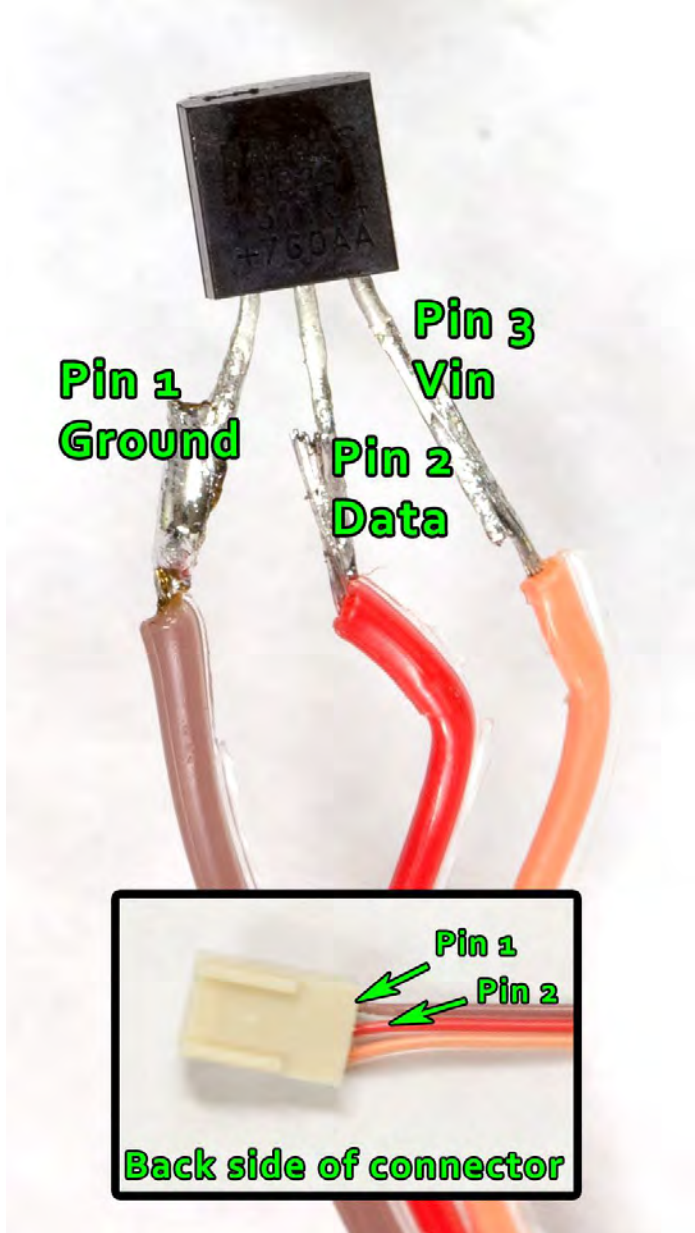


2. Shorten leads by cutting them off half way. Spread leads a little.

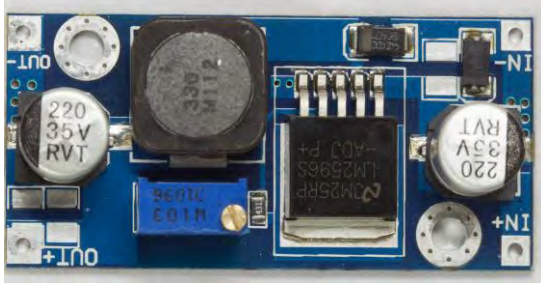


3. Set iron to lower heat and tin each lead
4. Take 3 pin flat and solder to sensor in correct order cable (colors vary, please check which pin goes where by following image below). Looking at flat face of the cylinder, left most lead is ground (despite it being marked with “+” on the chip), it goes to brown wire. Then rest will go in the order they are in the cable. Make sure you solder wires as parallel to the leads as possible. Pull slightly to make sure they are holding. You can also use heat shrinking tube if desired, but hot glue will keep them

separated when you attach to enclosure.



Power supply board



1. Take thick 2 wire two color cable, strip and tin both ends
3. Solder cable to DC jack as shown. If cable is Red/White, red will be positive. If its white and black, white is positive.

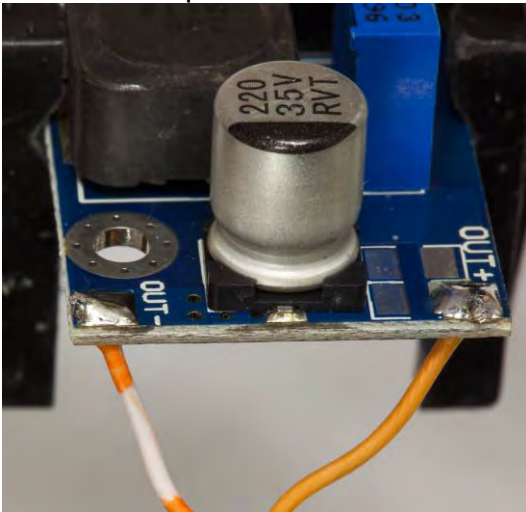


Note (on the pic above) how flat metal band is on the left side when positive terminal is on top.

4. Solder other two ends to power board to the IN part, using correct polarity.



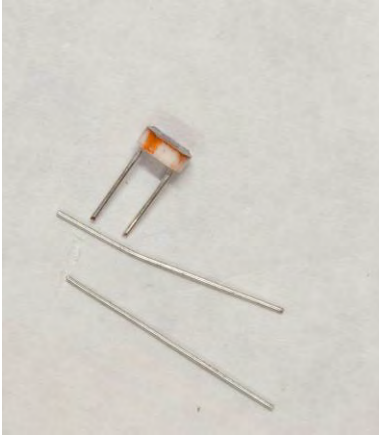
4. Take 2 wire two color cable (with plug already attached) and solder to the "OUT" holes on the power board. Solid color must go to OUT+, and striped to OUT-



5. Plug dc wall adapter to DC jack and with multimeter verify correct polarity and output voltage of 5V. If voltage is off, adjust screw of the blue pot (blue block) with small flat screwdriver.

Photo sensor

1. Trim leads



2. Tin leads
3. Take cable that has two wires of same color (yellow) and solder to photoresistor



Speaker

1. Tin speaker leads
2. Take two color two wire cable and solder, with solid color wire going to +



Note: Some speakers do not have polarity markings! In this case solder as in picture above, negative wire on top, positive on the bottom.

Test board

Now is a good time to test your circuit board if you haven't.

1. Plug in speaker cable into PCB Speaker jack (on top).
2. Plug in power supply board into PCB power jack (marked PWR)
3. Connect wall DC adapter to DC socket. Clock should make startup sound.

IR Receiver (Optional)

1. Trim IR receiver's 3 leads in half
2. As show in the picture below solder cable's pin 1 to IR receiver's pin 2 (middle)
3. Solder cable's pin 2 to IR pin 1
4. Finally solder remaining wire.



Paint enclosure lettering

This is the most tedious part. You'll need some patience but don't worry, it's not that hard 😊 You will need to get your own white Acrylic water based paint, as it's not included in the kit. You can buy small bottle in local Walmart or arts supply store (I use [Craft Smart paint](#) from Michaels) for about \$0.50



1. Peel protective paper from both sides of top (button) panel
2. Gently scrape remaining paper from letters
3. Wet q-tip in water and clean laser etched letters
4. Squeeze paint to a pallet (piece of paper, plastic, etc).
5. Dip another clean q-tip to paint and start filling in letters. Make sure you completely fill in all crevasses but try not to leave too much paint in other areas.
6. Let it dry for few minutes.
7. Now take a piece of soft rug, wet it slightly with water and start wiping off paint. Only paint should be left is inside etchings. Take a clean dry piece of soft cloth and wipe haze left by damp cloth
Tip: I recommend using 2 pieces of soft clean cloth, while you can also use paper towel it might scratch plastic!
8. Repeat 5-7 at least one more time, until text is clearly visible and looks nice.
9. Now repeat steps 1-7 with back and right panels. These have less engravings so you might not have to fill them more than once like with top panel.

Hot Glue

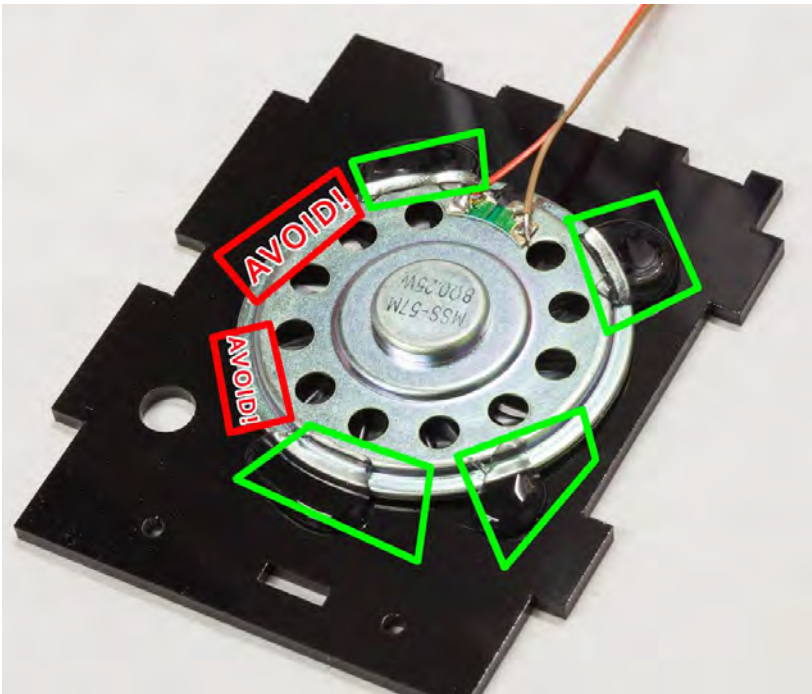
You will need to have a hot glue gun and some hot glue sticks for this. Any kind should work.

Before you begin keep in mind that:

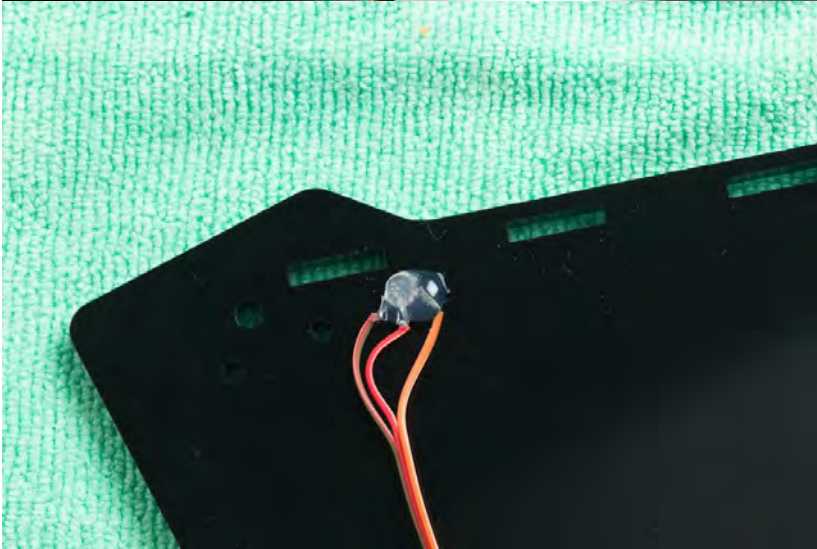
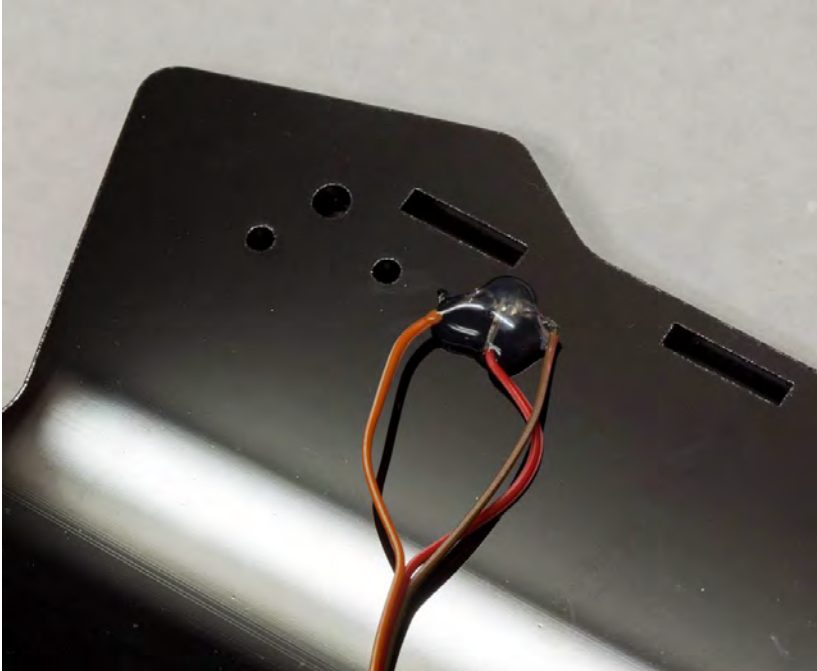
1. All glue goes on the inside of the panels, not visible after you assemble enclosure.
2. When gluing speaker and nuts, avoid some areas that will jam enclosure. These are show in the pictures below as red rectangles. Good areas are show as green.

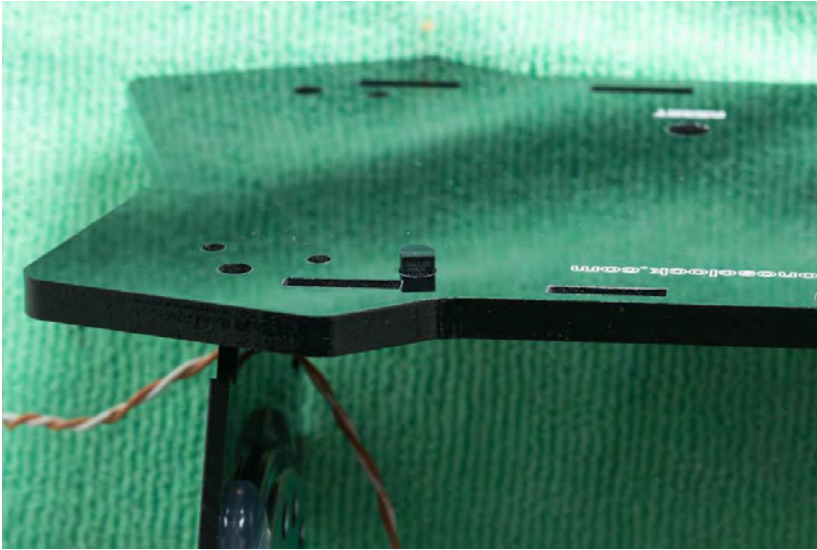
Tip: If you need to trim hot glue after it solidified use sharp razor blade. You can completely remove hot glue with heat gun (but keep in mind that speaker might get damaged by heat gun).

1. First glue speaker to inner side of right panel. Apply hot glue in several places but avoid areas shown in red on the picture. Green areas are good. And do not get any in the holes!

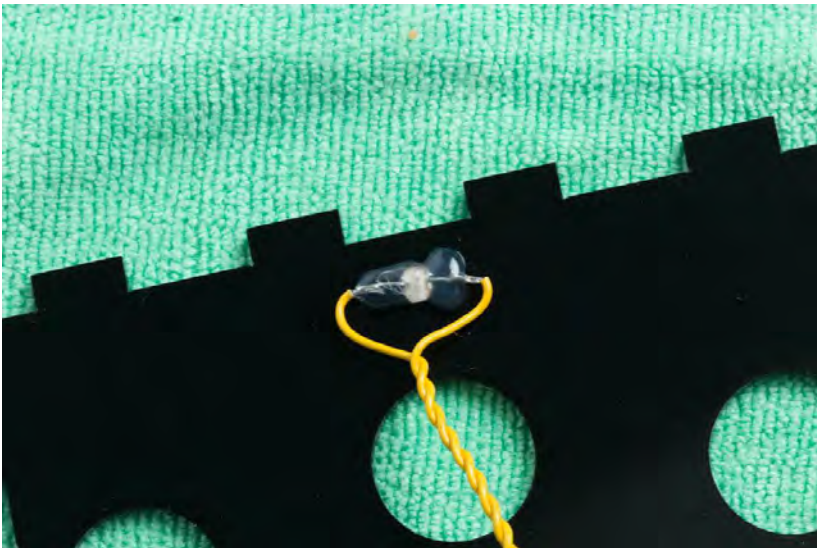


2. Set that panel aside to cool down
3. Insert temperature sensor into hole on back panel as shown (you must do it on inner surface). Put something under the panel (like a match) so sensor can protrude slightly outside. Bend leads and spread slightly so they not touching each over. Apply hot glue and let it cool and solidify.



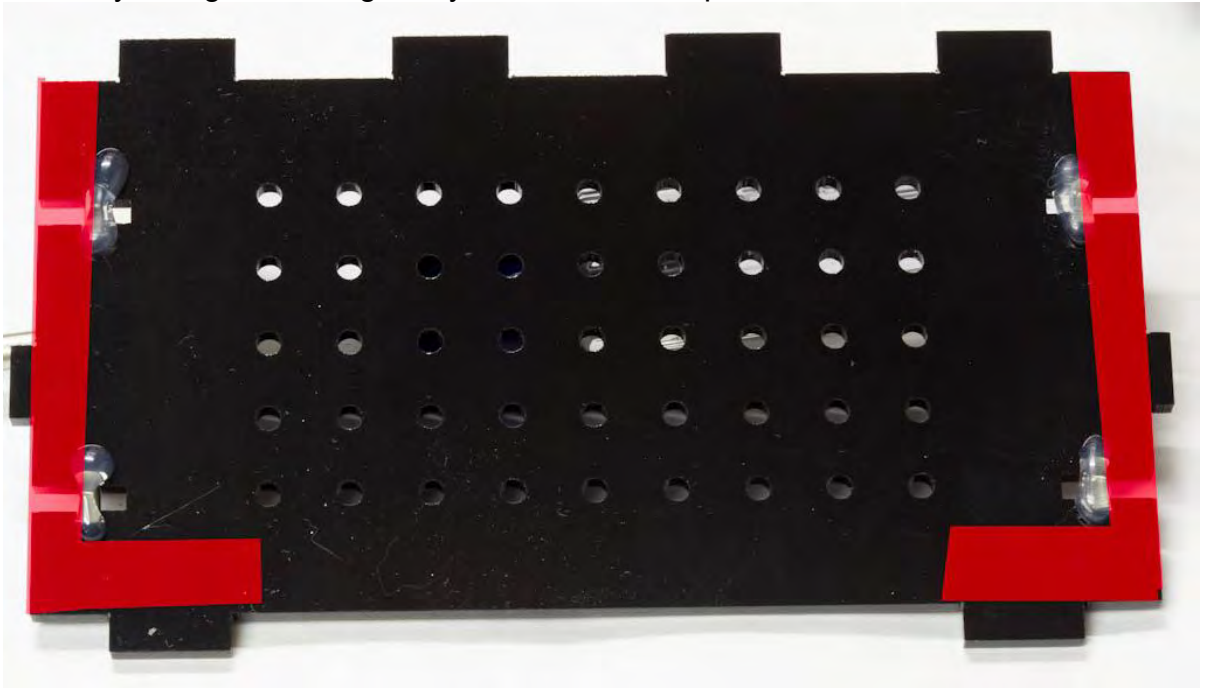


4. Glue photo sensor to top panel. From inside align it with oval hole that's shaped like sensor and try to level so it's flush with outside surface. Bend leads to opposite sides. You might want to use locking tweezers to hold one of leads. Apply glue. If you used tweezers after one side solidifies, remove them and apply glue to other side where tweezers were.

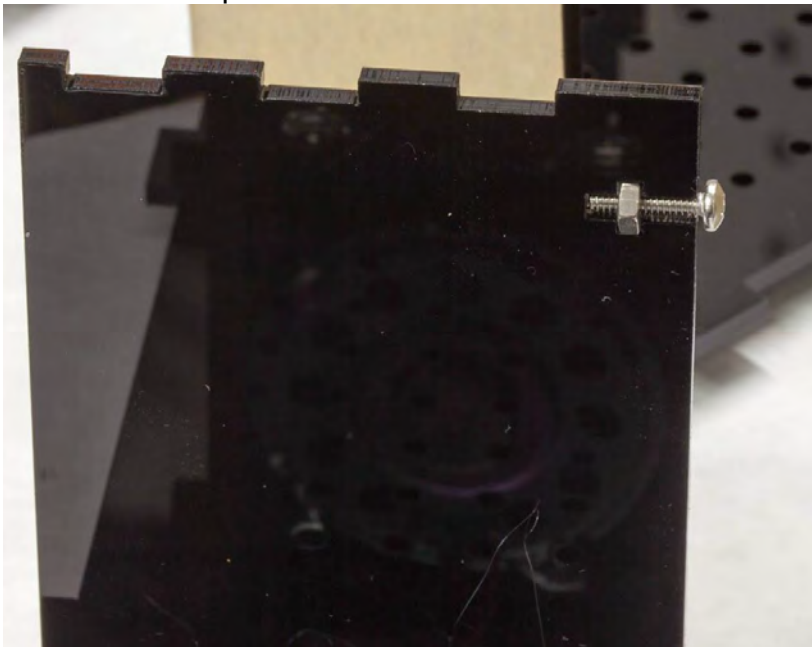


5. Now a tricky part - gluing 4-40 nuts. You can skip it, but it will be harder to assemble/re-assemble clocks if nuts are not held in place by hot glue.
 1. Take bottom panel (one with ventilation holes) and note which surface is inner (it's marked!). Remove paper from that surface only!
 2. Attach right (speaker) panel to bottom as shown, with two nuts and two 1/2 4-40 screws. On picture below I've indicated which way is front of the clock and which is back. See how bottom panel has only two tabs (this is front) and other side has four tabs (back). Right panel has two smaller tabs facing forward. This will help you identify to which side you need to place glue.
 3. Attach left panel to button on the other side.

4. Glue nuts as shown, taking care not to get any glue in the red marked zones. Use very little glue, don't get any on the screws if possible.

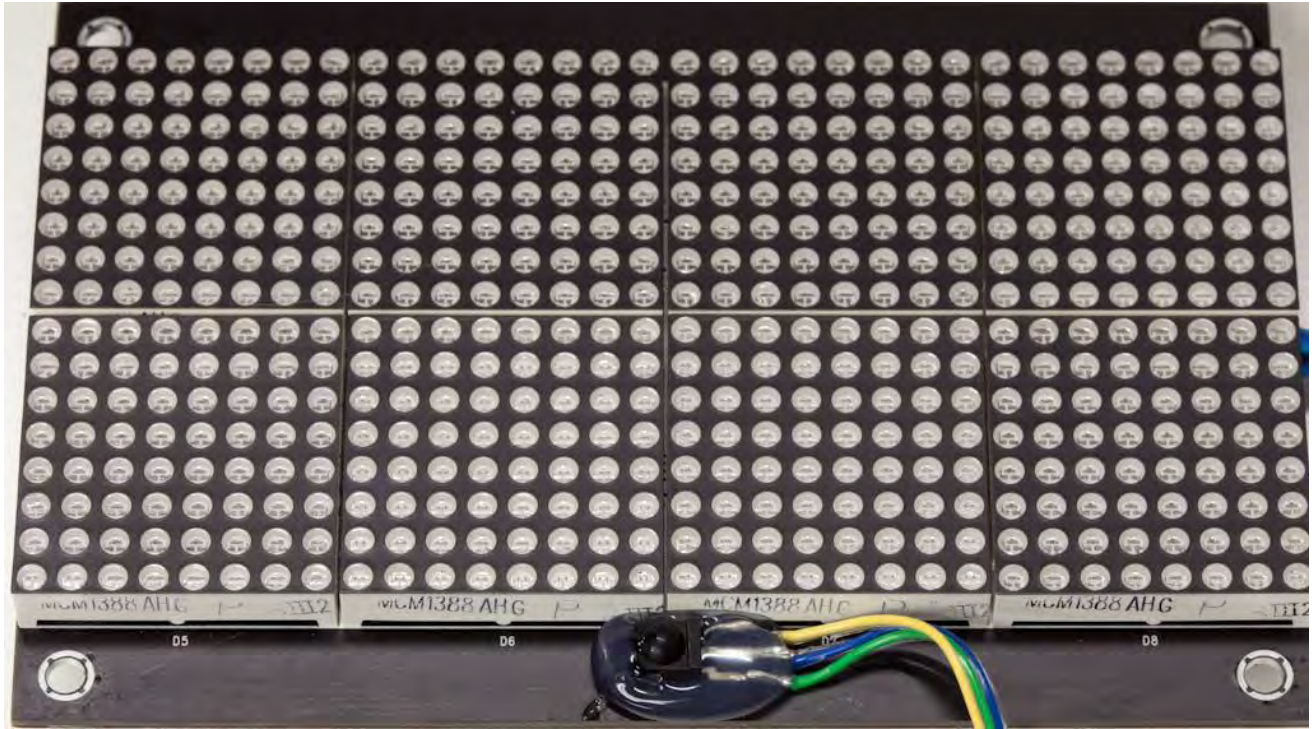


5. After glue solidifies unscrew and remove sides. You can now peel off paper from other side of bottom panel.
6. Peel paper from left panel's inner surface. Thread screw into nut and attach to the t-slot of left panel as shown.



7. Hot glue it.

Optional: RF Receiver

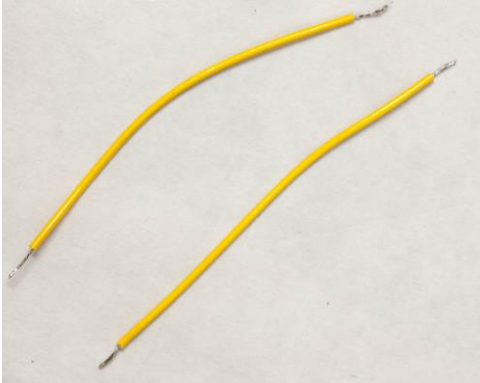


1. Locate bottom of the LCD panel (bottom is where all the plugs are).
 2. Turn it around so LEDs are facing you and place large drop of hot glue just below LEDs
 3. Just before it solidifies Place RF receiver (with attached wire) on top of it with round "window" facing you. Be careful not to get any glue on bulging part.
- Final result should look similar to the picture above.

Buttons

Note: Your buttons might look slightly different depending on manufacturer. Some have contacts on opposite ends with 2 holes, some have contacts on same side in line with just one hole in each.

1. Cut single yellow 6" wire in half

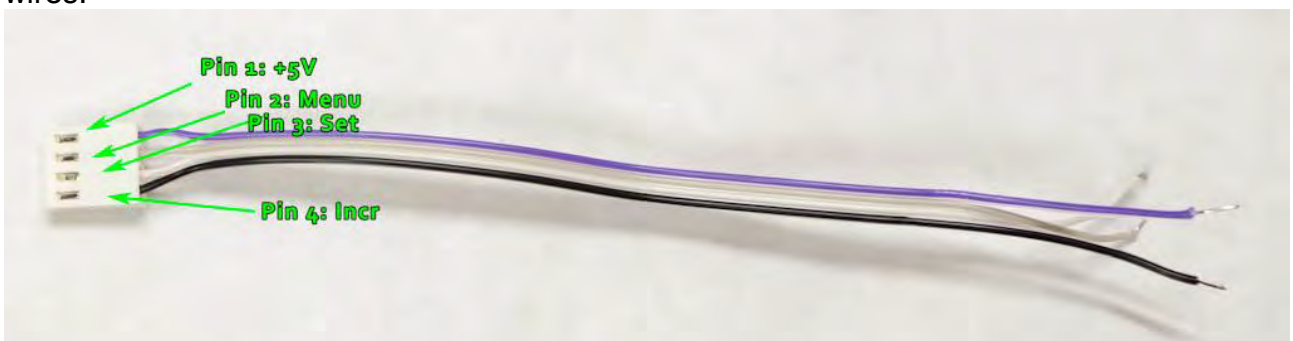


2. Strip and tin ends, taking care to not leave too much solder on them (so they can easily go through button round holes)
3. Take middle (set button), thread both wires through one lead (same hole) and solder. Cut off excess

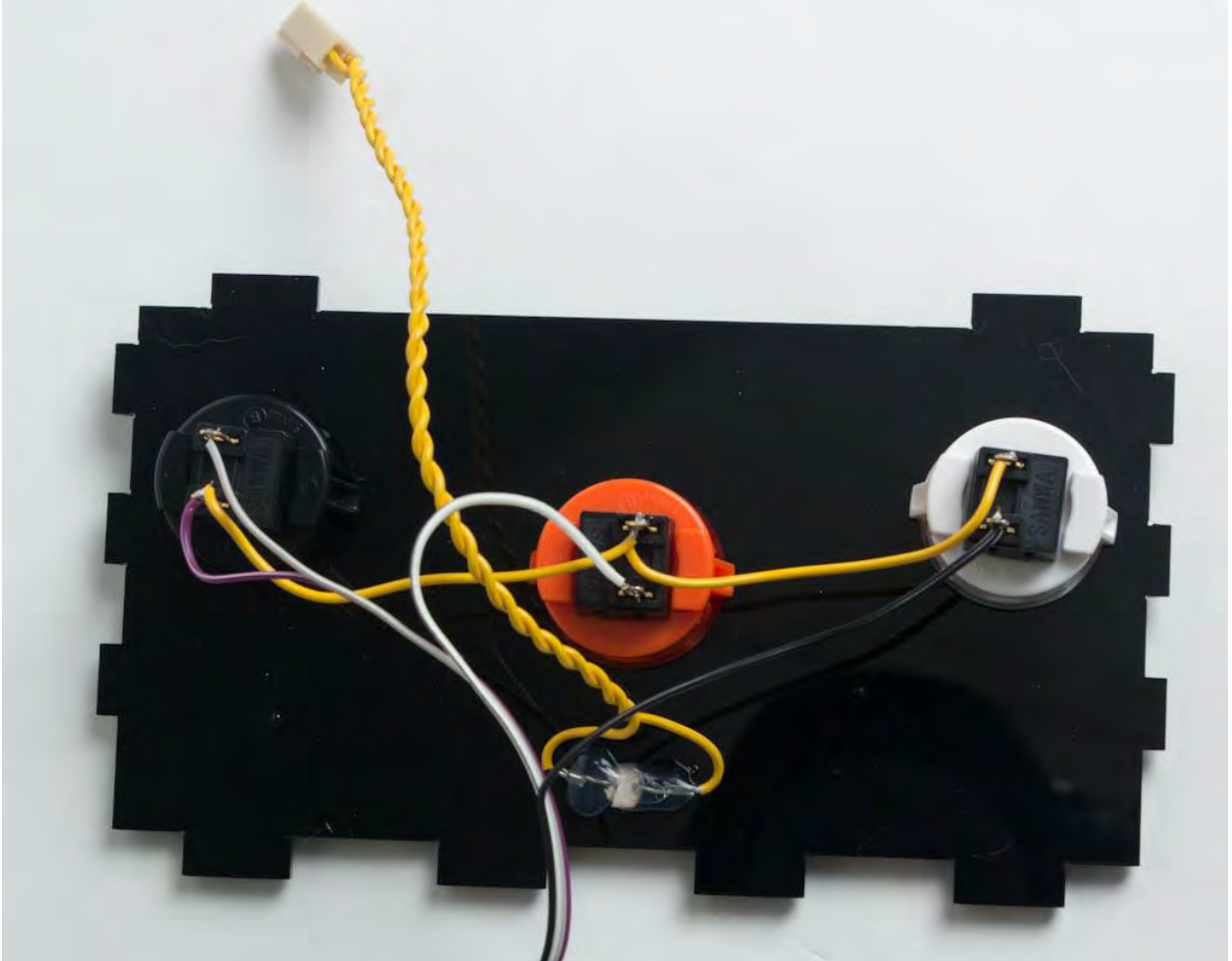
Note: your button might not have a hole large enough for 2 wires. In that case you will need to solder wires together and then to the button's lead.



4. Insert all buttons into top panel (in the right places) until they snap in place.
5. Solder one of the yellow wires coming out of the middle "Set" button to the white "Incr" button's lead.
6. Get 4-wire flat cable. By looking at the plug, determine which wire goes to pin 1 (usually violet or red). This is your +5V line. Next to it is menu, set, and finally incr signal wires.



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Prep circuit boards for mounting.

You going to attach aluminum hex standoffs to boards with 4-40 3/16" screws (they are shortest screws in the kit). Do not tighten any screws, leave them loose for now so standoffs can move around slightly.

1. Remove LED screen from box and antistatic bag.
2. Peel off plastic squares from front surfaces.
3. Attach four 3/8" hex standoffs (longest ones) to the LED display with 4-40 3/16" screws. Standoffs should be on the front side.
4. Attach two 1/4" hex standoffs to power supply with 4-40 3/16" screws.
5. Attach remaining 4 standoffs to main PCB' back side

Mount LED screen

1. Pay close attention to front panel. Its hard to say where top and bottom or back and front is, so we marked it with arrow on the FRONT side pointing towards top. You will attach LED from opposite side. Bottom of LED is where connectors are.
2. Align it and remember how it should be.
3. Now take protective paper from BACK (unmarked) side. It is better to leave front masking paper on for now.
4. Screw it LED in through the holes with four 4-40 5/16" screws. Some screws might not alight with hex standoff holes. That's why we didn't tighten them. Move standoffs until screws fit. Tighten screws on both sides.
5. Now we can peel masking paper from front face. It's held by screws to, so star peeling until you close to 1st screw, unscrew it a little and you should have no problem peeling paper from under it. Once it's clear of paper, screw it back in, then do hex one, one by one. It's actually easier than it sounds.

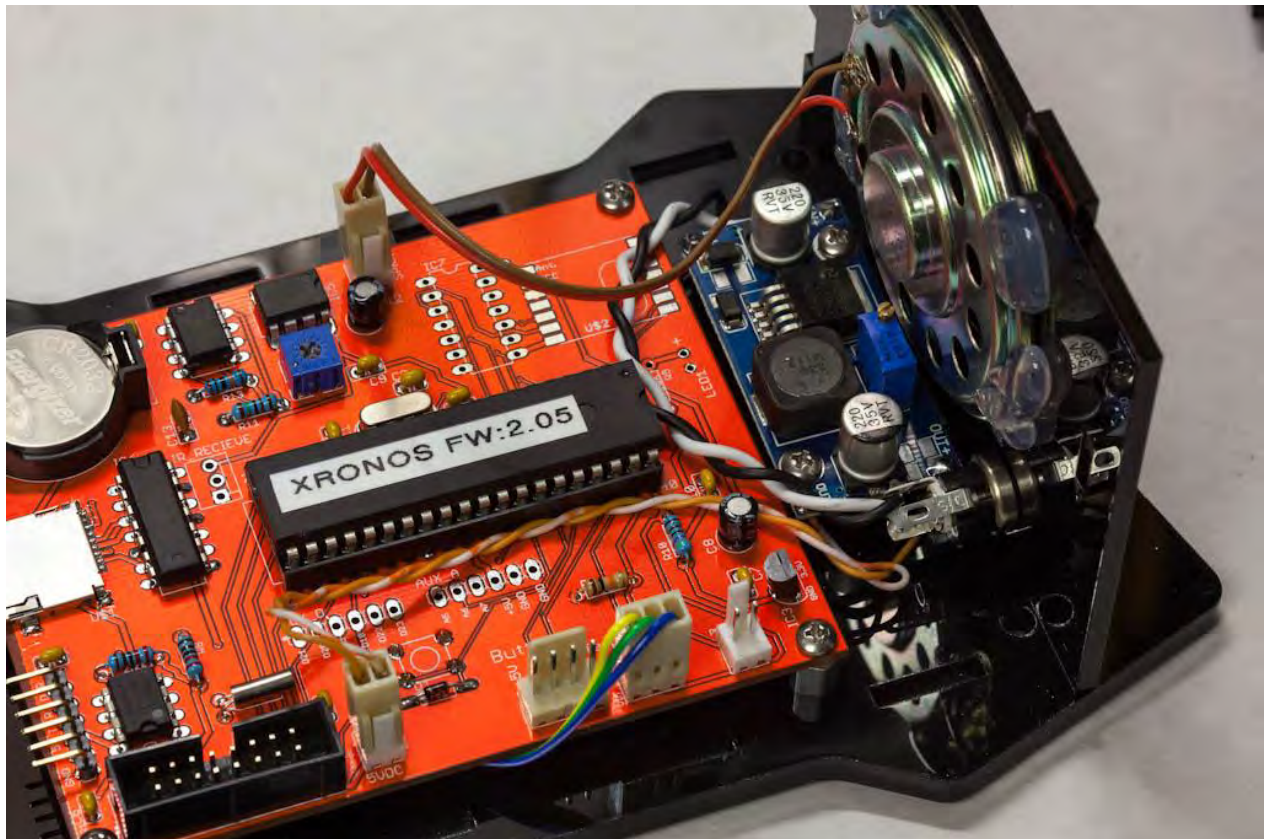
Tip: You can skip this step and leave paper to protect clock face until enclosure is nearly fully assembled!

Mount PCB

1. Align PCB as shown (temp cable under for better cable management)
2. Screw to the back panel with four 4-40 5/16" screws. If any holes don't align move standoffs slightly.
3. Tighten all screws, but not too hard.
4. Plug in temp sensor.

Mount Power Supply board

1. Align as shown (thick cable on top).
2. Attach to panel with two 4-40 5/16" screws
3. Unscrew nut from DC plug, insert plug into right (speaker) panel add washer and secure with nut.
4. Plug in 2 pin power connector to PWR plug on PCB.
Note: Speaker, Power and Light sensors have same kind of plugs on PCB. Make sure you use correct one!



Assemble enclosure

Warning! Acrylic is somewhat fragile. Do not force tabs into slots, you might break them.

1. Lay back panel on the table. You will insert all other panels into it.
2. Insert right speaker panel into slots
3. If bottom panel still has protective paper, peel it off.
4. Insert bottom panel into back and at the same time its tab should go into slot in right panel. You might have to lift right panel slightly for this.
5. Plug in speaker cable to PCB.
Note: Speaker, Power and Light sensors have same kind of plugs on PCB. Make sure you use correct one!
6. Secure right panel to bottom panel with two 4-30 1/2" screws. Don't over tighten, it's easy to crack acrylic here!
7. Insert top panel with buttons into bottom panel (you might have to raise right panel slightly to get tabs to interlock). Middle button might touch speaker plug. Rotate button slightly so it fits on top of plug, and check light sensor cable so it doesn't get sandwiched between button and plug.
8. Plug in button cable and light sensor cable into PCB
9. We will do left panel at the very end, don't worry about it, it's designed to be detached and re-attached when clock is fully assembled.
10. Take front panel with LED display, bring it close to the rest of case and plug big ribbon cable into PCB.
11. If you purchased IR Receiver plug its cable into IR header.
12. Gently slide front panel over until all tabs are in the slots. Do not press hard on it, it should go down effortlessly once everything aligned (wiggle various panels). Tabs will not protrude all the way, that's normal, just check from sides that its sitting ok. If display doesn't go all the way down and "squeaking" it means that hot glue holding nuts on the bottom panel is in a way. You can probably see it from left side. If that's the case you'll need to take bottom panel out and trim glue with blade.
13. Take faceplate, peel masking tape and put faceplate on top of front panel. You might press on it slightly so screws will "click" through openings.
14. Take 4 longest screws (8-32 3-1/2") and thread from the bottom, securing on top with acorn nuts. Easiest way to do it is hang one corner of Enclosure from table edge, insert screw, then expose next corner, etc.
Note: If crews experience much resistance it could be that hot glue holding nuts on bottom panel is on the way. You can either try threading screws thru the glue with screwdriver or trim glue with blade. Ideally these long nuts should go thru enclosure very easy.