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2020 02

Steaker9 Books

# Steak Electronics: 2018 - 2019

February 17, 2020

Henrik Wilkkomér

## Preface:

Welcome to my little book of stories from 2018 - 2019. Here is where I've put some of my time towards various electronics projects, among other things.

**Repairs:** Here we will start out with an HP Pavilion 15. This one ended up not being fixed, due to repair-man error - I shorted a regulator while working on this. Be careful in there.

From there, we will visit my car's transmission. Which had a cable chewed up one day by a hungry lapin<sup>1</sup>. This repair was a success.

The next article is from a Harbor Freight drill which failed within weeks of purchase (No surprise). The lesson: Don't buy anything but the simplest goods from Harbor Freight. Be wary of electronics there. Then, we have a bluetooth speaker, a Sony PVM, a Weller soldering iron that was returned under warranty and a Bose Cinemate speaker from a craigslist patron, which was repaired, and also tore down. Finally, a washing machine was repaired, after some padding got through the tub into the drain (fault of bedding that was falling apart, though repair was successful).

How did I obtain so many devices to repair? I put an ad on craigslist that offered free repair of electronics. In an effort to educate myself, and assist people... A great idea for anyone learning and has time.

**Electronics:** In 2018 - Two projects in which I pursued. One, a board to monitor air quality levels, the other a dabbling interest in solar and battery power. In 2019, I break into a stenography machine, following in other's footsteps. I also build a Flammable Gas Sensor, and a motion sensor for CCTV installations.

**IT:** I cover conduit, and a short review of the Honeywell T6 Internet connected thermostat, an early IoT device. A number of software pages, including fail2ban, docker, transmission (torrenting), mdadm, and how to install an IP Camera outside. I'm also putting these and similar articles on Steakwiki.com. Another article in this section, covers making a portable camera recording box. Useful let's say, if you were working on site and wanted to record everything through rain or snow. While it doesn't yet have solar or battery, that is the next step. Research. Develop. Test. Improve.<sup>2</sup>

**Carpentry:** I enjoy doing real work<sup>3</sup>, and two carpentry hobbies I've

---

<sup>1</sup>Rabbit

<sup>2</sup>Borrowed from online forum.

<sup>3</sup>As opposed to busywork.



taken to are hard floors, specifically stone (tile), and hardwood flooring. Dust has a harder time accumulating on hard floors, and they are thus cleaner. Rugs, I think should be shunned, perhaps outlawed. Rugs are always a bad idea.

**Story Book:** Here are political and moral writings. Join me as I navigate through the waters of corruption, copyright, greed, and illogical thinking. I'll cover why the stock market is a step back for society, and why jails should be reformed into education camps. Don't forget to eat some garlic every once in a while. But, don't overcook your steak. Keep it rare, and stick to clean animals. Finally, I'll cover what I should've learned in school. I'll be replacing English with Reading class, and getting rid of Math class in favor of trades that incorporate Applied Math. No more theoretical math. Only practical trades.

Finally, whatever you do, do not overpopulate the planet. If there is one message I hope to get across, it's that humans must limit themselves, or nature will do it for them<sup>4</sup>.

**Magical Book:** This section of the book is a mixer, including touchy subjects such as cannabis. As a preface: I do NOT advocate habitual usage of any mind altering substance. Including alcohol. Drugs have done enough damage to our neighborhoods, and its evident by looking around. The world tends to use too much drugs, and this is evident in our cities and towns (which are falling apart). However, on the 0.001% of time of your year that may be allowed to not be sober, one might step out of "normal" life for a moment, and a journal of growing one tool<sup>5</sup> for this is covered here. On the other side of the plant world, I cover an extremely dangerous plant, of which you should remember to respect, or suffer the consequences.

All of this book is intended to be taken as light reading. It is public domain, as I believe in free and open culture. You may take and use what you want of this book, as well as my music. I may ask that if you deem it worthy, and can afford without any inconvenience, to pay me what you find this worth. Alternatively, I've been quite limited in my finances for my life until now, and also understand if you must read these words without any financial tribute. I am with you there. We live in an age where technology allows for duplication of words, and media without cost, so let them be duplicated. Let not corruption and greed stand in the way of distributing information, entertainment, and knowledge. Such jobs are not jobs anyways. Save the carpenter, but let the jester starve. Let the scientist give up all hidden secrets. Shun those who obfuscate.

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<sup>4</sup>Asimov, Frontiers

<sup>5</sup>drugs are tools, not toys. Play with tools, and get hurt.

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## Repairs

*“They will talk down monkey see, monkey do, implying it is a bad thing. In machine instruction culture, there are coined terms, such as ‘code monkey’ and ‘cargo cult programming’. In fact, observing someone doing something, and then emulating them is how humans have learned skills for thousands of years. From talking, to riding a bike, to any trade you can imagine.”*

-Targes Attenuator

*“For millions of years, in millions of homes  
A man loved a woman, a child it was born  
It learned how to walk and it learned how to talk  
Like humans do ”*

-Variation of song by David Byrne

# HP Pavilion 15 Repair

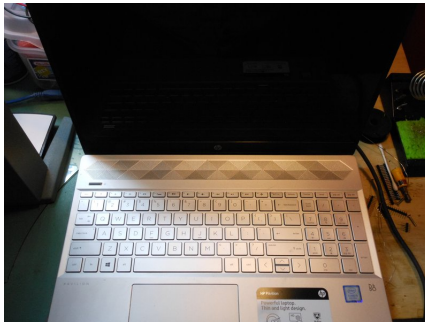
Steak Electronics

## 1 Overview

User spilled tonic water on a laptop, then kept it powered on and continued to use it (this was a mistake. Turning it off, and removing battery / power, letting the liquid dry, is always the first step in a spill)<sup>1</sup>. The next morning the laptop would not power on.

## 2 Equipment

Laptop is an HP Pavilion 15 CS model. They are fairly new (date codes on micros are from 2018), and retailing around 500-600 dollars as of just before 2019.



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<sup>1</sup>the second mistake, is trying to turn on the power again, after it gets liquid on it, but before it dries. The safety circuits on the board may shut it off, but its up to the user to know when to turn it on. Debatable engineering, but at least you never get locked out of turning on the computer

Figure 1: HP

### 3 Disassembly

There is no video tutorial on this online, but the steps are: Remove visible screws from the back of the case. Remove rubber feet, and screws beneath them. Pry open case from edges with plastic spudger tool to remove the clips. You must be careful, as the clips and case are fragile.

- Where to start with the spudger, and also showing the screw-holes underneath the rubber feet.



Figure 2: Disassembly

- I was able to scratch the case with the plastic spudger. Be careful!



Figure 3: Disassembly

- The case can also crack from pulling it. I didn't pull this hard, but the brittle weak case cracked slightly.



Figure 4: Disassembly

- Finally we are in.

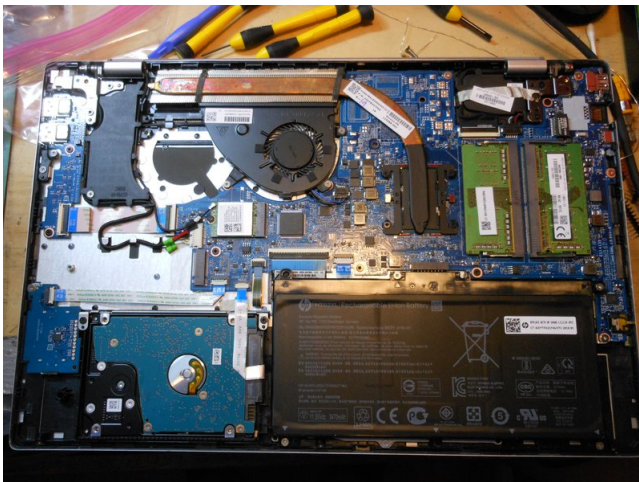


Figure 5: Disassembly

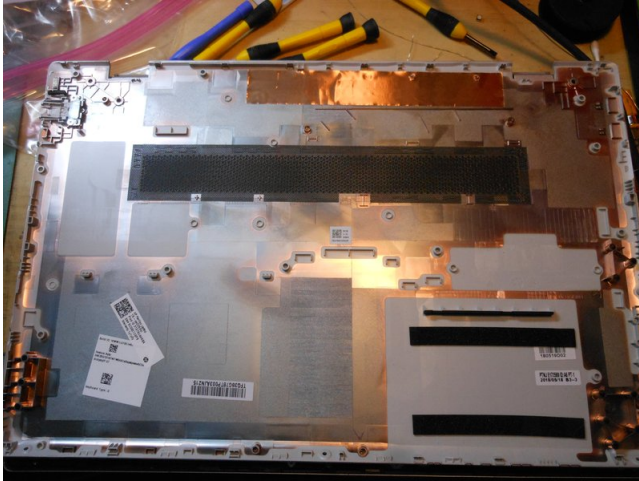


Figure 6: Disassembly

- Screws are labeled, to help illustrate what size each is:

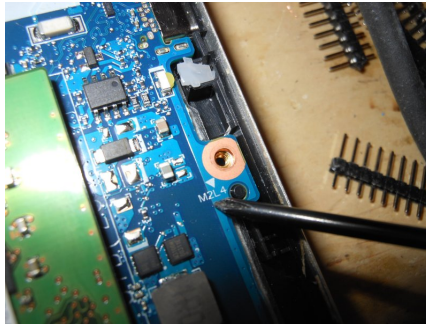


Figure 7: Disassembly

## 4 Diagnosis and Repair Log



Now we will try to find out what is wrong.

- Right away I can see some visible marring from a likely shorted component. This is where a lot of the soda residue is.



Figure 8: Repair

- You can see a layer of cellophane that is in place to protect against spills. Millions of man hours can go into designing computers, yet a single glass of liquid can destroy one. This isn't right.

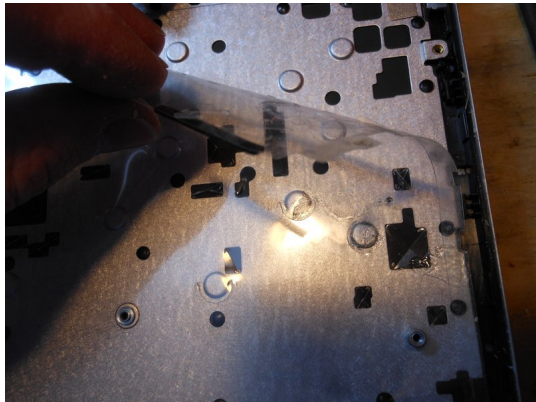


Figure 9: Repair

- This switcher, the BACAAB (?) chip is the one that has the failed components. I need a replacement but can't find a data sheet on it. I tried probing at some of the pins to see what was going on, and if I could understand a bit more about this, but due to me probing too close to the pins, (and a few factors, primarily the small package, but no leads, and also the fact I should've used the pads NEAR but not ON the package, I shorted something, and a spark resulted. While I saw a 2.4V signal on a pin, after the short, I was unable to find anything. The battery being removed and replaced did not bring it back.



Figure 10: Repair

- At this point, this chip, which I am unsure of what it is, appears to have a short and is overheating / shorting. I will need to get a motherboard donor at this point, to further repair the mistakes. As these are new boards, motherboards are not yet cheap enough to make this viable, so I will wait and try again at a later date.

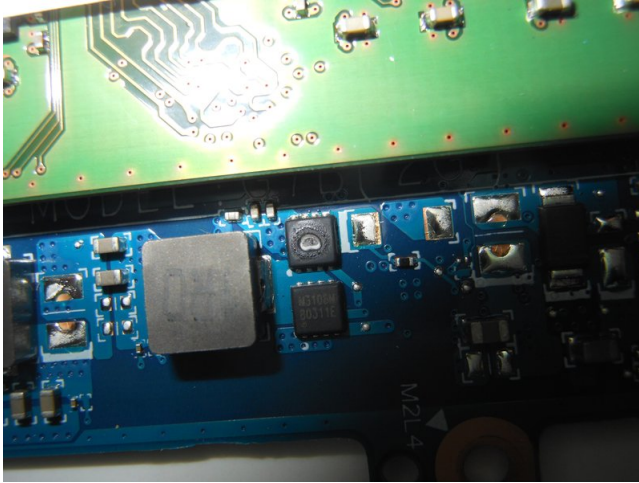


Figure 11: Repair

- During my troubleshooting, I did find an open resistor, and a capacitor that has visible charring on its solder joint. I'll need to replace these as well. I should've replaced this at first, but without a schematic, I don't know what value the cap should be. The resistor is labeled as 1R0, but reads open. There may also be one other cap that has failed. However, some other components appear OK.

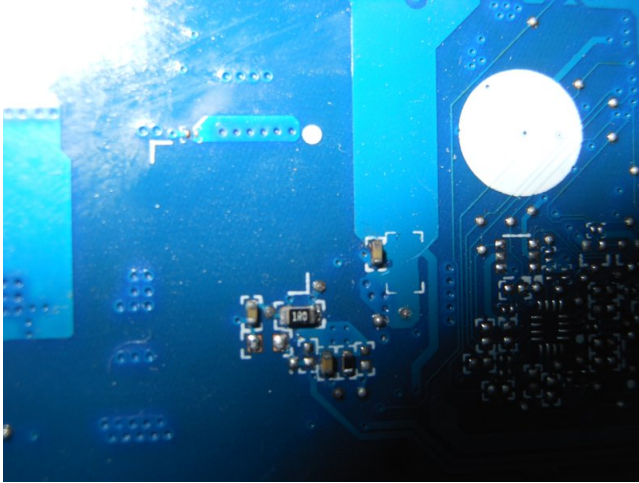


Figure 12: Site of failed components from soda water spill.

## 5 Day Two

I've received another motherboard in the mail. Unfortunately, I can NOT get the schematic for this motherboard, but I have an earlier HP version available. Maybe this is why people such as L. Rossman are successful - they focus on one brand: Apple, which has available schematic and layout <sup>2</sup>... I have no layout either.

Looking at this similar schematic, it's important to focus on what matters. checking power rails, I know I need to start at the beginning. Also, when looking at other schematics outside of the power rails you can see what inputs into them and what is relevant.

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<sup>2</sup>On the grey market.

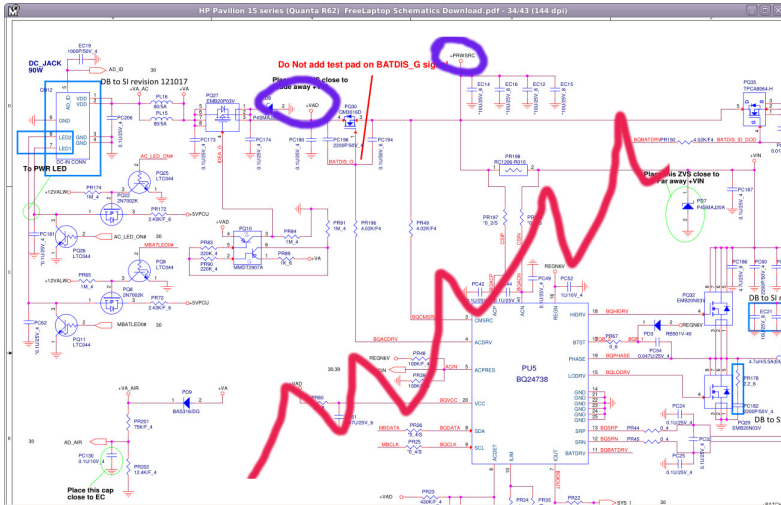


Figure 13: I'm worried about the AC adapter input. All the battery circuitry can be ignored to start, as there is no battery. First I need to follow PRWSRC and VAD...

Interestingly, there is a discharge IC. A IC for discharging caps. New to me. They call it a charge pump on the G5934 data sheet, but schematic says Discharge IC... I think same thing. There are discharge pins on the G5934.

## 6 Day Three

I replaced some of the transistors, (original one of them had burnt out) and I was able to use the toaster, and solder paste to reflow the QF no leads package. I think it came out good but haven't tested it yet. However, I had some trouble trying to desolder some passives, with a wick and a small tip. The lesson here is, if you are going to desolder things off a laptop, you need a hot air station, or a toaster. I shouldn't ever try solder wick on these tiny packages again... I should also watch some rossman videos as a reference. But I need a

temperature controller hot air station. I don't even think the butane torch / soldering iron would work, as I tried it yesterday, and it failed. The butane torch / iron works on leaded solder, but not on delead solder. So I'll need a hot air station to do any laptop repairs

going forward. Need the right tool for the job. Or I have to use the toaster, which works if you flood the area with solder paste. Hot air station seems more straightforward. For now, I am putting this repair off, as I'm frustrated with the process, and how antagonistic tech companies are to repairs. It's swimming upstream. I have not conceded defeat yet though. Another motherboard, and I can give this a chance again.

## 6.1 FET Replacement

I burnt out one of the FETs after the original damage was done to a part<sup>3</sup>, but luckily, there are two being used, so I was able to take the pin for pin identical (though lettering was different) mosfet and replace it. Looking at the similar schematic I have in resources, I think I should be OK.

## 6.2 MOSFET Pinout

The pinout of an SOIC-8 MOSFET, as well as a SOIC-8 op amp, give them away. They are often the same. The FET driver will always have three pins connected to one large plane, with a single pin next to it. Unknown PCBs are less and more complex than you think.

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<sup>3</sup>I think the part I damaged was the 5 / 3.3V Reg.

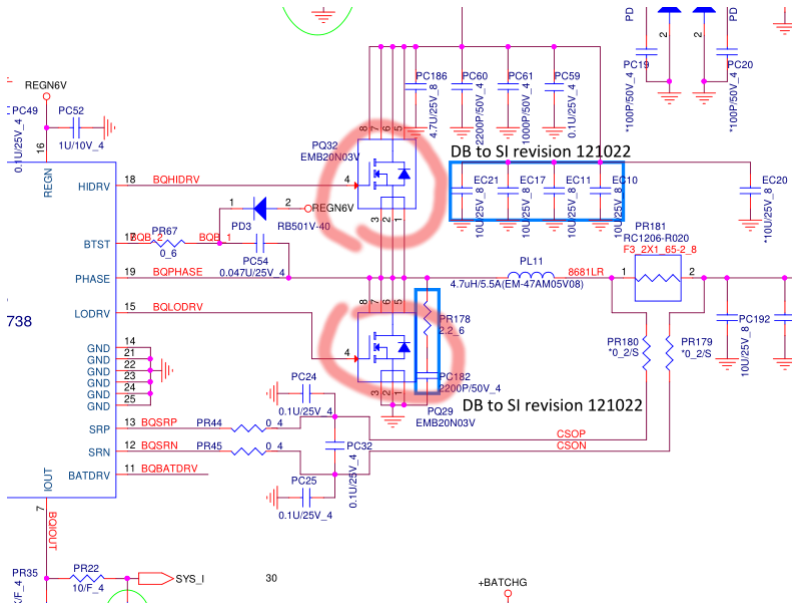


Figure 14: Mosfets in this schematic are much alike the mosfets in the laptop... When you can't find the exact schematic for your device, a similar schematic might offer some hints.

## 7 End of Year Retrospective

Not all items can be repaired. Whether it's repairman error or otherwise. Give it a try, and keep moving. There will plenty of other broken electronics to fix. You will improve.

# Car Transmission Repair

Steak Electronics

2018 (revised 2019)

## 1 Work Log

Just a quick note here.

I awoke one morning to find my car would not shift beyond first gear, and that the MPH gauge had failed. I smelt something burning. Upon opening the hood I found a bunny (alive) inside. I was able to coerce him to leave, and then repaired the two wires he chewed up.

Car was back in working condition.

See pictures.





Figure 1: Cut off the connector at one end, so I can attach wires to it. This is what connected to the transmission



Figure 2: Wires visibly chewed here



Figure 3: Further up the wire sleeve, where the wires are not chewed. Here I can cut them and solder new wires in. There are four wires here, as the sleeve was used for multiple wires.



Figure 4: With portable soldering iron (portasol butane powered) and some wire, this is an easy fix. A little scary, though, being close to the gas line. Even if gas burns not explodes I don't want any surprises. I made sure nothing was open, exposed, or leaking. Be careful out there!

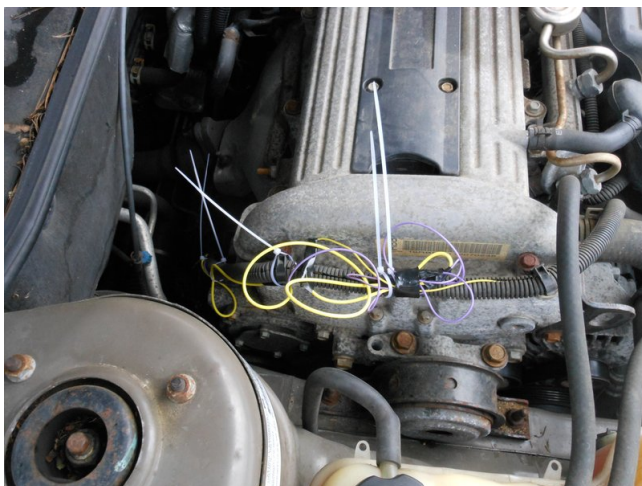


Figure 5: It's a sloppy hack, but function over form. The car works! We are set until the bunny returns. This time I gave him lots of easily accessible wire to chew.

## 2 Additional Details

The bunny had chewed up two of the wires. What happened, is that two sense wires (I believe that's what these were) to the transmission had failed, and as a result, the car was unable to control the transmission. A mechanic later implied that animals chewing wires was not uncommon. I was even fortunate enough to run into a bunny stuck in the car. Perhaps I caught him in the act.<sup>1</sup>

Since the wires were broken, it was simply an issue of having a portable soldering iron, and some solder. I brought the iron down to my car, adding some additional wire on, and soldered both ends. A trivial job for an electronics-wise fellow.

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<sup>1</sup>First I drove around, and smelled something like burning hair. This was when the car was unable to shift out of first gear. Stopping, I found him in the car, alive, and got him out before he was cooked bunny. I've heard stories of animals dying in hoods of cars (cats) and from what I was told, it's something to avoid (the smell is extreme).

Soldering near the engine was a little scary, but I didn't leave anything open. Say a prayer, then get in and get out.

# Contents

## 1 Harbor Freight Bauer Drill Repair

### 1.1 Overview

At a company I work for a drill was purchased from Harbor Freight. It was a Bauer 1791c-b1 drill. Sold for about \$40 US in 2018. I knew buying anything electrical or electronic was a bad idea from Harbor Freight. It is generally known that their products are cheap, but they are also likely to “fail early, and fail often” (to steal a word from startup world).

### 1.2 Background

I was using the drill when it failed. Not in any excessive capacity, instead simply using the drill, moderately. I began to smell something burning, but the drill continued to work. After another moment, the drill was completely failed. What had happened, is that one of the DPak FETs had failed, then the other.



Figure 1: This style seems to be the current favorite (techy red and grip, with a square lithium pack). A trip to the hardware store will reveal other brands with similar looks as of 2018 (Craftsman, Milwaukee, Black & Decker)

### 1.3 Repair Notes

2 Dpak components have big burnt out holes on them. Need replacement. What is their pinout?

Motor is Mabuchi<sup>1</sup> model: RZ-735VA-A014. Range 6-20 volts. Switch before motor is 7.2 24 volts.

Micro is TI msp430g252.<sup>2</sup> Question is, what is the level of the voltage regulator? Is it 20V? It appears to be an onsemi model such as: CS52015 I can't find an exact match from Digikey which only searches current models, not historical models.

I may be able to throw an adjustable vreg with similar pinout in... The battery is 20V. The dpaks are getting power, only when switch is pressed.

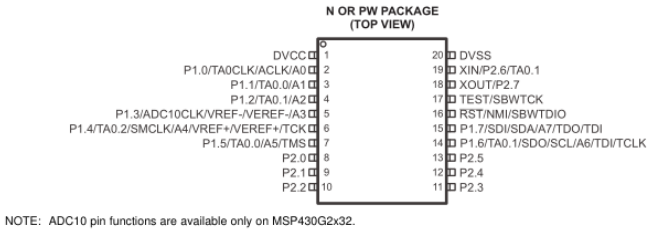


Figure 2: Pinout for MSP430

<sup>1</sup>Possibly Counterfeit, or from a ghost shift, as that is a well-known brand.

<sup>2</sup>Wait, this drill needs a microcontroller? As in a computer in a drill? Why not an IOT drill then? But, I suppose having an IOT drill is ridiculous, and likewise so is having source code in a drill, let alone black box proprietary source code...





Figure 3: Rough signal path for board. When switch is pressed, there is 20V on the tab of FET. I believe the FET must've overheated and shorted (perhaps counterfeit, or just not spec'd right). Though Right pin is to GND. Maybe it's a current limiter, not a FET, allowing Tab when V+ to be dropped down and current will flow. Too bad I wasn't able to stop using the drill before both FETs failed. I could've read one of them for a part #.



Trying to repair a harbor freight drill, and I need help identifying a Dpak component.

These two DPaks failed (overheated, and shorted I think) on the main circuit board. I'm not sure if they are some kind of constant current power transistor. I don't think they are voltage regulators. When you press the button on the drill, 20V from BAT+ goes to the tab. I think pin 1 is a resistor, and pin 3 goes to BAT-. Anyone have any ideas?

There are some other pins that go to the MSP430 micro, the VDD label is the micro's power, which I think is lower than 20V. The ground goes to the micro.

The marking on the DPak was melted off, but I could make out a CS something. I found some On Semi adjustable VRegs, but I don't know the part (e.g. CS52015) as the pinout seems to indicate something else.

**Anonymous** 10/22/18(Mon)18:51:16 No.1484857 ▶ [>>1484989](#)

[>>1484700](#)

They'll probably be switching FETs, and they look to be in parallel, which is odd for semiconductors. Since it's low-side switching, the source being the pad, the gate being the left-most pin, and the drain being the right-most pin. At least from what I can see. I'd check the gate is used, but it's probably 3.3V. So buy a couple of N-ch MOSFETs with a threshold voltage below 2.5V, V\_DS above 24V, and a gate charge you can reasonably get.

But she's a harbour freight drill, so don't expect any lasting performance even after fixing it.

t. never fixed anything

**Anonymous** 10/22/18(Mon)23:19:57 No.1484989 ▶ [>>1484991](#) [>>1485000](#)

[>>1484857](#)

Thanks. I didn't buy it, but I did break it, and I figured it would be fun to repair it if possible. Funny how a couple power transistors can break a drill. I wonder if old drills even have pcbs at all... I doubt it.

**Anonymous** 10/22/18(Mon)23:32:46 No.1484991 ▶ [>>1485000](#)

[>>1484989](#)

old drills probably don't have tetchy but power-dense battery packs. the few that had adjustable speeds did it triac-style and certainly not a power factor. features generally require components, same as ever (but a microcontroller? that one's new on me)

**Anonymous** 10/22/18(Mon)23:50:29 No.1485000 ▶ [>>1485003](#)

[>>1484989](#)

Old drills have the trigger switch mechanically switching the power supply, while the modern ones use transistors such that they can do speed control; they PWM the output to change the power going to the motor. Though I doubt that drill has speed feedback.

[>>1484991](#)

[>triac-style](#)

Never heard of them doing that, though I guess that's since most teardowns I've seen have been of cordless drills.

**Anonymous** 10/22/18(Mon)23:58:35 No.1485003 ▶ [>>1485006](#)

[>>1485000](#)

yep just ye olde phase angle fired dimmer switch, with a trigger controlled pot  
<https://electronics.stackexchange.com/questions/167556/how-does-the-circuit-of-a-basic-variable-speed-electric-drill-work>

**Anonymous** 10/23/18(Tue)00:08:42 No.1485006 ▶ [>>1485057](#)

[>>1485003](#)

I know how a triac dimmer works, just surprised that that's what they were using. My old Hitachi corded drill has dimming but it's discrete speeds, unlike what I'd expect from a triac dimmer with a linear pot inside the trigger switch. So either it's a triac dimmer switched sequentially by wipers or spring contacts within the switch, or it's some sort of less-analogue dimmer. I'd imagine it's the latter since it's been going strong for a few decades without any sign of a linear pot wearing out, which is a good enough reason to use made before the common clamshell setup we've got today, the back 1/4 comes off with lengthways screws, with the front gear quarter being moulded together. if I remember right. Big front-end bearing on it too. only one speed in each direction and certain

**Anonymous** 10/23/18(Tue)04:46:39 No.1485057 ▶

[>>1485006](#)



Figure 4: A short post to an anonymous image board for assistance. I prefer anonymous forums for their frankness. They also avoid some censorship and mob mentality (upvoting) issues. An example of a flawed system is Reddit, which is easily swayed by corporate interests or censorship able to subvert the discussion.

## 1.4 Work Log 12/2018

I purchased some N-Channels which seem to fit the recommendation. But these do not work. Short circuit protection appears to kick in, and the Dpak overheats quickly. So after the replacement, the devices spins for a short second, then stops. Something else is broken.

Checking the pins of the msp430 with a scope, I can see it has a sleep mode, a pin to control gate, a pin to control LED. I thought I saw UART, but it's just a CLK input. Led is two or three to the left. There also seems to be some pin, maybe adc monitoring drill (top, right side pin).

Something for another day. Overall, it seems the FETs were woefully unprepared to actually ever power this drill. It was fundamentally flawed - broken from the day it left its overseas factory.



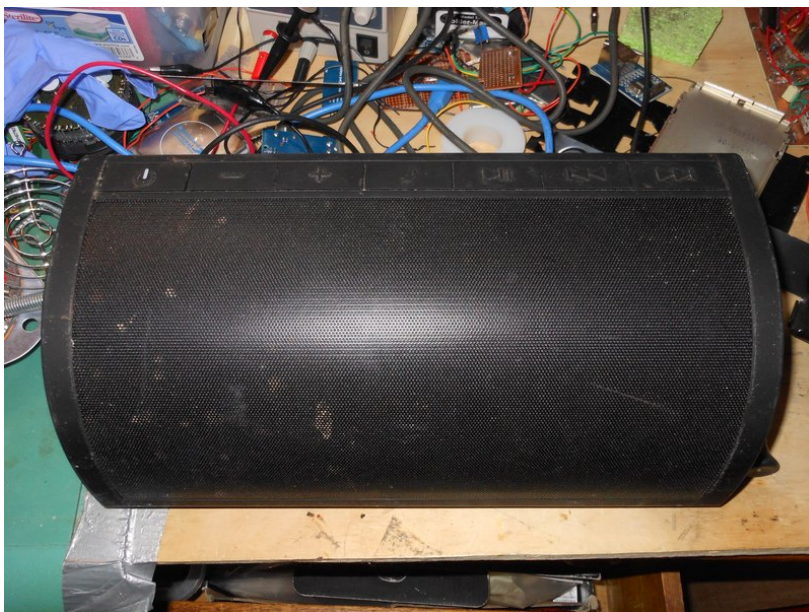
Figure 5: A dremel was used to help open the drill up, as I had not the required bit to open it (It required a longer torx driver than I had, so I opened up one of the drill inserts slightly).

# NYNE Bass Bluetooth Speaker Repair

## 1 Overview

User reports Bluetooth speaker is broken. Unit powers on but is not responsive. Power light, will light up but nothing else. Unit was damaged reportedly by rain.

## 2 Work Log



I dismantled device. You must remove the grate on the speakers to access all screws. I didn't do this at first, and just bashed through a few screw supports. Live and learn. It's OK, this repair is for family, not a stranger. I tend to take liberties on such repairs.

After opening device, I unscrewed all boards, and connectors. I disconnected battery. After arranging board on table, I reconnected battery, and this seems to have fixed the speaker. As the battery is

internal, it appears that it was necessary to do a full power on/off of the device to get it working. As right after I powered it on, this second time, it made a sound. Before disconnecting the battery, no sound was made when powering (if my memory serves right). I connected aux audio in and it worked. bluetooth also works OK.

Some more waterproofing of the inside of this device is in order here. They market it to outdoor enthusiasts, but it can't handle water.

Capacitors are heating up on this board. There are four 220 caps near the speaker and sub outputs that have heated up. High ESR? I've never seen warm caps before...<sup>1</sup> (<https://electronics.stackexchange.com/questions/51645/should-electrolytic-capacitors-get-hot> seems to say that caps only heat when current is going through them. So usually, they won't heat up, unless there is some ripple back and forth, alternately draining and powering the cap. These being AC speakers, I suppose that explains it for now.<sup>2</sup>

*“As a point of general reference, it is possible for an electrolytic capacitor to heat up even during normal operation, if the capacitor is exposed to ripple currents. This is a situation where the capacitor is rapidly charged and discharged, either partially or completely. For example, on the output of a rectifier, or in a switching power supply. Electrolytic capacitors have ripple current specs for just this reason.”*

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<sup>1</sup>Perhaps its the capacitor being seen as a short in AC...

<sup>2</sup>An application note search is in order. Search: “Application Note” Capacitor heating up

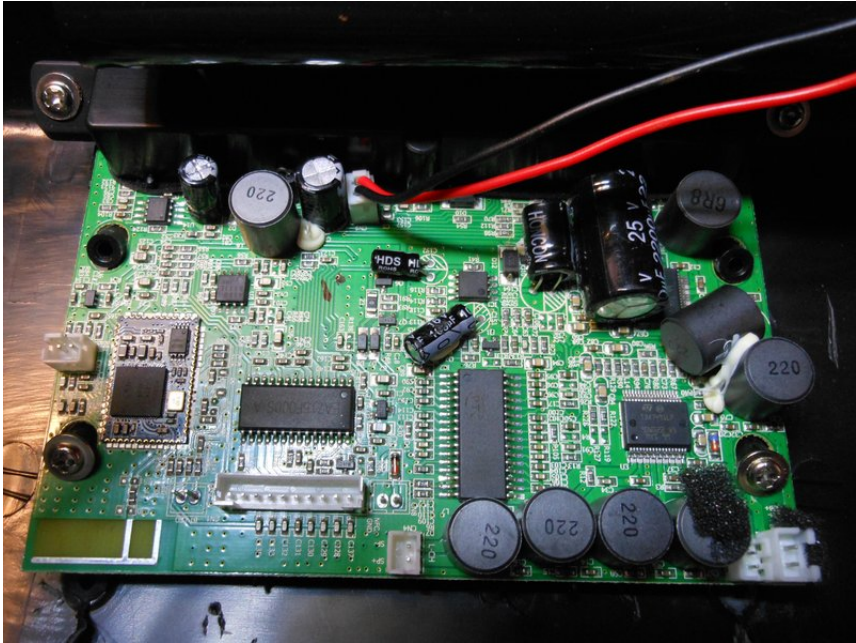


Figure 1: main board. The wire going off picture is for the 18650 Lithium Cells. Note the bluetooth module soldered on board. Pretty average looking consumer product with insufficient waterproofing for \$150. Sound quality is average, but not good.

Cap brands on this board, are questionable. I would not shell out the \$150 this device demands new if they are going to stock no-name caps on the board. Looking up Honcon now...(<https://www.gmdu.net/corp-664938.html>) Seems to be a small Hong Kong factory. Not giving me confidence about this speaker.

The sound quality is sub-par. I have a Bose Cinemate (original) next to me that I repaired this same week. That has a decent sound (although to be fair the price is a difference of 8:1 between the Bose and Nyne), and one is portable, the other is not.

The quick user guide is 15MB. The datasheet is 1MB. Hah. Data sheet is an ad. Not a data sheet at all. What an insult. The quick start is the actual user manual. There is no real user manual. Oh, but there's a brochure. Ugh...

Shows up on bluetooth as NYNE Bass. Some more pictures of the chips and I'm returning this back to the user. Simple fix.



Figure 2: Imagine working your way to Silicon Valley just to design a bluetooth speaker. Terry A. Davis said in one video that most people in Silicon Valley do busy work. This would line up.

### 3 End of Year Retrospective

For your \$150 you get a PCB made down to a price, with a lithium battery, some speakers, an off the shelf bluetooth module, and a fancy case which is not waterproof. There would be more soul in a plastic tote, or wooden box, some speakers, and an RPI. You may even be able to make it rainproof. Though this is ready out of the box. What is convenience worth...

# Sony PVM 14M4U Repair

Steak Electronics



Figure 1: Barely User Service-able!

## 1 Start

Video 1105.webm shows the problem. Lines moving both vertically (obvious) and horizontally (less obvious, looks diagonally).

The second problem, which was more of a problem at the start, was disassembly, and then putting it in a way that it could be repaired. Video from botnet tube (Sony PVM-8041Q Monitor Teardown and Repair-iyJDam0blYA) Shows a repair of a smaller 10 inch model, and you can see, the user is able to easily access parts of the board to repair. However, the 14 inch models are not as simple. The board



with all the processing on it (the A board), is on the bottom of the chassis, and to take that out... well video 1104.webm shows what I had to do to get access to the board, while it's powered on.

## 2 CAUTION

The tube <sup>1</sup> is extremely dangerous, and I get nervous anytime I go near it. Do NOT try this if you aren't careful. There is also 600V rails on the bottom of board A where the hi voltage (read flyback) transformer is. The only thing in our favor, is that there IS a service manual with some explanations of where everything is. The problem, as I already mentioned, is that actually servicing this device is damn near impossible.

## 3 Repair

At first I suspected capacitors had gone bad - due to the failure mode. When it originally failed, it had been working, then suddenly failed. I used a homebuilt ESR meter but was unable to find any bad caps. This ESR meter is untested, so it's either that there are no bad caps, the bad caps have failed in a way besides high ESR, or that the esr meter doesn't actually work. I do not have a capacitance meter. I poked around a bit, but after a few minutes, remembered that voltages should always be checked somewhere early in the repair. Lucky for me, a -15v voltage is showing -25 volts. It being a negative voltage (in my limited knowledge) points to it being for an op amp, and op amps that don't have the right voltage might fail the H and V sync. I will try to fix that and hope there is no other damage.

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<sup>1</sup>How to throw away a CRT tv? Well, common sense tells me that a tv is a plastic box, with a few pcbs, and a large glass vacuum tube. Basically, an oversized lightbulb. If you can crush the light bulb (from AFAR, as it is UNDER PRESSURE inside) and turn it into a pile of glass, which is sand, that can be thrown into the trash. The plastic can be put into the trash, while the PCBs should be given to recyclers, who will happily take them for free.

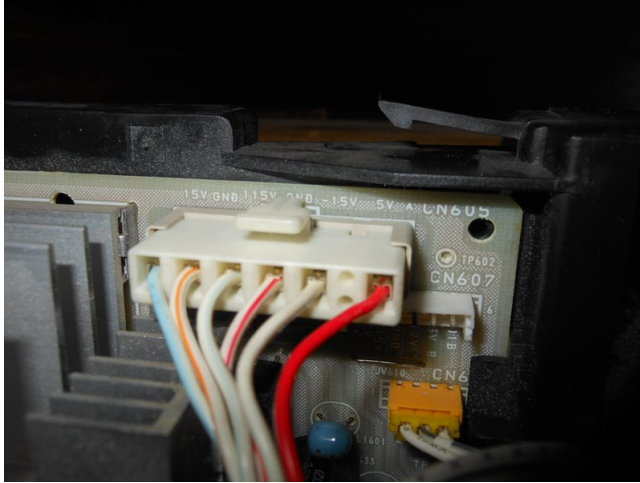


Figure 2: The Rail is listed as -15V...

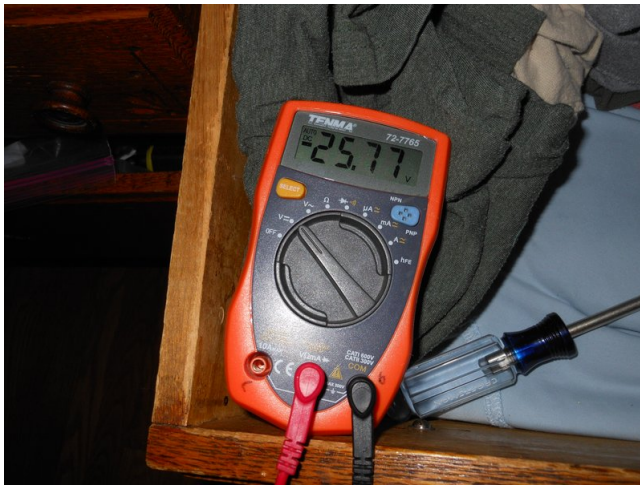


Figure 3: Fault. Later on I moved to a Fluke 27 for this, so please bear with the low quality DMM

I looked around, and the output from the PWM is fed into a transformer, where it's rectified into a number of different voltages. The service manual tells all of this.



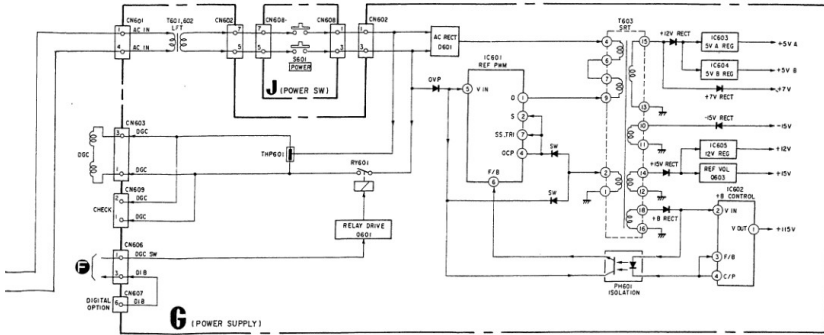


Figure 4: PWM to Transformer to Zener

It appears that the -15V rail (as well as the +7V rail, both have voltages slightly off. I thought at first, the diodes from the block diagram were zeners<sup>2</sup> but it looks like instead, the problem is before the transformer. I'll have to delve a little deeper to see what is giving an incorrect value.

## 4 Day 2

I did some more work on this, but was unable to determine the fault. I think that the fault is before the transformer, but I can't figure out which component has failed. There are not many electrolytic caps before the transformer, and I don't have equipment to check capacitance of other caps. The rail that is marked as 110V before the transformer reads 130, which 'might' be acceptable (my meter is also not true RMS). 110V would refer to Japan's 110V, and for it to be higher in US is expected. Add that to my non true RMS meter, and the error is not glaringly bad. On the other hand, the -22 Volts on the (spec'd) -15V rail definitely is out of spec. I did try a few things, such as isolating the Mains input (i.e. cutting traces on a few

<sup>2</sup>Negative Voltage rails always have diodes that are backwards on schematics... I learned.

spots, and caps) before it entered into the main Rectifier, but I did not find anything conclusive.

What I know is that there are two rails that are off, the 7V and -15V rails. The 7V rail doesn't appear to be used. I've decided to add in an additional -15V regulator using an LM337, to output 1.5A of -15V. I tried adding another cap on C629, the one of two electrolytics on the -15V rail, but no difference. There are two paths the -15V rail takes in from the mains. One is from the PWM pin B, which has a resistor divider go to S and then down to the pin of the transformer for -15V. One of these resistors might be underspec.

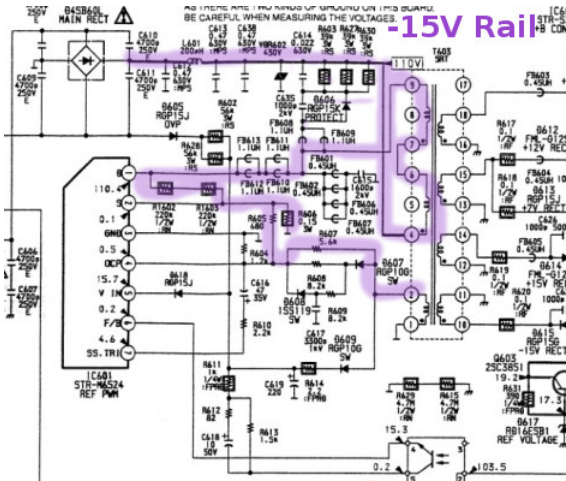


Figure 5: -15V Rail

R605 Measures 380, which may be right (due to it being on board when measuring. it IS close). R604 is .4K (390). Supposed to be 1.2K. But, measuring on board... R607 is .4K again. Seems measuring these in circuit is a losing game. C616 is not a short. R610 is 8.1K. Seems high. It's value should be no higher than 2.2K... Looks like this is a schematic error, as R608 and R609 are the same value resistors and both are similar readings. R610 is in spec. About all I can think, is pulling R604, R605, and R607 and measuring them.

I'm a bit confused whether the test probe measurements are AC or DC. It says 110, which is after a rectifier, (so DC) but I see AC also on this line, and as well, it's going through a transformer, so it must be AC that is coupling, but the AC is 22V, while the DC is 135V or so. Perhaps the fault is near the bridge diode, and with the coupling capacitors nearby... I tried removing them before, but I don't have equipment to test their values. I didn't see any shorts. I give up - I will put in the LM337 and call it a day.

One thing that is interesting, is that I really shouldn't need to troubleshoot this at all. This kind of information should be found on a forum or document provided by the manufacturer. Surely they have had this failure mode on other Televisions. A shortcoming of capitalism, and disposable electronics.

## 4.1 Day 3

I managed to get an LM337 tested and built up on perfboard. As I was soldering wires to the machine, (while unplugged) some caps discharged back into the 115 VOut of the STRS3115 chip as I accidentally moved the probe the wrong way. Oops. Too bad there wasn't a diode there. Now the chip won't output 115V DC. Upon turning the Television on, you can hear the tube attempt to start (sounds like a high voltage ping, which fails to complete, then repeatedly pings - see video). Not enough voltage.

Good news is, a new chip should fix the 115V rail. There is nothing else on that rail that would've failed (although I can't speak for downstream), so a reasonably straightforward fix. The Television remains on the bench another few days. And some more good news, the LM337 seems to output a near clean -15V. It will be interesting to see what the repaired voltage rail does to the tv output once the 115V rail is back in order.

## 5 Conclusion

This was my first Television repair. After I replaced the new chip which I had shorted out earlier, I attempted to turn it on, but the tube would only start for a brief moment before turning itself off (after what seems to be the opto-coupler relay on the power board switched on). At this point, out of the need to clean my desk, I threw in the towel, and tore down the device for what I wanted, giving the rest to recyclers. All in all, it was a learning experience for televisions, and I'm not afraid of CRTs (maybe I should be, though) as much as I was... The lessons to learn in this experience are:

- Be careful of multiple grounds on power supplies like this
- Fuses are good. Without a fuse on this, I would've burned something, my probe likely.
- Be especially careful when checking voltages in a device like this. Any caps that are charged, will release a shock into other lines if you slip while probing, and that can be the end of your repair right there. Probe as little as possible.

Upon watching other videos online <sup>3</sup> I noticed a few other aspects which would've been useful for my setup (in terms of safety), and also one for repair success.

- Use an isolation transformer for the device under test
- Use isolated probes (or make them from the math function and two probes with the ground leads disconnected... Look online if you are not familiar with this).
- Use a GFCI on the outlet where the device is connected. (I need one of these for my lab bench).

And the one note about repair success is, that if I systematically took all (or some of the early ones perhaps, or the ones in the target 15V rail) of the capacitors, and was able to measure with both ESR

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<sup>3</sup>Example being EEVblog #378, where he attempts a repair of a Yamaha Stereo Amp.

and a Capacitance meter - which I don't have - I might've been able to find a fault there. Not just electrolytics, but other caps, and of course as Michael Geier wrote in his book on diagnosing electronics, not just caps but anything can fail. TV Try #1 was not a success but there's no telling what will happen next time. Onto the next repair. This one was repairman error. One slip, and a chip is fried.

## 6 Post Script

Watching a youtube video<sup>4</sup>, the narrator pulls out a similar Panasonic television schematic, which has some waveforms, and a relatively (but not exactly) similar power schematic. Maybe it would've been advisable for me to check other japanese televisions to see if I could find the same schematic, but in this case, possibly one with more detail.

## 7 End of Year Retrospective

I should've decapped the old and new chips. I imagine the new one was a fake, most likely. If not, I could've repaired another component to fix this.

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<sup>4</sup>I do not like the youtube gov't supported monopoly. Support distributed video platforms.

# Weller WSD51 Repair

## 1 Overview

I purchased a Weller WSD51 from Newark, and after about 8-9 months, it started displaying a temperature from 888-902 on its screen. It would not heat up. I contacted Newark whom said to contact weller. I contacted Weller via phone on the Apex tools webpage (I tried the web contact form on the weller site but never received a response)<sup>1</sup> The secretary was kind and sent me a UPS shipping label since the device was under warranty. I shipped the iron, with all original items, and a receipt from Newark in the box, and waited for the response.

## 2 Work Log

Before shipping, I read online (Guido, creator of Arduino ENC28J60 TCP/IP library and gnulinux user) that an 888 flashing error was solvable by adding another capacitor to the inside of the board. I tried this without success. In retrospect, his error was different than mine. I didn't have flashing, and my temperature changed between 888 and 902. I also checked the resistance on the iron and didn't get the values I expected, but didn't pursue further. It's under warranty they should fix it.

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<sup>1</sup>EDIT: Eventually I did receive a response, but it was faster to call in.



Figure 1: The board is a large power transistor with a Pic to control it. Here I added a capacitor per some online guides, but no dice. It turned out to be a failed iron.

### 3 Conclusion

Weller has replaced and repaired the iron. I'm out of Warranty as of Dec. so I will avoid twirling the Iron like I used to when changing tips (spinning it to unscrew). I'm not sure if this is the cause, but just to be safe.

The temperature sensor on the end of irons is just a wire, and susceptible to breaking if not handled carefully. You can see it when changing tips.

They did end up getting back to me per my email, though took a few weeks. Contact by phone was faster. By the time they emailed me, they were able to confirm it was being sent to me via post.

It's a new iron, but I haven't checked to see if they replaced the base model. The small tip on the iron seems to move more than before (slight movement when pressing onto components, which I don't recall from before), I wonder if these were reject models. Anyway,

I've recently learned how to do SMD soldering with a toaster, so I don't see much of a need for the small tip, as it were. A new tip may also fix this.

Overall, pleased but if the iron breaks again...

One other note, When you are changing tips, you can see that there is a wire at the end of the iron. This wire is likely to be fragile when hot, so changing tips should not be done until the iron has cooled a reasonable amount. If you accidentally hit the wire enough, you could likely bend or break it...



Figure 2: Front of the base.



# Bose Cinemate (Original) Repair

## 1 Overview

Find out why Bose speakers don't work. User reports possible lightning surge caused damage to device.

## 2 Work Log

No visible damage inside. Power rails are all clean. Transformer outputs 22V AC. There is a switcher and a linear LDO Vreg both inside a can on the main board powering the ADSP chip.<sup>1</sup> The clock is OK. CLKIN and XTAL both have 33.33MHz clocks. No visible CLKOUT found.

The board is reading external flash at boot, possibly, due to the accessing of the chip. Checking pins of BMS and BSEL per ADSP data sheet... BMS is high, and BSEL is low, which means in data sheet... When BSEL is low, BMS and BSEL determine input. This appears to mean that BMS is an output, and its reading from external memory. There is a JTAG on the bottom of the board. I don't have the appropriate reader.<sup>2</sup>

There is a necessary delay after powering off the board, you have to wait for the caps to discharge, before powering back on. I found this by watching the Output enable pin of the flash on the scope (which seems to be working and apparently the flash is being read at bootup by the ADSP CPU). If you unplug power, and don't wait for the power to drop (about 5-10 seconds) it will not fully restart. The online docs say to wait one minute, hehe. (Although 10 seconds is not 1 minute). That's why.

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<sup>1</sup>Note that analog devices and Bose are both in MA.

<sup>2</sup>I think I watched Shariar of Signal Path debug a broken device like this, and felt the desire to emulate it. In retrospect, I was just poking around, not very hot on the trail.



Figure 1: Main Board. CPU / ADC is under shield.

Pin DQ0 on the flash is constantly changing, in a set pattern. Perhaps flash is being accessed regularly? G (bus read) is normally high, but low during periods at boot. Based on data sheet, G is high and W down, when writes occur, separately G is down when reads occur. Write is pin 11. Write is normally high, and goes down briefly during boot up sequence (much less than the G pin). Based on all this, I suspect the flash is operating OK, without checking jtag.



Figure 2: Main CPU board under can. Starting from 12 o'clock going clockwise, Linear and Switching power regulator, Flash, RAM, ADSP CPU (SHARC), ADC (under blue foam).

Checked the Remote control by viewing it via a digital camera<sup>3</sup>. It is working.

Checking the user manual. No information of any real substance. Checking the service manual. I found a similar model (not exactly the same). Let's see. Can't find the exact service model for this model. Service manual not available. Facing the connector for the IR remote box, the ramps up, female side, the last two pins are audio in. The green LED is the third on the top row. IDC connector, looking at bottom, 2nd on top row is green led. Two series caps at the power, connector, breakout board (with two DB-9 connectors), is the audio coupling between the RCA connectors of the IR remote box, and the rest of the board.

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<sup>3</sup>Image sensors used in Cameras record IR and visible light. They use a piece of transparent plastic to block IR. The IR filter.

Looking at .1 ribbon cable, nub on the bottom, the 3rd from last column (top) is one audio connector, other is 2nd column from last, bottom. On the controller board, beneath the metal case, the two audio signals are fed into resistor dividers, one for each signal. From there they go (see picture) . From there the audio signal goes into that mysterious package, that has no label on it. Probably some ADC. EDIT: I can barely make out it is a Cirrus Logic chip. CS422BA

One of the pins on the ADC is going up and down. Connected to pin 4 of DSP (not adc). That's serial clk (pin 5 adc). Very slow. Pin 4 of DSP is: RCLK0 RCLK is the serial receive clock. The master clock is an input, PIN 10. It looks like the clock is not there. Data sheet says it must be between 4kHz to 24kHz, about. And the clock signal on Pin 10, is absent. It's like 2 Hz, or something slow. I'm going to trace where the master clock for the ADC comes from. It comes from around 25 or so on the DSP. I marked the DSP. I counted about 26, give or take one. Let's count again. I counted 25 this time. It looks like it goes to ground...? It's the one before ground. I realized I could just count down from continuity from ground. So it's PWM.Event1. Let's boot up the device and see if it ever activates this PWM. It may be that the ADC is fine, and something else is broken. It looks like the ADC communicates with its CLOCK and the DSP during boot up, but goes into a sleep mode. I think it's something else.

Something with the infrared diode... I should also check that the infrared diode receiver recognizes the controller button presses. I tested the remote, and the receiver. I can see output on the remote, but do not see any on the diode receiver. I'm going to do some research on what the waveform should be.



Figure 3: Audio In Path to the ADC

Looks like there is no waveform. I will buy a new receiver diode, and if that doesn't fix it, I give up.

## 2.1 Work Log 10/18

IR Emitter Diode fixed it. 38KHz model from Radio Shack. Pinout was identical. There is a youtube video online that covers this repair also.

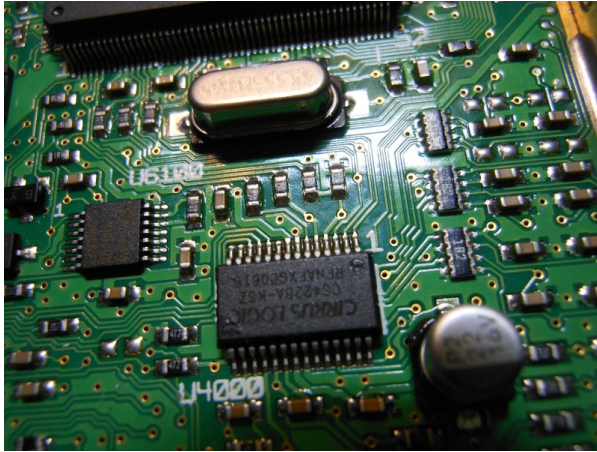


Figure 4: ADC with logo visible: CS4228A



Figure 5: IR is normally invisible, however my digital camera picks it up. A Quick way to test IR is to take a picture. Alternatively, you can probe the diode leads with an oscilloscope.

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<sup>4</sup>An exception would be IR that is borderline visible spectrum as in some CCTV cameras. These give away the cameras position, but serve as a healthy reminder not to stare at the IR leds when you see the dim red light.

# Repairing A Laundry Machine

Steak Electronics

06/01/19

## 1 Overview

A laundry machine is an appliance. There is a whole industry devoted to appliance repair, but those with knowledge of electronics also have skin in the game. At least the washing machine I repaired was simple enough to troubleshoot.

## 2 Details

I washed some bed sheets, and soon after my laundry machine was making a high pitched noise. Something was wrong. It also wouldn't completely go through each mode. It was broken, so the only choice was to repair it.

## 3 Simple Appliances are Made up of Modules

The schematic showed me how it was built. By looking at the machine, I could surmise what each part did. When I bypassed the switch that requires the top loader door to be shut, I was also able



to watch the laundry in motion <sup>12</sup> Here is a diagram of the major functions of the washer.



Figure 1: Landry on bottom, and dryer on top

A scary discovery of the washing machine, was that the belts are always exposed on the very bottom, so if an adventerous person, youth or otherwise, was to put their hands under the machine when it was running, they might get the hands run through a belt and pulley. Perhaps the front cover prevents this somewhat, but what

<sup>1</sup>I would recommend all people bypass this switch at some time, if only to get a better understanding of what's going on, when the clothes are actually washed. I saw a glass door on a dishwasher the other day in a video, and such an idea is so obviously beneficial that is hard to understand why its not standard.

<sup>2</sup>Things they should actually teach people in school.



if it was on wooden blocks or a contractor reaches through a ceiling below?

One of the first things to do when you get an appliance open, is to take a DMM and probe for live voltages. There is 120VAC on this machine when it is powered on in many places, and less places when it is powered off.<sup>3</sup>

So the two chief dangers of working on this machine, are the belts on the bottom, and the mains running through it.

As to what my problem was, I found that there was something in the drain and pump (it technically does two functions). It turned out that my old blanket, had fluff inside that was coming out in small clumps. It has been falling apart for many years, and I have not addressed it, but finally the clumps were pulled through the small holes of the tub, and into the drain. This jammed a rotater in the drain/pump, and lead to the noise as the belts tried to turn the pump. A simple disconnection of the drain hose (When the tub was empty, otherwise, you would get a 10-15 gallons spill), and pulling out of the fluff with a hook and pick set solved the jam.

It helped that the drain was transparent at the top. That detected the jam. I didn't end up needing the schematic, it was possible to repair this without knowing how the washing stages worked. Another important thing, was to not run it after it started to fail. I'm sure if I left it running longer, it would've broken itself. Replacement pumps are purchasable online.

Overall, a repair attempt of a washing machine is a project, I'd recommend to anyone comfortable with mains. Educational, and often able to be fixed.

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<sup>3</sup>This means, if you aren't comfortable working with mains, then you shouldn't attempt a repair on a washing machine. Careless poking inside will get you shocked.

## **IT**

*“The primary function of the design engineer is to make things difficult for the fabricator and impossible for the serviceman.”*

- Uncited

# Running Conduit - Tips

Steak Electronics

## 1 Overview

I recently took up running conduit for cable runs at the office. Here it's used for ethernet runs: CCTV, IoT, or general LANs. Here's what I learned early on.<sup>1</sup>

## 2 Conduit

Here are some general tips on Conduit:

**Where conduit is hard:** Adding cabling to existing conduit, doing unusual bends, using thicker pipes (harder to bend)

**Where conduit is easy:** The opposite: Cabling as you put up the conduit, doing only straight runs, 90 degree bends, and offset bends, and using 1/2" (smaller) conduit.

## Types of Pipe

There are different kinds of conduit, based on the size of the pipe. The price increases with size.

1/2" pipe is good for one or two ethernet runs.

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<sup>1</sup>Of course you can run mains through conduit, but I'll cover that later. Start with low voltage wiring.

3/4" pipe is good for 3 ethernet cables.

1" pipe can run say, 6 ethernet cables.

Now, you can get away with more, but it's best to underspec, so you have room in case of future expansion. However, it's recommended to not add additional cables to the conduit afterwards, and instead use ethernet switches.

## How to Fish Conduit

Ethernet cable should be led through conduit with steel fish tape. You can't use nylon string on existing conduit, unless you are going through small sections of straight conduit - fishing the string as you put up the conduit (new installs). For existing installs, or if you already put up some conduit and just need to get the wire through, use steel fish tape. The steel, allows you to pull AND push the ethernet cable, should it get stuck. However, let me say this: **fish the cable through each piece of conduit you put up as you go**. It's faster, and easier. This also means that future expansion is not nearly as practical.

## Couplers

The ideal coupler has the pipes inside sitting flush against each other, but some couplers have a notch in the middle between them. Those aren't as good, as the notch is a gap where ethernet cable will catch when pulling through. Not an issue if you cable as you go, but a problem for running cable through existing conduit.

## Boxes

Use the deeper, larger electrical boxes. They usually come in a few sizes. The additional space, makes everything easier. Use frequent boxes if you plan to expand more cables later, so you can access everything inside. Use boxes where you will have an ethernet

switch or outlet, or need to branch out...

## Bendy Conduit

Bendable or Bendy conduit<sup>2</sup> is sized one size bigger than it's listed. So if you buy 3/4" conduit, you get a 1" size bendable pipe, with 1/4" the bendy part. This means you must size boxes accordingly. Supposedly, you must buy the specific bendy conduit connectors, but you can fit a 3/4" bendy conduit, in a 1" hole in an electrical box in a pinch. You can also use a coupler (for standard pipe) sized one size bigger, in a pinch. Not as professional looking, but it works.<sup>3</sup>

## Grease

They sell grease, but its a mess, and I wouldn't use it. Not only will it get all inside the pipe, but all over your hands as you pull the wire through. You shouldn't run new wires through existing conduit. One of the problems is that you might wrap the ethernet cable in electrical tape, but tape is rubber, and sticks to the metal. What you want is some kind of slidy, metal surface that doesn't stick to metal on the front of the ethernet cable.

## Fish Tape and Plastic Ends

There is a little piece of plastic on my fish tape at the end. When running through existing small conduit, that plastic is a problem, as it hits wires, and couplers, catching. Solution: Remove the plastic piece. However, there are times when you want something plastic at the end of the metal fish tape. I.e. when you are running fish tape through the bendable conduit. In that case, put some electrical

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<sup>2</sup>There are a couple different kinds of this, and its something I'm still figuring out.

<sup>3</sup>Low voltage only, of course. The correct (codewise) connectors for (mains-wire) flexible conduit are the ones that clamp down. You can adjust the screw as needed to adjust.

tape at the end of the conduit. This little trick can be the difference between barely fishing, and not getting through the pipe. The idea is, it's removable depending on your need. This is primarily for fishing through existing conduit. Again, you can't use nylon string to pull wire through conduit, you need metal fish tape. That is because metal fish tape can be pushed back and forth, but nylon string can only pull.

### 3 End of Year Review

Being a maintenance / IT / electronics engineer at my company, I get to wear a lot of hats, and conduit is one of them. I'm about to run some new conduit, and a few things make it easier, which I learned already. Use the smaller conduits. For awkward turns and bends use bendable conduit. Don't waste time trying complex bends on small runs. Light switches can always go before an outlet to control it on/off. This means you can have as many on/off switches you want. 120V Mains and conduit are easy if you are an EE, but I will cover this in a later document. It's a good idea to pick up a copy of the NEC or related reading material.

# Work Log: 12/03/18 Honeywell T6 Pro Thermostats

*"The primary function of the design engineer is to make things difficult for the fabricator and impossible for the serviceman."*

## 1 Overview

There are 5 Honeywell T6 Pro Thermostats in the Office, which have been installed to replace Google Nest devices. However, they are unable to connect to the wifi. The Nest devices did not have such an issue.

## 2 Details

What was tried:

- Changing Wifi settings from 2.4GHz and 5Ghz to 2.4GHz only (this was recommended by Honeywell docs, as the thermostats work on 2.4GHz only). I verified the wifi was on 2.4GHz only by restarting all APs, and checking with Wifi Analyzer. No effect.
- Changing wifi settings to use WPA1 and WPA2 (in case this was a device without WPA2 support). Previously wifi was set to WPA2 only. No effect.
- Read through all documentation for the Pro T6 thermostats to see if any other settings were required. Nothing of note was found. Documentation is lean. This is my biggest complaint.

- Attempted to connect T6 to wifi by using Lyric (now honeywell home) app with iphone. Failed to complete.
- Disabled a setting in the menus called WAC, which is a setting which automatically transfers credentials from an iphone to the T6 thermostat. At this point, I was required to change to the thermostats wifi access point, type in the password for the wifi manually into the Lyric app, where the wifi showed connected and the thermostat even said Success, indicating completion, however the app failed its side of the registration. This got me further, and I saw on the app that it said the Device had done a Geofencing, and had just come back online. However, it was not listed in the devices of the lyric app... Still no luck.
- At this point, I called support, whom after 30-40 minutes of holding, I was directed by a tech of Resideo to use a phone's wifi hotspot, which should work in this situation (whenever the techs have seen this happen before, this has worked). During the holding time I worked on the network doc for the server rack. He also mentioned that if the device failed to configure like this, that *it was necessary to call up Resideo to delete the device from their servers, as once it is 'half configured' it can't fully be configured.* Wow...
- I attempted to use a 2nd phone outside of the iphone as the mobile hotspot, and to configure wifi on the Lyric aka Honeywell Home app. WAC was enabled. I was able to get about as far as I did with the WAC. The device was able to see wifi, and I could see it connected to my phone... The thermostat even said "Success" and returned to the temperature screen, however the Honeywell Home app did not complete, and gave a failed error (finalizing registration was the last message it tried to complete - often multiple times).
- I tried once or twice more, but was unsuccessful. At this point, I contacted support again, and while waiting on hold for 30-40 minutes worked with another office on their tech issues. Finally,



support recommended I try some of the other thermostats in the office, and also recommended a factory reset. <sup>1</sup>

- I tried on a downstairs thermostat, factory resetting it to new settings and again tried the Access point method. No further progress was made.
- Pretty much the only thing I didn't try, was to factory reset, disable WAC, and then use the Phone's access point. I also didn't try contractor mode (requires answering an email to complete the app install). I did not try a newer Android phone (my phone is too old / doesn't have Google apps). Overall, the only way to connect to the main wifi was to disable WAC. Connecting to a phone hotspot always worked. Poor Antenna?

Based on this, I have come to the conclusion that these IoT devices, or wifi connected smart things, whatever they may be called, are young technologies and not mature enough to be used without bugs. The Nests, which were from a startup bought by Google, show that this kind of embedded device, with online capability, is new ground, and the space is open for startups to innovate. However, that was 2011, and the big players are now rushing to catch up with their own smart thermostats, cameras, light switches, etc... This means some care must be made with buying the smart devices. Some may be more mature than others.

As for what I think the problem is, it's hard to say, but possibly wifi interference in this business location is causing these home devices to be unable to find the wifi. Or, it's simply faulty hardware. Possibly the iphones (two were tried overall) were unsupported, somehow. That's not acceptable in my view.

I'm not impressed with the Honeywell T6 Pro devices, and the performance here shows it's simply not ready yet.

---

<sup>1</sup>(done by holding down the menu button, and then in the window that appears - a service menu - clicking the reset option, then the factory option. Note that this is different from the reset option of the normal menu which doesn't have a factory reset capability... You MUST hold menu down for a few seconds.

### 3 End of Year Retrospective

Early IoT attempts. They can't all be winners. It's deceiving to see a large brand name on something like this, and think there is anything more than a small group of engineers behind it. I think when I called into their support I was probably talking to the engineers.

## RAID on GnuLinux - Mdadm Reference

### 1 Overview

There are a few options for software RAID on Gnu Linux. Among them is BtrFS and ZFS, however today I will focus on using mdadm. This is historically the oldest software raid, therefore should be better vetted, although its performance may be less of that of the first two mentioned - for simple servers, mdadm might be the most stable choice.

### 2 Details

I've worked with this in setting up some Core 2 Duo PCs, with 2 to 4 SATA HDDs. This will be a reference. Let's begin.

#### 2.1 Creation of RAID:

Will not be covered here (yet). You must create the partition tables. Create the raid with mdadm. mkfs.ext4 on the raid partition. Add mdadm to grub config. Reinstall grub. Details may be provided later.

#### 2.2 Details of RAID:

```
root@advacoONE:/dev# sudo mdadm -D /dev/md127
/dev/md127:
    Version : 1.2
  Creation Time : Fri Feb  1 01:00:25 2019
    Raid Level : raid1
    Array Size : 57638912 (54.97 GiB 59.02 GB)
  Used Dev Size : 57638912 (54.97 GiB 59.02 GB)
    Raid Devices : 3
  Total Devices : 2
 Persistence : Superblock is persistent
```

```

Update Time : Fri Feb  1 02:40:44 2019
State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 0
Spare Devices : 0

Name : devuan:root
UUID : 83a8dc03:802a4129:26322116:c2cfe1d4
Events : 82

```

```

Number   Major   Minor   RaidDevice State
-         0        0        0      removed
1         8        17       1      active sync  /dev/sdb1
2         8        33       2      active sync  /dev/sdc1
root@advacoONE:/dev#--

```

so you can see, one was removed (it auto removes, when unplugged)

### 2.3 Add Drive to RAID:

```
sudo mdadm -add /dev/md127 /dev/sda1
```

NOTE2: If you setup 2 hdds, in a raid, and want to add a third, if you just `-add`, it will show up as a spare... if you do `mdadm -grow /dev/md127 -raid-devices=3` then the third might be active sync (what we want) note that the `-grow`, seems to allow for parameter changes after you have already created the raid. you can also specify the exact same command, `raid-devices=3` in the setup of the raid (see install doc). Note that if you lose a drive, you can simply add it.

NOTE: don't worry about mkfs.ext4 on the raid members, after initial setup. The RAID will manage that.

NOTE: if you have a new drive and need to copy the hdd partition tables: <https://unix.stackexchange.com/questions/12986/how-to-copy-the-partition-layout-of-a-whole-disk-using-standard-tools> or aka (FOR MBR ONLY)

Save:

```
sfdisk -d /dev/sda > part_table
```

Restore:

```
sfdisk /dev/NEWHDD < part_table
```

(FOR GPT:)

```
# Save MBR disks
```

```
sgdisk --backup=/partitions-backup-$(basename $source).sgdisk $source
```

```
sgdisk --backup=/partitions-backup-$(basename $dest).sgdisk $dest
```

```
# Copy $source layout to $dest and regenerate GUIDs
```

```
sgdisk --replicate=$dest $source
```

```
sgdisk -G $dest
```

```
root@advacoONE:/dev# mdadm --add /dev/md127 /dev/sda1
```

```
mdadm: added /dev/sda1
```

```
root@advacoONE:/dev# sudo mdadm -D /dev/md127
```

```
/dev/md127:
```

```
Version : 1.2
```

```
Creation Time : Fri Feb 1 01:00:25 2019
```

```
Raid Level : raid1
```

```
Array Size : 57638912 (54.97 GiB 59.02 GB)
```

```
Used Dev Size : 57638912 (54.97 GiB 59.02 GB)
```

```
Raid Devices : 3
```

```
Total Devices : 3
```

```
Persistence : Superblock is persistent
```

```
Update Time : Fri Feb 1 02:41:43 2019
```

```
State : clean, degraded, recovering
Active Devices : 2
Working Devices : 3
Failed Devices : 0
Spare Devices : 1
```

```
Rebuild Status : 0% complete
```

```
Name : devuan:root
UUID : 83a8dc03:802a4129:26322116:c2cfe1d4
Events : 92
```

Number	Major	Minor	RaidDevice	State	
3	8	1	0	spare rebuilding	/dev/sd
1	8	17	1	active sync	/dev/sdb1
2	8	33	2	active sync	/dev/sdc1

```
root@advacoONE:/dev#
```

Looks good.

```
Rebuild Status : 6% complete
```

```
Name : devuan:root
UUID : 83a8dc03:802a4129:26322116:c2cfe1d4
Events : 103
```

Number	Major	Minor	RaidDevice	State	
3	8	1	0	spare rebuilding	/dev/sd
1	8	17	1	active sync	/dev/sdb1
2	8	33	2	active sync	/dev/sdc1

as it progresses, you see the RAID rebuilding.

```
watch -n1 cat /proc/mdstat
```

```
Every 1.0s: cat /proc/mdstat
advacoONE: Fri Feb 1 02:43:24 2019
```

```
Personalities : [raid1] [linear] [multipath] [raid0] [raid6] [raid
md127 : active raid1 sda1[3] sdb1[1] sdc1[2]
          57638912 blocks super 1.2 [3/2] [_UU]
          [==>.....] recovery = 11.2% (6471936/57638912)
```

unused devices: <none>

**WARNING:** Reinstall grub on the new drive again as well afterwards.

## 2.4 Email Notifications on mdadm

Test emails on mdadm.. first configure email however you prefer (i currently use ssmtp, see this link: [https://wiki.zoneminder.com/How\\_to\\_get\\_ssmtp\\_working\\_with\\_Zoneminder](https://wiki.zoneminder.com/How_to_get_ssmtp_working_with_Zoneminder))

then edit /etc/mdadm/mdadm.conf to have your email in mailaddr then

```
sudo mdadm --monitor --scan --test --oneshot
```

should send an email

<https://ubuntuforums.org/showthread.php?t=1185134> for more details on email sending

## 3 References

The section about degraded disks

<https://help.ubuntu.com/lts/serverguide/advanced-installation.html>

General partition tips.

<https://github.com/zfsonlinux/zfs/wiki/Debian-Stretch-Root-on-ZFS>

SSMTP email setup:

[https://wiki.zoneminder.com/How\\_to\\_get\\_ssmtp\\_working\\_with\\_Zoneminder](https://wiki.zoneminder.com/How_to_get_ssmtp_working_with_Zoneminder)  
[wiki.zoneminder.com/SMS\\_Notifications](https://wiki.zoneminder.com/SMS_Notifications)

# Docker Primer

Steak Electronics

08/30/19

## Contents

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## 1 Overview



Docker is a program in the tradition of Virtualization. However, Docker differs from a Virtual Machine, in that it uses less resources, and allows for more containers (essentially isolated OS') to run. With Docker I can run 8 different websites on a Core 2 Duo. Docker makes it trivial to transport these websites to a new machine. It's as simple as copying the docker-compose (you should be using docker compose) yml configuration, and keeping all permanent volumes, and saved files in one folder. Docker is a little more setup upfront, but promises savings in time plus interest down the line.

## 2 General Notes

It always helps to read a book on a subject, and then keep it as a Reference. I have read "Using Docker" By Adrian Mouat. It is a decent book. Not bad.

Here are some general tips:

First off, Docker is 64 bit only for i386 architecture. ARM has a separate build. There is no 32 bit, unfortunately.

You will want 'some' RAM. I had 1GB on a P4 machine, and that was not enough. 4GB was enough.

You should always use docker compose. If you read the book above, you will understand why. Docker can run on the command line (commands are somewhat complex for each container), but with a compose file, you can write everything down in a much simpler fashion. Use compose. It's a separate install, currently. Install it.<sup>1</sup>

One of the benefits of docker, is its simplicity. There are essentially two commands you will ever need to know to use docker. Both must be run as root. One is `#docker` (e.g. `docker restart container_name_here`). The other is `docker-compose` (e.g. `#docker-`

---

<sup>1</sup>Seriously, just ignore the (non-docker compose) docker command lines. I consider them useless. More of a red herring for rookies.

compose up -d).

## 2.1 Docker Commands Reference

Here is just the good stuff.

- `docker-compose up -d` (starts the containers in the docker compose file, if they aren't already started. the `-d` detaches from the stdout logging. You don't need to use stdout logging, you can use `docker logs`, but its there if you want it)
- `docker ps` (lists containers running. If one fails to start, you'll see it missing from here)
- `docker logs ;containername;` (gives you some logging output from the container. Often enough to troubleshoot.)
- `docker exec -it ;containername; /bin/bash` (this will get you in a shell in the docker container. From here you can do what you need to. Most are debian, and need `apt-get install less nano` or whatever program you are missing. Ping is missing from possibly all containers, so if you want to test via ping, you'll have to `apt-get` it).
- `docker-compose restart` (this will restart all containers. However, I don't recommend it. Initting containers can get corrupted this way, and also its much easier to restart a single faulty container via...)
- `docker restart ;containername;` (this will restart one single container.)
- `docker cp ;containername;:/dir/to/file dest` (you can copy files from local machine to docker, or vice versa with this. Extremely useful).

Less often, you might want to know `docker kill ;containername;` and `docker rmi -f ;imagename;`. The first will stop a container, the second

will remove an image. If you corrupt the install of a container, the second will save you. The force switch (-f) is required. Alternatively, you can just install a container of the same type with a new container name. <sup>2</sup>

## 3 Specific Tips

### 3.1 YAML is space sensitive

When you edit the .yaml file for docker-compose, you have to hit spaces in a certain pattern (tabs not allowed). This is absurd, but just be aware. The errors are cryptic, and its often just because the spacing doesn't stick to what it expects.

### 3.2 If you restart a containers namesake process, it will probably restart / reset the container

So if you are troubleshooting an apache container, you edit some files, then /etc/init.d/apache2 restart, uh oh... You just undid all the edits you made, if they aren't in a permanent volume. You can shell in, make edits, and then exit the shell, but a service restart often resets the container.

### 3.3 Use a single reverse proxy, to handle multiple web-sites

There are many ways to do this. I use an nginx proxy from scratch. You can also use some containers that are built for this purpose (I personally think it's bloated but a lot of people use Jason Wilder's proxy) <sup>3</sup>

---

<sup>2</sup>This is a good way to test that your containers are built in a reproducible way. If you are able to rebuild them by deleting everything, then you likely won't have trouble down the road.

<sup>3</sup><https://github.com/jwilder/nginx-proxy> - A lot of people swear by this, but I think it's straying too far from the motorcycle.

### 3.4 If you use a single reverse proxy, Lets Encrypt can be done easy

In this case scenario you would have certbot on the host and a local volume that the proxy has access to which is the webroot of the Lets Encrypt scripts. The nginx proxy entry look something like this:

```
location ^~ /.well-known {
    alias /var/www/html/.well-known/;
    autoindex on;
}
```

And this is put in every server declaration of nginx.conf. Real simple, real easy. The docker compose of the nginx proxy is something like:

```
nginx:
  image: nginx:latest
  container_name: custom_name_for_my_proxy
  volumes:
    - ./nginx.conf:/etc/nginx/nginx.conf
    - /etc/letsencrypt/:/etc/letsencrypt/
    - ./webroot/:/var/www/html/
```

The volumes section is extremely simple, don't be scared. There are two entries. Local and remote. You specify what folder will be the local directory which will be cloned to the host at the remote path you specify. So, the host runs certbot at /etc/letsencrypt, and this folder is cloned to the nginx proxy container, at the same location. Finally, webroot must be set in certbot, but it prompts you for this<sup>4</sup>

### 3.5 Give every Container a Containername

---

<sup>4</sup>And if you forget or get it wrong, it can be configured somewhere in /etc/letsencrypt. it's a one liner text entry).

This makes it easier to refer to them later. All you need to do in the compose file is include `container_name: something`. Much better than the gibberish they give these names if you don't include it.

### 3.6 Beware of Interrupting Initting Containers

When you first build a container, it might take 30-60 or more seconds to do whatever it needs to do. If, before then, you restart it... It may get corrupted. This has happened to me more than once. When you are testing a new container, and it doesn't seem to work for some inexplicable reason, create a container with a new name (it will create a new one), or delete the first one, and start it again.

### 3.7 Put Apache or Program logs from the Container in a volume that is locally accessible

This means you want a volume something like `./containerA_files/logs:/var/www` so that you can monitor the logs from your host machine easily. docker logs doesn't have everything.

### 3.8 Only Restart Containers you need to Restart

You can restart everything with `docker-compose restart`, but it's faster, and less prone to break initting containers, if you `docker restart containername`. Do the latter.

### 3.9 Volumes Mounting Over Existing Directories

As discussed here:

[web.archive.org/web/https://github.com/moby/moby/issues/4361](https://web.archive.org/web/https://github.com/moby/moby/issues/4361), if you add a volume to an existing container, it will seem to delete the folder's contents. I've seen mixed behaviour with this. Sometimes it deletes it even if you start a new container with the folder... Other times it has not. In any case, just `docker cp` the files to the folder, then add the volume mount.

### 3.10 Further Reading

<https://steakwiki.com/Docker>  
hosts my current docker notes.

# Windows Licensing 7: Rectal Insertion

## 1 Overview

Windows 7<sup>1</sup> is a beast to activate. Constant cat & mouse game, where the admins are slowly trained that the best way to get it activated is to pay for it. But what if you did pay, and then it gets deactivated somehow? Pay for it again. It's the fastest way. Only a fool goes down the rabbit hole of trying to illegally activate a legal copy of Win7<sup>2</sup>.

## 2 Details

User had Windows 8. Their IT advised them to downgrade to 7 because 8 was garbage. 5-10 years later, the license unexpectedly becomes inactive.

Notes: The users had actually taken a screenshot of the windows ID, in the system screen, but this wasn't the windows key. It was the

---

<sup>1</sup>Before someone complains about the title rectal insertion, I will say that generally humans (and animals) don't like things inserted into this oriface, and if you need proof, then consider that they don't make recreational drugs in suppository form (as George Carlin says).

<sup>2</sup>Some users have been managing a list at [reentry.co/fwt](http://reentry.co/fwt) which details backdoor activation of some Windows. For now, I will use that, when necessary. To be fair, 7 will run without much fuss these days (didn't always, though. I remember Vista and 7 used to shut down after 30 minutes) though it will have a message on the background that says 'not valid'. Not a problem for those hacking around.

OEM ID. That was a trap. If it says OEM, you can get the windows key from a vbs script provided on lenovos webpage for finding win7 keys, (I'll include it in the git). That is what they should've used.

Cat & mouse. Even for paying customers. If there is a way to screw you, they will screw you. You might even take a picture of what you thought was the ID. Well, it wasn't the ID. Predatory business model, really.

### 3 Test.vbs

In this folder, is a copy of a visual basic script that will run on Win7 to get the true product key/id whatever it is being called. Not the fake OEM one that is where the key used to be in control panel - system. It seems to work, sometimes,



# Fail2ban Primer

## Contents

### 1 Overview

Fail2Ban is a firewall adjunct, a spiritual successor to denyhosts<sup>1</sup>, which is used to block ip addresses that try to break into your internet server.

Here are some of the traps, and configurations I've needed to setup fail2ban correctly. It's not a complex program, but unless you sit down and understand it, you might get caught. To be honest, it took me some time to figure out fail2ban, as I initially didn't have the patience to sit down and configure it.

### 2 Instructions for Setup

Quick setup for Devuan / Debian 9: First install fail2ban using apt-get. (apt-get install fail2ban).

Fail2ban is a service that will appear in /etc/init.d/ in Devuan. So it can be managed with service fail2ban {start,stop,restart}. Second, navigate to /etc/fail2ban/jail.d/ Add the following to a sshd.conf file (or name it anything you like)

```
# this is used in devuan. no other changes are made to other files
# that the default ssh filter is disabled in jail.conf if it enabl
```

```
[sshd]
ignoreip = 127.0.0.1/8
action   = iptables-allports
maxretry = 6
```

---

<sup>1</sup>denyhosts was used for ssh, but eventually was abandoned. It was quite a bit simpler to configure than fail2ban, and this was its strength, but it is also more limited, and now has vulnerabilities.

```
enabled = true
filter = sshd
logpath = /var/log/auth.log
bantime = 360000
findtime = 3600
```

Now, a few notes on this file.

First, action can be iptables for a single port, or iptables-multiport for more than one, but we are using iptables-allports, as we want to block everything. These actions are listed in `/etc/fail2ban/actions.d/`

Second, logpath, should point to your ssh log. In devuan ascii / debian stretch (9) it should be `/var/log/auth.log`. Other distributions may vary. The format of the ssh log can vary as well. In this guide, it's assumed to be `auth.log`. Gentoo users see below to enable `auth.log` in `syslog-ng`.

Third, be careful of different ssh ports. I routinely change ssh ports to be a non standard port, which although it's somewhat pointless, it still seems to block random ssh port scans for port 22. If you use a different port, you must specify it in `iptables-multiport` above. A potential trap is to use a nonstandard port, then wonder why `fail2ban` blocks port 22, but your ssh is on port 123 or something. An aggressive and easier approach is to just block everything.

Fourth, the default action in `iptables-common`<sup>2</sup> is to REJECT packets. However, I have changed it to DROP (`blocktype=DROP`). For those unfamiliar with the difference between REJECT and DROP, from my understanding, it is that REJECT will alert the outside host that the port is unreachable, while DROP simply goes silent, leaving the other host to figure it out on their own.

**To configure it, see `/etc/fail2ban/actions.d/iptables-common.conf` and search for `blocktype`.**

---

<sup>2</sup>this parent file in `actions.d` applies to all child iptables of course, being named "common"

As I consider the offending ip addresses to be attackers, I have set it to DROP. If they try to break into the server, then block all ports from them, and don't tell them anything. The DROP timeout is more work on their end. With REJECT, my server responds. No need to play nice, with people/robots that have no morals.

On fail2ban issues git tracker, there is some discussion about this, and it is not really definitive. It ends up being that, REJECT is default, and if you want you can change it to DROP. As I have. As long as the option is there, I think that is acceptable.

Fifth, review jail.conf, and fail2ban.conf. Usually nothing needs to be changed, but occasionally jail.conf will enable the default sshd jail (which you can disable, and use instead the new one). This will be distribution dependent.

## 2.1 Getting auth.log to appear in Gentoo

This guide will only cover those working with syslog-ng in Gentoo. You can add a config to syslog-ng to get auth.log to appear in Gentoo.<sup>3</sup> Notice in the below config, that a destination has been defined for authlog. You need not copy all the syslog-ng below, only what you need.

```
/etc/syslog-ng/syslog-ng.confSyslog-ng
```

```
@version: 3.17          #mandatory since Version 3, specify
                        the version number of the used syslog-ng
```

```
options {
    chain_hostnames(no);

    # The default action of syslog-ng is to log a STATS line
    # to the file every 10 minutes. That's pretty ugly after
    # Change it to every 12 hours so you get a nice daily update
```

---

<sup>3</sup>Reference: [https://wiki.gentoo.org/wiki/Security\\_Handbook/Logging#Syslog-ng](https://wiki.gentoo.org/wiki/Security_Handbook/Logging#Syslog-ng)

```

        # how many messages syslog-ng missed (0).
        stats_freq(43200);
};

source src {
    unix-stream("/dev/log" max-connections(256));
    internal();
};

source kernsrc { file("/proc/kmsg"); };

# define destinations
destination authlog { file("/var/log/auth.log"); };
destination syslog { file("/var/log/syslog"); };
destination cron { file("/var/log/cron.log"); };
destination daemon { file("/var/log/daemon.log"); };
destination kern { file("/var/log/kern.log"); };
destination lpr { file("/var/log/lpr.log"); };
destination user { file("/var/log/user.log"); };
destination mail { file("/var/log/mail.log"); };

destination mailinfo { file("/var/log/mail.info"); };
destination mailwarn { file("/var/log/mail.warn"); };
destination mailerr { file("/var/log/mail.err"); };

destination newscrit { file("/var/log/news/news.crit"); };
destination newserr { file("/var/log/news/news.err"); };
destination newsnotice { file("/var/log/news/news.notice"); };

destination debug { file("/var/log/debug"); };
destination messages { file("/var/log/messages"); };
destination console { usertty("root"); };

# By default messages are logged to tty12...
destination console_all { file("/dev/tty12"); };

```

```

# ...if you intend to use /dev/console for programs like xconsole
# you can comment out the destination line above that references /
# and uncomment the line below.
#destination console_all { file("/dev/console"); };

# create filters
filter f_authpriv { facility(auth, authpriv); };
filter f_syslog { not facility(authpriv, mail); };
filter f_cron { facility(cron); };
filter f_daemon { facility(daemon); };
filter f_kern { facility(kern); };
filter f_lpr { facility(lpr); };
filter f_mail { facility(mail); };
filter f_user { facility(user); };
filter f_debug { not facility(auth, authpriv, news, mail); };
filter f_messages { level(info..warn)
    and not facility(auth, authpriv, mail, news); };
filter f_emergency { level(emerg); };

filter f_info { level(info); };
filter f_notice { level(notice); };
filter f_warn { level(warn); };
filter f_crit { level(crit); };
filter f_err { level(err); };
filter f_failed { message("failed"); };
filter f_denied { message("denied"); };

# connect filter and destination
log { source(src); filter(f_authpriv); destination(authlog); };
log { source(src); filter(f_syslog); destination(syslog); };
log { source(src); filter(f_cron); destination(cron); };
log { source(src); filter(f_daemon); destination(daemon); };
log { source(kernsrc); filter(f_kern); destination(kern); };
log { source(src); filter(f_lpr); destination(lpr); };
log { source(src); filter(f_mail); destination(mail); };
log { source(src); filter(f_user); destination(user); };

```

```
log { source(src); filter(f_mail); filter(f_info); destination(mail)
log { source(src); filter(f_mail); filter(f_warn); destination(mail)
log { source(src); filter(f_mail); filter(f_err); destination(mail)

log { source(src); filter(f_debug); destination(debug); };
log { source(src); filter(f_messages); destination(messages); };
log { source(src); filter(f_emergency); destination(console); };

# default log
log { source(src); destination(console_all); };
```

### 3 Future Advancements

What is next for fail2ban after the above? You will want to watch apache logs, and ban any hosts from your IP that search for things they should not be looking for (wordpress logins, phpmyadmin, etc).

Gentoo has a use flag to use a DB to do persistent blocking over time. This way you can block offending IPs through restarts.

### 4 Further Reading

<https://github.com/fail2ban/fail2ban/issues/2217>  
<https://www.jwz.org/blog/2019/03/apache-2-4-1-killed-fail2ban-so-thats-awesome/>  
<https://www.fail2ban.org/wiki/index.php/Apache>  
<https://www.fail2ban.org/wiki/index.php/>

# AutoSSH - a Reverse Proxy Alternative

This document is best read printed out on paper.

## 1 Overview

I recently added another apache server to an existing infrastructure, and I wanted it to be accessible under a similar IP as another server. Due to the complexity of the website, it was not possible to simply do a reverse proxy without knowing the correct settings (e.g. X-Forwarded for). Instead, AutoSSH was used.

## 2 Work Log

Ok, I'm going to get right to the configs that I used. You want the tool, you don't need to know all the details.

### 2.1 Crontab

Here is the crontab script I used. I put this in `/etc/crontab`, so it has root after the times. I only use `/etc/crontab`, as it's easier to manage.

```
* * * * * root  pgrep autossh > /dev/null || \  
/usr/local/bin/autosshzm/autosshzm.sh
```

A few notes about this. Pgrep will search for autossh. If it doesn't find it, then it will try the next command. (— is an OR). Put the bash script wherever you want.

### 2.2 Bash Script

This script is obviously what the crontab calls.

```
#!/bin/bash  
logger " /usr/local/bin/autosshzm script started."  
#source $HOME/.bash_profile #not needed.  
source $HOME/.keychain/$HOSTNAME-sh
```

```
logger " /usr/local/bin/autosshzm sourced."
```

```
autossh -L 0.0.0.0:2:localhost:80 -f user@ipaddress sleep 315360  
&> /var/log/autosshzm/autosshzm.log  
#autossh -M 0 -o "ServerAliveInterval 30" -o "ServerAliveCountMax  
-L 0.0.0.0:2:localhost:80 user@ipaddress &>  
/var/log/autosshzm/autosshzm.log  
logger "auto ssh ran"
```

Note that the second `autossh` does not work, as it's missing the `sleep` and the `-f` command. <sup>1</sup> In order for this to work, you'll also need the following commands:

```
apt-get install keychain autossh
```

There were some more setup steps required for `keychain`... From [stackexchange](#):

```
25
```

```
keychain
```

solves this in a painless way. It's in the repos for Debian/Ubuntu

```
sudo apt-get install keychain
```

and perhaps for many other distros (it looks like it originated from Gentoo).

This program will start an `ssh-agent` if none is running, and provide shell scripts that can be sourced and connect the current shell to this particular `ssh-agent`.

For `bash`, with a private key named `id_rsa`, add the following to your `.profile`:

```
keychain --nogui id_rsa
```

---

<sup>1</sup>Figuring this kind of stuff out can take about an hour.



This will start an ssh-agent and add the id\_rsa key on the first login after reboot. If the key is passphrase-protected, it will also ask for the passphrase. No need to use unprotected keys anymore! For subsequent logins, it will recognize the agent and not ask for a passphrase again.

Also, add the following as a last line of your .bashrc:

```
. ~/.keychain/$HOSTNAME-sh
```

This will let the shell know where to reach the SSH agent managed by keychain. Make sure that .bashrc is sourced from .profile.

However, it seems that cron jobs still don't see this. As a remedy, include the line above in the crontab, just before your actual command:

```
* * * * * . ~/.keychain/$HOSTNAME-sh; your-actual-command
```

The only thing that I needed to do here was

```
keychain --nogui id_rsa
```

The rest of it (notes about crontab) was not required.

### 3 What Did NOT Work

Here's some things I tried that did not work.

- <https://github.com/obfusk/autossh-init> - This init script, didn't do much for me. Remember, I'm stuck with systemd in Ubuntu 19.04...<sup>2</sup>

---

<sup>2</sup>The scourge of deleting software history. Keep backwards compatibility at ALL COSTS, developers.

- Reverse proxy with Apache - As I said, my website <sup>3</sup> was too complex, and I didn't want to go down that rabbit hole.
- Starting AutoSSH in rc.local. Didn't work.

---

<sup>3</sup>Some people might call it a web application. I will not.

# Transmission Bittorrent Primer

*“Whomsoever diggeth a pit, shall fall in it” - Marley, B.  
(You reap what you sow)*

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## 1 Overview

Transmission is a Bittorrent server that can be deployed on a computer or dedicated seedbox. It’s installable with apt-get install transmission-daemon. There is transmission-remote, and transmission-remote-gtk to view the torrents over the LAN.

## 2 Setup Notes

I setup transmission behind a VPN, and forward ports appropriately. In order to do this, I have an outbound VPN from my LAN that goes to a remote server, then the ports for transmission are open on the remote server.

## 2.1 Setup Start

Install `openvpn road warrior` from Nyr on github. This is deployed on the remote VPS. Create a client certificate and install that on the LAN seedbox.

On server you need to forward ports:

```
iptables -t nat -I PREROUTING -i eth0 -p tcp --dport 52000 \
-j DNAT --to-destination 10.8.0.2:52000
iptables -t nat -I PREROUTING -i eth0 -p udp --dport 52000 \
-j DNAT --to-destination 10.8.0.2:52000
```

In fact, you probably only need one, but here we are opening TCP and UDP. This example assumes you are using the default transmission ports. It's advised to change the default ports.

On transmission daemon client, you don't need anything (for iptables). The remote VPN server does all firewall routing.

Test that the port is open in Transmission remote gtk's settings. If it's not, diagnose with `tcpdump`.

## 3 What can go wrong

### 3.1 Changing transmission configs

In order to change any `settings.json` of transmission, you must stop transmission. Otherwise, the running program will overwrite / ignore your changes.

### 3.2 `/var/lib/transmission/config/settings.json`

Make sure peer port is 52000, or whatever you set it to. Disable random peer port (shouldn't be enabled by default).

make sure `bind-address ipv4` has your vpn address, or make it

0.0.0.0. If you have it to a previous or incorrect ipv4 address, it will look like \* (for all ports) in your # netstat -ano , but it just won't work. **TRAP**

### 3.3 All Bittorrent traffic through Transmission

If your vpn for all the traffic is working correctly when you examine ifconfig you will see the packet numbers for eth0 and tun0 be comparable in numbers.

if it seems like eth0 is moving more packets than tun0, your tunnel is not working and the torrent client is leaking.

Verify it by doing either a netstat or more helpfully a tcpdump for the local interface

#### 3.3.1 Block WAN traffic

You can block the WAN traffic that isn't from the VPN to the transmission daemon at the router.

So wan – no vpn – router – seedbox – BLOCK and on top of that (insert for iptables, not append)

Wan – yes vpn – router – seedbox – ALLOW

### 3.4 RPC

RPC on transmission. This is the protocol that you can access transmission through from another machine.

**Problem:** Only works through http. If you want it on a VPS, you have a problem (It's not encrypted and passwords are in plain text). There's no way to access the Seedbox remotely (securely).

**Solution:** Use it through a VPN tunnel. e.g. Transmission-remote-gui.

Force binding of RPC to be only the TUN IP address as well. This way RPC is not accessible from WAN.

### 3.5 Crashes due to high torrent count

I've used a Beaglebone with transmission, and eventually (after about 400 torrents) found instability. Transmission-daemon would crash. Instead, I moved onto x86 hardware, and the problems have mostly gone away. It's possible to tune transmission to connect to less peers, or have less torrents active if you are having stability problems. This lowers your seeding ability, but brings stability back. Ideally, you should use server motherboards / hardware.<sup>1</sup>

Another thing to consider is the SATA controller for your HD. If you are using a NAS, or external USB enclosure, there can be some controllers which perform more reliably.

## 4 Conclusion

Basically:

- install nyr on server, then make cert for client and setup
- server, add two prerouting commands (just these two!)
- client, double check transmission settings.json if necessary.
- client, watch `/var/log/transmission/`, and verify the port is open via `transmission-remote-gtk`

---

<sup>1</sup>Babies first server lessons, and why a server is needed. RPI/Beagle is great, but it is not a server.

# Installing an Outdoor IP Camera

Steak Electronics

10/11/19

## 1 Overview

Notes on installing a 'professional looking' outdoor IP camera.

## 2 Parts

First things first. You'll need to make the camera weatherproof.



Figure 1: Lots of parts required for this to do it right.

Here's an assortment of items I used to make this possible. it's not as easy as you think. You will be running conduit from the inside of the building to the outside. You will use waterproof conduit connectors at certain spots, and at others, you will silicone or roofing tar the connectors so that water doesn't get in.

This particular camera <sup>1</sup>accepted a conduit connection on its enclosure (it was designed for this), so I brought the camera into Home Depot, and played around with the conduit fittings a bit, to find the right ones. I actually had to mix and match... The waterproof connector fit on the outside, but it's closing nut didn't, so I grabbed a general smaller nut, which did fit. Therefore, first recommendation, is to bring the camera into the hardware store, and try fittings in the store to make sure they fit.

You'll want silicone <sup>2</sup>. Get a small container, that doesn't require a caulking gun. You'll want water proof hardware (screws), so I bought the brass ones<sup>3</sup>. Second, you'll need conduit, a 90 degree conduit elbow, and I also bought some roofing tar (it's cheap, and supposedly more weather resistant than silicone) for the space around the conduit as it goes into the building.

You also need a way to get out the buildings wall. Here I used a very long drill bit with an extension. I only went through wood. If you have to go through brick, you'll need a concrete drill, and what not. Some contracting experience is assumed here.

I also assume you have a good outdoor camera. Most people expect dome cameras outside. Bullet cameras are OK for industrial work, but not for a public space. <sup>4</sup> The camera must also be rated for the climate. A lot of cameras can't handle winters, so spec accordingly.

---

<sup>1</sup>Axis brand

<sup>2</sup>Another option might be that rubberized waterproof ribbon / tape they use for waterproofing coaxial connections.

<sup>3</sup>This will depend upon what you are connecting to of course. I had the ease of wood. Others will need concrete appropriate hardware

<sup>4</sup>Dome is the standard for public areas. They are not as imposing.



## 3 Work Log

### 3.1 Size up the Site

Take a look at the building, and decide where you think cameras can go. After you do that, talk with the building owner, and see where he/she wants the camera to go. This is a survey phase.

### 3.2 Drilling to the Outside



Figure 2: This hole went above the drop ceiling, through the old and new drywall, and also some insulation.

Drill to the outside. You might need a drywall saw, or a concrete drill as mentioned depending on what you are going through. Here a note of caution. Beware of A) Electrical Wiring, and more importantly B) Plumbing pipes in the wall. Getting shocked is one thing, but putting a hole in some copper pipe will flood the wall, so especially don't do that.

### 3.3 Conduit to the Outside



Figure 3: This won't work to the outside..

In my inexperience, I make bad choices. Here I thought I could just bend the conduit 90 degrees and put it outside. Fail. If you bend it like this, it will stick out of the outside wall, which isn't professional looking.<sup>5</sup> If you have a hacksaw it's an easy fix. Alternatively you can use a handheld band saw, as I did to cut the conduit up.

### 3.4 Installing the Camera

Here's one example of a camera setup. Note the 90 degree conduit elbow. This elbow had rubber on the inside of the access panel so it is water resistant. I also put silicone on both ends of the conduit, as well as roofing caulk on the outside wall, to keep the elements out of the new hole.



---

<sup>5</sup>You can't have the bend go outside and stay flush to the wall... An assumption got me.

Figure 4: Before: Hole is Drilled.



Figure 5: After: Camera is installed.

The big piece of plastic on the conduit against the camera is the waterproof conduit connector. These are expensive. Be prepared.



Figure 6: Close Up View of Camera

Finally, some roofing caulk to the hole in the outside wall for protection.



Figure 7: Roofing Caulk

# Portable Recording Camera Setup

This document is best read printed out on paper.

## 1 Overview

The goal is to setup a portable remote camera recording server. So, I will have a computer (that is weatherproof, such as a Tough-book) recording a camera (also weatherproof). I will want remote access to the setup across a VPN, and perhaps a cell hotspot. The idea is, the technicians will deploy this box and camera on site, and the video's live feed will be accessible at the company HQ. It will also be recording locally.

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## 2 Initial Ideas

I started with Devuan Ascii / Debian 9 as it is my preferred OS of choice at the moment. Configuration is much easier without the regressions that have come about due to limited init choice.

Also I had considered including a wifi router onsite, but this ended up too difficult, as we would have to find internet to connect to onsite. Instead, the company I was working for had some cell hotspots, so I went with a wifi connection to the hotspot instead. However, some wifi router steps have remained here for personal reference. Note that a mifi (cell wifi) was used at the end.

Some other ideas were to use a toughbook, as it would be weatherproof. This idea was later tossed out, as it is cheaper to buy an RPI. A toughbook is also larger and heavier, requiring a bigger enclosure.

I also tried 3 different ZM installs, but this was only necessary at the time due to development in ZM. In the end I went with 1.32 on Raspbian 10, and Raspbian 9 or 10 is what I would recommend with an RPI.

I started by using a power button on the outside of the enclosure, but also scrapped this idea later. The technicians should not need to power it up. Instead, I will use a UPS for the RPI, and a mifi with its own lithium battery. Let us begin.



## 2.1 Wifi on Devuan Ascii Setup Notes

In order to get wifi to work, I needed to install firmware-iwlwifi\*

I also installed firmware-linux-nonfree

That latter step might not have been necessary.

Needed also iw.

apt-get install iw wpasupplicant

There were some configs made for wifi.

```
ctrl_interface=/var/run/wpa_supplicant
```

```
network={
```

```
    ssid="wifiname"
```

```
    psk="passwordhere"
```

```
}
```

```
# should be all thats needed, unless you hide ssid.
```

```
# this above file goes in /etc/wpa_supplicant/wpa_supplicant.conf
```

Then, the network interfaces looks like this:

```
# interfaces(5) file used by ifup(8) and ifdown(8)
```

```
# Include files from /etc/network/interfaces.d:
```

```
allow-hotplug wlan0
```

```
iface wlan0 inet dhcp
```

```
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
```

```
source-directory /etc/network/interfaces.d
```

```
#tested in ascii
```

```
#ifup wlan0
```



#should work

Now, I need to do the following:

Have wifi router connect to company LAN via vpn Have laptop connected via wifi (static IP), then have a dhcp server on ethernet lan, or simply set all cameras with static IPs. <sup>1</sup> Have route to wifi router lan, over vpn, and test that LAN can connect to the laptop. Set static ip on camera (a unique subnet, such as 192.168.220.101).

## 2.2 OpenVPN setup

I need to setup the recording computer as a VPN client, to the company, and then have the company LAN, be able to access the computer via the tunnel.

So, to put it simply: Computer is vpn client Connects through cell hotspot Lans are shared, or somehow there is access to the remote camera server <sup>2</sup>

## 2.3 Wifi Router Setup

**Note:** Here are some steps on setting up an OpenWRT router as the VPN Client. I ended up shelving this approach in favor of the cell hotspot, as mentioned, but I will retain them here, as they are still valid for the given use case.

I got a bit confused, as I saw the openwrt wiki had hidden the old good documentation and replaced it with poor new documentation. Also I was considering the wifi router as a VPN server, but of course that is wrong. I got a bit confused by the available documentation, which steered me towards making a VPN server by accident.

Steps:

---

<sup>1</sup>Static IPs ended up being the choice here for simplicity sake. No need for a DHCP server.

<sup>2</sup>Note that I ended up going with a simple approach, that of a reverse proxy in apache, to forward requests to a distinct URL, to that of the remote camera server over the VPN. See the Ubuntu section for full details.

Go to main LAN server. Run Openvpn roadwarrior script (nyr) to generate a new client key.<sup>3</sup>

<https://forums.openvpn.net/viewtopic.php?f=24&t=15768#p41027>  
Has some assistance too.

That gives you a .ovpn file with everything included, including key.

Bring that to wifi router. Rename it to .conf instead of .ovpn. Redo port number if its wrong, in conf file... test it on the router with `openvpn /etc/openvpn/confname.conf` should work, and connect. Now we need to figure out the routing. start it again with `openvpn /etc/openvpn/confname.conf &`

### 2.3.1 OpenWRT VPN Troubleshooting

Got an error with keys: VERIFY ERROR: depth=0, error=CRL has expired: CN=Eyeround

this is covered here: <https://forums.openvpn.net/viewtopic.php?t=23166>  
so

```
root@CamSys:/etc/openvpn/easy-rsa# nano openssl-1.0.cnf
root@CamSys:/etc/openvpn/easy-rsa# ls
COPYING  ChangeLog  README.quickstart.md  doc  easyrsa  gpl-2.0.txt
root@CamSys:/etc/openvpn/easy-rsa# cd ..
root@CamSys:/etc/openvpn# ls
ca.crt  ccd      client-common.txt  dh.pem  ipp.txt  s
ca.key  client  crl.pem           easy-rsa  openvpn-status.log  s
root@CamSys:/etc/openvpn# openssl ca -genctrl -keyfile keys/ca.key
```

Then this error:

```
140116092167824:error:0E065068:configuration file routines:STR_COPY:variable has no value:conf.def.c:584:line 3
```

I was in danger of running into a rabbit hole here, so... I went back to the earlier error:

---

<sup>3</sup>If you are not familiar with the Openvpn Roadwarrior script, it's a shell script that will quickly initialize you with a VPN server, and also a client. You can also iterate additional clients, extremely fast. It assumes a few things about VPNs, such as that we want to direct all outgoing traffic through the VPN, but it works well for our limited use case (the most common VPN). Any custom VPN settings though, will require a basic understanding of OpenVPN configuration files. <https://github.com/Nyr/openvpn-install>

<https://github.com/Nyr/openvpn-install/issues/352> covers it. There is a fix for future install guides, but:

if you installed version before this committed.you can

```
cd /etc/openvpn/easy-rsa
./easyrsa gen-crl
```

And that solved that error. Should've been more specific with my original search query. Never know which is right, broad or specific, when searching.

My configs:

```
openvpn server.conf
```

```
/etc/openvpn/ccd/Eyeround
```

```
push "route 10.1.10.0 255.255.255.0 10.8.0.1"
route 192.168.220.0 255.255.255.0
```

```
#the idea is, push business network to RPI, and add route for lan
```

```
/etc/openvpn/ipp.txt
#these are static ips for vpn tunnel
Eyeround,10.8.0.20
```

```
server.conf
```

```
port 33333
proto udp
dev tun
```

```
topology subnet
mode server
```

```
sndbuf 0
rcvbuf 0
```

```
ca ca.crt
cert server.crt
key server.key
dh dh.pem
tls-auth ta.key 0

server 10.8.0.0 255.255.255.0

ifconfig-pool-persist ipp.txt
keepalive 10 120
cipher AES-256-CBC
comp-lzo

user nobody
group nogroup

persist-key
persist-tun

status openvpn-status.log
verb 3
crl-verify crl.pem

client-config-dir ccd
client-to-client
route 192.168.220.0 255.255.255.0 10.8.0.20 #make sure this matches
#the static ip in ipp.txt
```

Also adjusted luci to have vpn - lan forwards allowed.

Able to ping from both sides. Able to traceroute both sides on the vpn only. Troubleshooting would consist of tcpdump and seeing where packets are dropped / stopped. That is where the problem would be, in regards to firewall. You can also use **iptables -v** and **iptables -v -t NAT**, and watch where each packet gets trapped by the numbers given by verbose output.

I'm also able to wget from the company LAN computer, to the remote lan of the wifi router. This is good. Most of the work done. Just need to share that route with the rest of the lan or forward or something. <sup>4</sup>

## 2.4 DHCP Server on CamLAN

Next thing I need to do, setup statics on the cameras connected, and also setup a static IP on the ethernet port of the toughbook computer, so I can connect to the cameras. If something is on wifi, it will not apply, this is only for one or two wired ethernet cameras. <sup>5</sup>

I could use a dhcp server, but statics are best, as camera ips can change, and have in my setups. I do not recommend using DHCP for camera setups unless you do DHCP reservations. I will set a range of ips on openvpn lan to 100-200 on dhcp just in case. This is not done through luci but cli in /etc/config/dhcp. I think I am done with this part. Need to set static on camera, and start recording.

## 3 Ubuntu 19.04 instead of Devuan 9

After all that setup, I tested my install for ZM, which used the wifi install guides for Devuan/Debian 9 and found out that H264 encoding and passthrough were not available because the mp4v2 libraries had been obsoleted from Debian while development of ZM had been going on <sup>6</sup>. Instead, this post here details Ubuntu and explicitly includes the H264 encoding, so I went with that:

[https://wiki.zoneminder.com/Ubuntu\\_Server\\_19.04\\_Zoneminder\\_1.32.3\\_\(with\)](https://wiki.zoneminder.com/Ubuntu_Server_19.04_Zoneminder_1.32.3_(with))

---

<sup>4</sup>As I mentioned earlier - with a reverse proxy was the simplest approach.

<sup>5</sup>Note that I have the option of having wifi or ethernet connected cameras. However, some cameras don't have wifi built in.

<sup>6</sup>And the ZM package in the official experimental Debian repos had not been compiled with the mp4v2 libraries, which means a recompile was necessary, if using that package. Note that this has since been changed with ZMRepo and Debian 9 or 10 / Devuan Ascii is now a viable path.. Additionally, the Raspbian repos have addressed the lack of mp4v2 as well, and helpfully included it, so H264 Passthrough works there as well.

### 3.1 Regressions of Ubuntu networking

What used to be in `/etc/network/interfaces`:<sup>7</sup> <sup>8</sup>

```
auto eth0
iface eth0 inet static
    address 192.168.1.230
    netmask 255.255.255.0
    gateway 192.168.1.1
```

is now:

```
network:
  version: 2
  renderer: networkd
  ethernets:
    eth0:
      addresses:
        - 10.10.10.2/24
      gateway4: 10.10.10.1
      nameservers:
        search: [mydomain, otherdomain]
        addresses: [10.10.10.1, 1.1.1.1]
```

Static IP Address Assignment:

To configure your system to use static address assignment, create a netplan configuration in the file `/etc/netplan/99_config.yaml`. The example below assumes you are configuring your first Ethernet interface identified as `eth0`. Change the addresses, `gateway4`, and `nameservers` values to meet the requirements of your network.

The configuration can then be applied using the netplan command.

```
sudo netplan apply
```

Oh you want wifi? That isn't covered in the docs. Not even joking. Official ubuntu documentation is outdated, due to them chang-

---

<sup>7</sup>five lines has turned into twelve...

<sup>8</sup>[http://web.archive.org/web/http://www.ariel.com.au/jokes/The\\_Evolution\\_of\\_a\\_Program](http://web.archive.org/web/http://www.ariel.com.au/jokes/The_Evolution_of_a_Program)

ing from ifupdown package and wpa\_supplicant to netplan (some new flavour of the month networking tool).

<https://help.ubuntu.com/community/WifiDocs/WiFiHowTo> Still only covers `/etc/network/interfaces`.

Best option is from:

<https://bugs.launchpad.net/netplan/+bug/1735288> essentially: disable netplan, reinstall old tools. <https://askubuntu.com/questions/977243/17-10-disable-netplan> `sudo apt -y install ifupdown sudo apt -y purge netplan.io`<sup>9</sup> add interfaces then restart networking service or reboot<sup>10</sup>

Wifi wouldn't connect for me so needed to add two modules.

```
ccm
ctr
to /etc/modules text file
```

error was explained here:  
<https://bugs.debian.org/cgi-bin/bugreport.cgi?bug=749201>

After that, it worked.

## 3.2 Worker Power Switch

I'll need a way for the workers to power this on.

I'm going to have a momentary push switch for them to hit to power it on. As for powering off, I could do another switch for off,

---

<sup>9</sup>The dot io means it's techy and hip. Many smart entrepreneurs and VCs utilize dot io to increase profit potential for their shareholders. /sarcasm

<sup>10</sup>Also make sure you renamed ethernet interfaces to the obfuscated forms (another regression from a few years ago, where wlan0 and eth0 were changed to things like wlp10s0 and enp0s25 primarily to confuse beginners). I ended up adding the flag to grub to remove the new names, so I could get back the more user friendly wlan0 and eth0.

and an Arduino to USB. I've been working on a project similar to this thankfully, so I won't need to do too much.<sup>11</sup>

All they will need is a power on, and power off switch. Also a notify led so we have a colour green if on, or some audio notification. I ended up going with the PC Speaker on grub instead of a LED for power up, and I will add a beep to the power down script.

Workers arrive on site. Plug power in, and hit power switch on box. computer beeps or lights up. When leaving, they hit off button, Green light turns off or beep sounds. If they forget, well, then battery will die, so I should consider a graceful shutdown when battery is below say 30%.

First step will be to wire into the existing power switch. Let's tear down.



Figure 1: The board on the top right, was trivial to tap into for the power switch

That wasn't hard at all. Though removing the seized screws was slow. The actual wiring of the power switch is on a separate board, so quite accessible for an outside modification. Very easy for someone with a soldering iron.

Now, just need to fine tune my related Computer Switchboard

<sup>11</sup>[https://git.steakelectronics.com/adminguy/Electronics\\_Projects\\_2019](https://git.steakelectronics.com/adminguy/Electronics_Projects_2019) includes the Computer Switchboard source code I am referring to.



project and implement it into this project. I will need an LED, and the existing switch. Computer switchboard is in Electronics Projects 2019. This switchboard will run on an Arduino nano which will communicate via USB - UART bridge to the computer (and I think a python script).

The switches that were used, were arcade switches from Microcenter, Sparkfun, or Adafruit. These are big enough to fit through the box.<sup>12</sup>

### 3.3 Box Build

The box I started with was a Hammond Fiberglass (actually made by a different company in Ohio.). It's the PJ14126L model : <https://www.hamfmg.com/part/PJ14126L>



Figure 2: Framing Hardware is Used Here

---

<sup>12</sup>These switches are probably not 100% weather proof



Figure 3: Everything put together - Box 1

See pictures. It's important to get the mount for the laptop right in the middle, so there is enough space for the power, usb, and ethernet connectors, which hang off the side. I messed this up at first. Another issue, is that the louvre / air vent,<sup>13</sup> when I connected the fan and bolted it in, the fan was pushing out the louvre. So I put some nuts and bolts on the plastic sides of the louvre to help keep it locked to the box. This is not ideal, and the fan positioning could use some further consideration. A 2 inch hole saw was required for the louvres, and this was used also for the hole on the bottom of the case. Works very well. The fan is a 24V fan, run off of a 12V PSU, so it's 50% and not too loud.

The power on and off switches are working as they should - no issues there. I have yet to setup an LED for power indication from outside. Easiest is to connect one to the Arduino. The cell mifi I'm using is not detected on the USB by Ub.19.04, so I won't pursue that further. I'll connect to wifi of the mifi instead of usb tethering. Next will be VPN setup, so it connects to the companies site LAN upon boot.

---

<sup>13</sup>These could be 3D printed by the way, if you so desired. These louvres were 2 inches, and the hole drilled with a two inch hole saw (one with fine teeth - metal type - is what I like. They were bought at a local hardware big box store.

### 3.4 Connecting over Cellphone Hotspot to VPN and accessing mobile computer from company LAN

I setup the mifi today. I then connected the VPN. From the camera server, to the company LAN, I was able to ping. However, from the company lan ,to the camera server I tried a ping. This ping worked like 5 times out of 100. Then I did a ping from the camera server to the company lan, and when that started pinging, then all pings from company lan back to camera server worked. Strange.

I may have to run a constant ping service on the camera recording machine, so that it opens up a connection to the company lan <sup>14</sup>. If ping drops, it's likely a cell connection issue.<sup>15</sup>

Seems the mifi connection is touchy. This will work better when the box is outdoors. Mifi could use an external antenna and has a connector for one.

On another note, it looks like the mifi can't be started from power on... I might have to have someone in the office turn on the mifi (or the guys on site) the morning of them using it, then when they get to the site, the mifi will be on. <sup>16</sup>

#### 3.4.1 Persistent Udev name for Arduino Nano

With the Mifi and Arduino connected via usb, I need to make sure the nano always has the same name, for the serial script. Details in computer switchboard repo on how this was done (it's well covered online at the moment).

### 3.5 Accessing the VPN Client on LAN - Reverse Proxy with Apache

The goal was to access the remote computer over the VPN and on the Company LAN. I was unsure how to originally handle this. At first,

---

<sup>14</sup>The mifi errors were probably due to Gen 1 mifis. Later Mifis were better.

<sup>15</sup>After further testing, I found it was also an issue of the cell hotspot connection. The bars on the Cell mifi 4G router must be watched, if the connection is spotty.

<sup>16</sup>Later I left the whole box plugged in, so the mifi would have a few hours of power while in transit to the job.

I thought I would route from the VPN server to the remote LAN, then I considered port forwarding, then finally, it dawned on me that I have Apache server running on the VPN server, so why not just use a Reverse Proxy. I had dealt with Reverse proxies previously, while setting up Docker, and found this was a simple approach, that does the job.

All that was needed to do, was to make sure that the remote VPN client ZoneMinder server was accessible from the VPN server, and then I needed to set the reverse proxy settings in Apache.

```
<VirtualHost *:80>
    # The ServerName directive sets the request scheme, hostname
    # the server uses to identify itself. This is used when cr
    # redirection URLs. In the context of virtual hosts, the S
    # specifies what hostname must appear in the request's Hos
    # match this virtual host. For the default virtual host (t
    # value is not decisive as it is used as a last resort hos
    # However, you must set it for any further virtual host ex
    #ServerName www.example.com

    ServerAdmin webmaster@localhost
    DocumentRoot /var/www/html

    # Available loglevels: trace8, ..., trace1, debug, info, n
    # error, crit, alert, emerg.
    # It is also possible to configure the loglevel for partic
    # modules, e.g.
    #LogLevel info ssl:warn

    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined

    # For most configuration files from conf-available/, which
    # enabled or disabled at a global level, it is possible to
    # include a line for only one particular virtual host. For
    # following line enables the CGI configuration for this ho
    # after it has been globally disabled with "a2disconf".
```

```
#Include conf-available/serve-cgi-bin.conf
```

```
#ZM On Remote One  
ProxyPass /ONE http://10.8.0.21/zm  
ProxyPassReverse /ONE http://10.8.0.21/zm
```

```
</VirtualHost>
```

This ends up being the default debian / ubuntu apache install, with only the end part added. That of

```
#ZM On Remote One  
ProxyPass /ONE http://10.8.0.21/zm  
ProxyPassReverse /ONE http://10.8.0.21/zm
```

Incredibly simple. Note that I first tested the proxy to the root of the VPN client, then later added the alias to /zm there to simplify everything for the users. As it is, the company is able to access the main server at its LAN `http://ipaddress/ONE` and it will redirect to the remote VPN client. Very graceful setup.

## 4 Reverse Proxy Troubleshooting

Onsite the reverse proxy failed due to “Insufficient permissions” on the zm website. I did some more research. Here is my notes. First this website has some helpful troubleshooting. (in resources). <https://nitstorm.github.io/blog/apache-forward-reverse-proxies-1/> So let’s add the test.php and see what we get.

With the following through an ssh forwarding proxy (I hope this doesn’t add more complications here...), as I’m not onsite.

```
ProxyPass /ONE http://10.8.0.21/zm  
ProxyPassReverse /ONE http://10.8.0.21/zm  
ProxyPreserveHost off
```

Array

```
(  
  [Host] => 10.8.0.21  
  [User-Agent] => Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/2  
  [Accept] => text/html,application/xhtml+xml,application/xml;q=  
  [Accept-Language] => en-US,en;q=0.5  
  [Accept-Encoding] => gzip, deflate  
  [Cookie] => zmSkin=classic; zmCSS=classic; ZMSESSID=rftngdnhp9  
  [Upgrade-Insecure-Requests] => 1  
  [X-Forwarded-For] => 10.1.10.222  
  [X-Forwarded-Host] => 192.168.1.178:81  
  [X-Forwarded-Server] => CTCamSys  
  [Connection] => Keep-Alive  
)
```

Now with preservehost on:

Array

```
(  
  [Host] => 192.168.1.178:81  
  [User-Agent] => Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/2  
  [Accept] => text/html,application/xhtml+xml,application/xml;q=  
  [Accept-Language] => en-US,en;q=0.5  
  [Accept-Encoding] => gzip, deflate  
  [Cookie] => zmSkin=classic; zmCSS=classic; ZMSESSID=rftngdnhp9  
  [Upgrade-Insecure-Requests] => 1  
  [Cache-Control] => max-age=0  
  [X-Forwarded-For] => 10.1.10.222  
  [X-Forwarded-Host] => 192.168.1.178:81  
  [X-Forwarded-Server] => CTCamSys  
  [Connection] => Keep-Alive  
)
```

Note that none of the above two worked. ZM loads, but the video won't.

Let's try it, through an SSH forwarding proxy, but no reverse proxy.  
So instead of the above, it will be a bit different.

Array

```
(
  [Host] => 192.168.1.178:82
  [User-Agent] => Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/2
  [Accept] => text/html,application/xhtml+xml,application/xml;q=
  [Accept-Language] => en-US,en;q=0.5
  [Accept-Encoding] => gzip, deflate
  [Cookie] => zmSkin=classic; zmCSS=classic; ZMSESSIONID=rftngdnhp9
  [Connection] => keep-alive
  [Upgrade-Insecure-Requests] => 1
)
```

And this one works. Looks like the X-Forwarded for info is the  
difference here.

Let's add just ProxyAddHeaders off

Array

```
(
  [Host] => 192.168.1.178:81
  [User-Agent] => Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/2
  [Accept] => text/html,application/xhtml+xml,application/xml;q=
  [Accept-Language] => en-US,en;q=0.5
  [Accept-Encoding] => gzip, deflate
  [Cookie] => zmSkin=classic; zmCSS=classic; ZMSESSIONID=rftngdnhp9
  [Upgrade-Insecure-Requests] => 1
  [Connection] => Keep-Alive
)
```

That doesn't work. Let's try removing proxypreservehost but keep-  
ing addheaders off.

Array

```
(
  [Host] => 10.8.0.21
```

```
[User-Agent] => Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0
[Accept] => text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
[Accept-Language] => en-US,en;q=0.5
[Accept-Encoding] => gzip, deflate
[Cookie] => zmSkin=classic; zmCSS=classic; ZMSESSIONID=rftngdnhp9
[Upgrade-Insecure-Requests] => 1
[Pragma] => no-cache
[Cache-Control] => no-cache
[Connection] => Keep-Alive
)
```

This doesn't work. So clearly, we don't have enough information to accurately troubleshoot this from just the test.php given to us in the resources link. In the reverse proxy error logs we have the following:

```
[Wed May 22 12:16:09.764499 2019] [:error] [pid 32744]
[client 10.1.10.222:33016] PHP Notice: Undefined index:
id in /usr/share/zoneminder/www/ajax/status.php on line 77,
referer: http://192.168.1.178:81/ONE/?view=watch&mid=1
[Wed May 22 12:16:09.764659 2019] [:error] [pid 32744]
[client 10.1.10.222:33016] PHP Notice: Undefined index:
id in /usr/share/zoneminder/www/ajax/status.php on line 78,
referer: http://192.168.1.178:81/ONE/?view=watch&mid=1
[Wed May 22 12:16:09.766515 2019] [:error] [pid 32744]
[client 10.1.10.222:33016] ERR [Unrecognised action or
insufficient permissions], referer:
http://192.168.1.178:81/ONE/?view=watch&mid=1
```

A working ssh forwarded request looks like (from the cam server, not reverse proxy):

```
127.0.0.1 - - [22/May/2019:16:19:26 +0000] "GET
/zm/index.php?view=request&request=stream&connkey=154294&command=9
HTTP/1.1" 200 491 "http://192.168.1.178:82/zm/index.php?view=watc
Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"
```

A non-working reverse proxied request looks like



```
10.1.10.222 - - [22/May/2019:16:21:14 +0000] "GET /zm/ HTTP/1.1" 200 4838 "-" "Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"
```

```
10.1.10.222 - - [22/May/2019:16:21:20 +0000] "GET /zm/?view=watch&mid=1 HTTP/1.1" 200 3946 "http://192.168.1.178:81/ONE/" "Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"
```

The difference is in the request, being from localhost, or 10.1.10.222... I don't think I have apache listening on 10.1.10.222. Only on all interfaces (and that is not one...).

What if we were to set the 10.1.10.222 to be the localhost, or a local interface of the proxy?

did a search and someone recommended:

```
if (isset($_SERVER['HTTP_X_FORWARDED_FOR'])) {  
    $_SERVER['REMOTE_ADDR'] = $_SERVER['HTTP_X_FORWARDED_FOR'];  
}
```

Which is **similar but not the same** what I did to get my wordpress working. Hm... Must be on the right track. What Wordpress does is:

```
if (isset($_SERVER['HTTP_X_FORWARDED_HOST'])) {  
    $_SERVER['HTTP_HOST'] = $_SERVER['HTTP_X_FORWARDED_HOST'];  
}
```

They also have another line for SSL (not relevant here). So wordpress is trying to make host equal to the x forwarded. Why don't I do that. I also tested ssh portforwarding to the 10.8.0.21 vpn connection instead of localhost. This works no problem. Again, host in access.log is 10.8.0.21, or a local ip and everything works.

```
10.8.0.21 - - [22/May/2019:16:50:26 +0000] "GET /zm/index.php?view=1 HTTP/1.1" 200 1024 "-" "Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"  
10.8.0.21 - - [22/May/2019:16:50:26 +0000] "GET /zm/index.php?view=1 HTTP/1.1" 200 1024 "-" "Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"  
10.8.0.21 - - [22/May/2019:16:50:25 +0000] "GET /zm/cgi-bin/nph-zmindex.cgi HTTP/1.1" 200 1024 "-" "Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0"
```

```
10.8.0.21 - - [22/May/2019:16:50:27 +0000] "GET /zm/ HTTP/1.1" 200
:::1 - - [22/May/2019:16:50:33 +0000] "OPTIONS * HTTP/1.0" 200 126
```

## 4.1 SSH Forwarding instead of reverse proxy

Really seems like ssh forwarding would be easier here, than to spend hours debugging reverse proxies. Online documentation on reverse proxies is shit. You need a book.

I've learned a bit on reverse proxies before this, and it still doesn't make any sense. A fight for another day.

<https://github.com/obfusk/autossh-init> couldn't make my own init script, so trying this... but he logs in as disabled autossh user. I can't into this at the moment. instead:

```
* * * * * root pgrep autosshzm > /dev/null || /usr/local/bin/autossh
```

I don't trust rc.local, and init scripts failed on me. The script has:

```
#!/bin/bash
autossh -M 0 -o "ServerAliveInterval 30" -o
  "ServerAliveCountMax 3" -L 0.0.0.0:2:localhost:80 user@10.8.0.21
```

Also needed sudo apt-get install keychain autossh

```
* * * * * root . ~/.keychain/$HOSTNAME-sh; pgrep autosshzm > /dev
```

And of course you need to copy the ssh keys. To do that, it can be as simple as:

```
# ssh-keygen
# ssh-copy-id user@remoteip
```

OK, After an hour or so of troubleshooting, I have it working.

You need the following:

```
in /etc/crontab:
```

```
* * * * * root pgrep autossh > /dev/null || /usr/local/bin/autossh
```

in shell script:

```
#!/bin/bash
```

```
logger " /usr/local/bin/autosshzm script started."
```

```
#source $HOME/.bash_profile #not needed.
```

```
source $HOME/.keychain/$HOSTNAME-sh
```

```
logger " /usr/local/bin/autosshzm sourced."
```

```
autossh -L 0.0.0.0:2:localhost:80 -f user@10.8.0.21 sleep 315360
```

```
&> /var/log/autosshzm/autosshzm.log
```

```
#autossh -M 0 -o "ServerAliveInterval 30" -o "ServerAliveCountMax
```

```
-L 0.0.0.0:2:localhost:80 user@10.8.0.21 &>
```

```
/var/log/autosshzm/autosshzm.log
```

```
logger "auto ssh ran"
```

Note that the second `autossh` does not work, as it's missing the `sleep` and the `-f` command.

There were some more setup steps required for `keychain`... From [stackexchange](#):

25

`keychain`

solves this in a painless way. It's in the repos for Debian/Ubuntu

```
sudo apt-get install keychain
```

and perhaps for many other distros (it looks like it originated from Gentoo).

This program will start an `ssh-agent` if none is running, and provide shell scripts that can be sourced and connect the current shell to this particular `ssh-agent`.

For `bash`, with a private key named `id_rsa`, add the following to your `.profile`:

```
keychain --nogui id_rsa
```

This will start an ssh-agent and add the id\_rsa key on the first login after reboot. If the key is passphrase-protected, it will also ask for the passphrase. No need to use unprotected keys anymore! For subsequent logins, it will recognize the agent and not ask for a passphrase again.

Also, add the following as a last line of your .bashrc:

```
. ~/.keychain/$HOSTNAME-sh
```

This will let the shell know where to reach the SSH agent managed by keychain. Make sure that .bashrc is sourced from .profile.

However, it seems that cron jobs still don't see this. As a remedy, include the line above in the crontab, just before your actual command:

```
* * * * * . ~/.keychain/$HOSTNAME-sh; your-actual-command
```

The only thing that I needed to do here was  
keychain --nogui id\_rsa

The rest of it (notes about crontab) was not required.

## 5 Fixes

### 5.1 Gen 1 Mifi - Wireless Cell Wifi

The mifi was dropping out. Turns out we had a generation 1 mifi. Had the company purchase a more up to date mifi, and now there are no drop outs that I'm aware of.

## 5.2 Battery Life & Cylinders vs. Packet

I started with a packet lithium battery (the flat kind) of about 2.5Amp hours, and this lasted around 1-2 hours with no power connected. Because the technicians will be traveling to the site with this device, and they are not tech savvy, the best scenario is for them to unplug it from the company, bring it to the site, and plug it in again. They should not need to open up the box, or hit the power button on the mifi or the RPI. The human factor is in play here.

I exchanged the 2.5 Amp hour battery for a 6 Amp hour battery with cylindrical lithium cells. The benefits of this are not only for the longer battery life, but also because the packet batteries are easier to puncture, and more hazardous. The cylindrical batteries, in this setup, are more resilient.

## 6 Raspbian Install - Box Revision 2

This went much faster, due to the above documentation, which set the foundation. I ended up with a smaller box (purchased a used fiberglass waterproof junction box off of ebay for 1/5th the price of the hammond box), and a lower price tag, as I used an RPI which is around \$30-50 instead of a used toughbooks price of about \$150. I also made sure to use an SSD, not a spinning HDD, as these boxes will be moved around. I have an external SSD, on the RPI, and I have again setup a fan, a power strip, and a waterproof camera. See the below picture for a recommended setup.

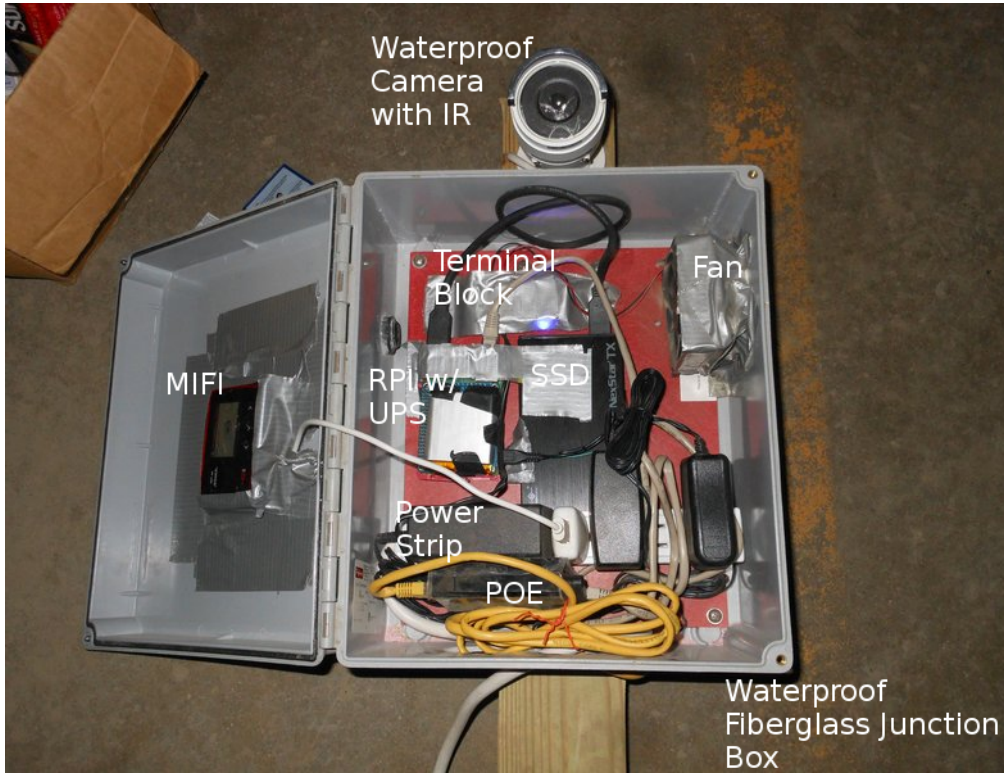


Figure 4: Box Revision 2. Total Price around \$300.  
Let us quickly go over this box.

There is a back panel of fiberglass, but a piece of wood could also be used. This was for attaching things. There are two holes on the bottom for the cables, and one hole on the side for the computer fan and louvre. There is a power strip on the bottom that goes to the outside. All power items (RPI usb adapter, Mifi usb adapter, Camera connector, and Fan PSU) connect to the power strip. The RPI has a UPS (I used the geekworm, though there are better UPS at a higher cost online, see Tindie.com). The Camera on top is a Hikvision of about \$150 and will get us HD resolution. It has an ethernet connection that goes into the box via the bottom holes, and then connects to a POE adapter.

The fan is duct-taped to the side of the box, and lovre, to keep it in place. It vents out, and there is a slow influx of air from the bottom and out the side. A terminal block was used so that the fan wires could connect to the psu (this is optional, really). Everything was held down with either screws, and 24 gauge wire, or duct tape. There is also an RPI case, cut in half helping to hold the RPI. Note that this picture is not the latest, as I ended up removing the packet lithium battery and replacing with a cylindrical type. Everything is mounted on a 4x4 wooden post. It is about 10-12 feet tall, and intended to be dug into the ground, so it out of reach, and also gets a fair view. The box is kept onsite powered on until it is time to travel to the site.



Figure 5: Wooden Post

Thus, we have a portable Zoneminder recording station. Powered by a Raspberry Pi, ZM 1.32 with H264 passthrough, a cellular hotspot, and a waterproof camera. It requires mains power when on site, but can travel for a couple hours without needing to be powered on or off. Simply unplug from the headquarters, bring it onsite, and plug it into 120V AC. Additionally, the site can be viewed live from the headquarters.

## 7 Optimizations

Further tweaks. Change bandwidth in ZM to low. Setup ZMNinja (cellphone app).



## Electronics

*“The right to repair electronics refers to government legislation that is intended to allow consumers the ability to repair and modify their own consumer electronic devices, where otherwise the manufacturer of such devices require the consumer to use only their offered services. While a global concern, the primary debate over the issue has been centered on the United States and within the European Union. “*

[https://en.wikipedia.org/wiki/Electronics\\_right\\_to\\_repair](https://en.wikipedia.org/wiki/Electronics_right_to_repair)

*“Possession is nine-tenths of the law: In a property dispute (whether real or personal), in the absence of clear and compelling testimony or documentation to the contrary, the person in actual, custodial possession of the property is presumed to be the rightful owner”*

[https://en.wikipedia.org/wiki/Possession\\_is\\_nine-tenths\\_of\\_the\\_law](https://en.wikipedia.org/wiki/Possession_is_nine-tenths_of_the_law)

# Air Quality Sensor

Steak Electronics

2018 (revised 2019)

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## 1 Overview

To know when I need to clean my room. I usually vacuum every two or three weeks, but sometimes am lazy and I need a reminder.

The dust sensor will be more motivation to get me to clean, when I see the dust levels increase. <sup>1</sup>

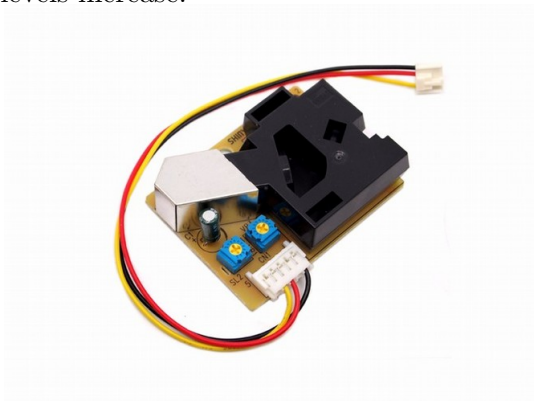


Figure 1: Shinyei Dust sensor PPD42

## 2 Work Log

### 2.1 Parts List

- Shinyei PPD42NS Air Quality Sensor
- MSP-EXP430G2553 V1.5
- 5V adapter (required as MSP is 3.3V only)
- SD Card adapter
- Ethernet Module
- Energia version 0101E0012 (or later, possibly)

---

<sup>1</sup>Technically, I also get a rash from excess dust, which is another great motivator.

## 2.2 Beginning

Here are some things I learned working on this project.

**IDE** I'm using Energia from [energia.nu](http://energia.nu) which is an Arduino IDE clone for TI Launchpads. This will allow for rapid development. And ease me into the TI platform.

**MSP-EXP430G2 V1.5** There are different version of this. My particular board is the and as explained here: [http://energia.nu/pin-maps/guide\\_msp430g2launchpad/](http://energia.nu/pin-maps/guide_msp430g2launchpad/) and [http://energia.nu/pin-maps/guide\\_msp430g2launchpad/](http://energia.nu/pin-maps/guide_msp430g2launchpad/). You need to rotate the UART jumpers to get UART to display correctly. Oddly enough you can choose a different chip in the boards list and serial will print out right... But switch the jumpers and the correct board will work with UART. Otherwise, it does not work out of the box for serial.print. Though the blink example sketch works.

**Dust Sensor** The code for the dust sensor is found online easily. The pinout is tricky as the colours of the wire are nonsense, but the pinout seems to be the same for all sensors, and is: PIN 1 (closest to black box) GND, PIN 3, VDD (5+V), PIN 4 output A. there is also an output B for different readings (I think size) of dust. I'm not that particular (no pun intended) about my dust so I will go with the one most people are using.

**3.3V only on TI** The TI takes input of USB but only outputs 3.3V. Fail. I'll through a 5V PSU on the board. It won't be connected to USB for its use anyways.

**POW function** There is a pow function (power exponent) in arduino. In TI, I changed it to powf, and included math.h.

I'm not sure if my change was correct.

EDIT: looks like there is a LED tied to pin 14. I'm moving to pin 13. I meant to use 13 earlier but accidentally used the wrong pin and kept using it. Oops.

EDIT 2: Actually, I was reading from the wrong pin in software. Maybe I will leave it on the LED pin as you can see when the dust is firing off the sensor. Hm.... Neat.

EDIT 3: Yes, so I had to use powf instead of pow, and it works. The accidental incorrect pin was a bonus as it allows me to see visually how often the sensor is going off. Over time, I should have a

vague grasp of the dust levels just looking at the light. Actually, I won't. Nevermind. The dust sensor reading, is too irregular for that.

### 2.3 Work Log 08/2018

I've put everything on a single piece of plywood, and need to do some more work on the code. I've decided to forgo the SD card, as I don't want to deal with reading a 2MB sd card with the buffer provided by the SRAM. I'm not quite sure how to manage that, and whether it's possible to read such large data files. I did some quick research and did not find what I wanted. It is likely possible, but let's do something simpler. Instead, I will use the EEPROM to store the last 5 minutes of data or so, and then have the server read the data every five minutes. This keeps the client simple, and puts the burden of complexity on the server. In addition, I don't want to read SD cards manually, as that is cumbersome, though possibly scripts could be made.

The PPD42 was made sure to be put vertically.

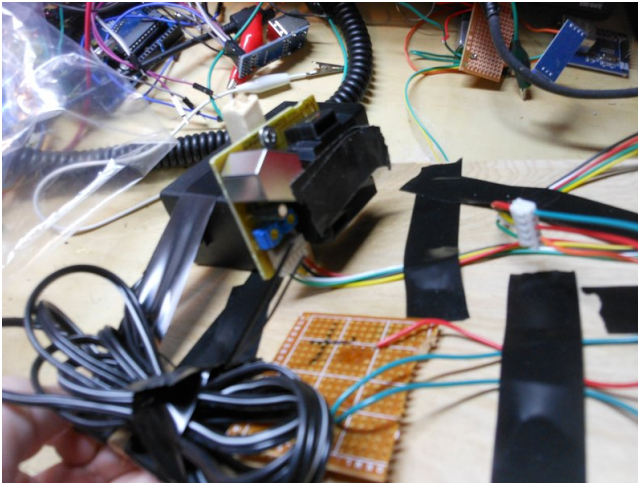


Figure 2: Plywood can make a good base. While this one wasn't screwed in, I commonly use wood to hold projects. Wood can be finished, and looks nice if desired.

## 2.4 Work Log 12/2018

I have decided to change how I do this slightly. Instead of an SD card, I will connect on the LAN and use thingspeak from a locally hosted instance (and deployed with docker, possibly) or some other aggregating server to pull the data. I'll also make a shield, to simplify deployment. That might not be necessary, but I can make a shield in a few hours, and pcbs are cheap. These options such as thingspeak sometimes have graphing / plotting included.

I'm going to use this library: <https://github.com/reaper7/EtherEncLib/releases> so git clone that, then git tags -l git checkout tags/v0.4.2 to get the latest release (or a newer one if possible). The pinout for the ENC is viewable at the figure to the right. This is from the 43oh.com forum.

<sup>2</sup>

## 2.5 PCB Layout

Layout is simple for the most part. I again, flipped the ENC as I had done on the Uno board, so it is inserted upside down on the board. This time I went only with the 2x5 pin enc for simplicity sake. The shield is below the MSP, so longer pin headers will be used (already have those) to give space for the barrel plug. The board needs a 3.3v regulator and 5v for the PPD42. To get the sizing of the shield right, I aligned my grid with that of the design files for the msp430 dev board, and made sure the spacing between the 0.1 headers was exactly the same easy. Ran all traces of 20 mils and made the board small as reasonably possible. Now to get them made, and actually test this.

### 2.5.1 Aligning shield with Eagle and KiCad

So here was an interesting segway. I had design files in Eagle, and I wanted to make a shield for the MSP in Kicad. What I did, was align the grid in Eagle, to be the same as Kicad, and then as appropriate, sized points on the Kicad grid to fit exactly where the

---

<sup>2</sup>You will see later, that this library turns out to be not developed enough, and results in overall failure for this project. Next time, use a well vetted library!

MSP shield was. In fact, it turned out 100% correct the first try. Here is where FOSS and OSHW worked out well. Without the design files (say if I had only a PDF with some measurements), I can't say it would've turned out as well. Open file formats for all components and shields!

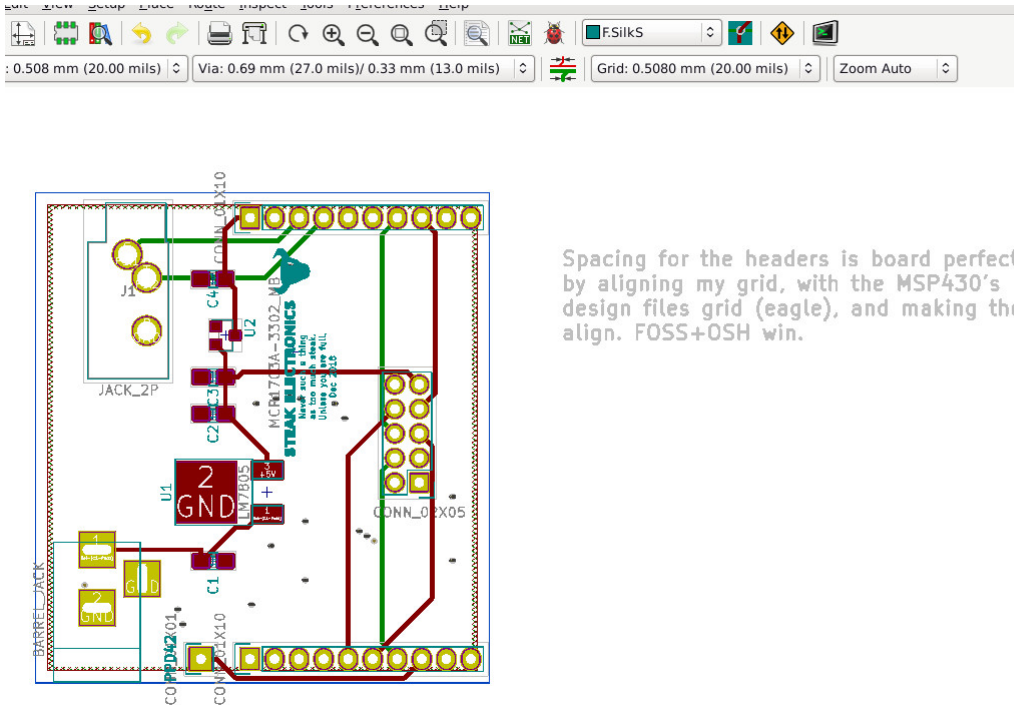


Figure 3: See caption on picture.

## 2.6 Revision 1 Results

I built up the PCB today. A few errors were made, but this is much better than the mess I had on the plywood originally. First off, the ENC pins are wrong, so that is not going to be able to be mounted (unless I wanted to wire pins manually). Second, the orientation of

the MCP part is wrong. I'm not sure how this was done incorrectly, but I suspect that the default KiCad libraries were wrong. I have a few other changes to do, but this was overall successful, and I can respin another board quick quickly. On my todo list is:

- add gnd breakout
- add 5v breakout
- add 3v3 to enc NOT 5v
- fix enc pins
- fix orientation of main board
- add anime picture to back of board
- fix orientation of 3v3 reg
- buy more msps (need two more at least)
- buy 100 1uf 0805 caps put in main box (I'm surprised I don't keep these in stock. I do have through hole 1uf but not 0805).  
buylist + pcb : header so you can just plug in ppd. This is a sort of wish list thing, but something that will save a few seconds on build time. Although NOT necessary.

It looks like the connector between the board to the PPD42 is a type of 2.54 or 0.1 header. I will add a separate connector for the PPD42 that has all five pins. No need for any special connector.

## 2.7 BOM Creation Notes

Here's some notes on creating the BOM.<sup>3</sup>

The MSP-EXP430G2 is being obsoleted, in favor of the MSP-EXP430G2ET. This is not a good thing, and shows poor sport on TI's part. I was always wary of the two dozen MSP430's, and now

---

<sup>3</sup>This is a tounge in cheek reference to automated searches for weapons, etc... Yes, the algorithms read everything on every computer.



they are removing the original one from production, according to digikey. Ugh. Makes me think I should've just used an Arduino, but I digress.

Planned obsolescence means, I'll have to make my own dev board for a TI part next time. Which I may just do, the chip is simple enough, and if ICSP and energia will work with this (which I found after a short search on the 43oh.com forums), then that is good enough.

## 2.8 Work Log 01/24/19

Adding Library to Energia The path for adding a library to energia is: /home/dev/Desktop/code/electronics/airqualitysensor/energia-0101E0012/hardware/msp430/libraries on my machine. The idea is to add the library to the libraries folder (but, NOT the lib folder, a little confusing). And you might have to hunt to find that. So I git cloned the ethernet lib, and added it in Remember that this ENC library works with only certain launchpads. Including, my now OBSOLETE one. F\$#% companies, and their obsolescence. There's a special place in hell for these people.

Upon adding the Ethernet libraries, and running webserv example, I get this error: fatal error: avr/pgmspace.h: No such file or directory compilation terminated.

After some fumbling, it looks like <https://github.com/energia/Energia/commits> is what I should be using.

Make sure you grab from the msp430 section, not the other cores. There's only two header files, and one short c file. Then it's all dupes for different cores (not sure if 100% alike, but we only want msp430). This library is poorly done. Had to manually add an include to EtherEncLibUdp.cpp for the dtostrf.h file. I also had to put that file somewhere it could be found. I think you can put it in the etherenc library folder, but perhaps I'm wrong and it should be in the reference folder of Arduino. One of those places.

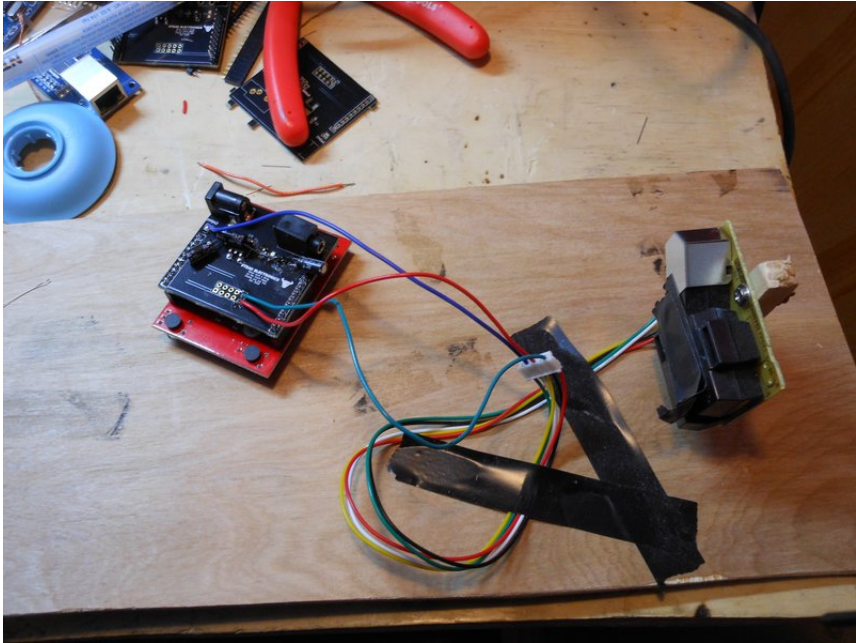


Figure 4: Shield PCB and PPD42

After that it builds. With the default example, you have to change a pin. Its the CS pin that is wrong. I think its by default pin 10, but on the pin mappings, it should be 8 (see image in pics folder). Theres two places to change this. One in the sketch (obvious). The second is in etherenclib somewhere I saw this mentioned in the post in resources I have saved, so refer to that in the git repo. Ah, looks like I also forgot to solder some pins. Oops. After thats out of the way, lets look at the pin mappings. Quote: (you can change this pin in file enc28typedef.h - line 424, then also mandatory! in sketch `pinMode(10,OUTPUT)`); Says the forum post. I believe its this:

```
#if (ENERGIA)
```

```
#define ENC28J60_CONTROL_CS           8
//#define SPI_MOSI 13
//#define SPI_MISO 12
```

```
///#define SPI_SCK 14
```

And with that, I was able to get this to work. Note that pings do NOT work. It should do nothing if you ping. If you are getting destination not found, then something is wrong. Pings simply reach a dead end. Now to incorporate this with the air quality sensor.

At first, I had some memory issues. This TI chip has 512 Bytes of SRAM (compared to Atmega328p's 2K SRAM), so I had to do some cutting down of the code. Here's a short interlude where I did this. NOTE: Later on I simplified the code even more.

### 2.8.1 ENC28J60 on TI Launchpad Code Troubleshooting

Basic Server test

Works.

Basic Sensor test

Works

Basic Sensor and Server test

Fails. Out of memory.

Lets see at what point, the basic combination of server and sensor fails What is pushing it over the barrier I can put math.h and go through setup no problem

Ok, its this block of code:

```
if ((millis()-starttime) > sampletime_ms)//if the sample time == 3
{
    ratio = lowpulseoccupancy/(sampletime_ms*10.0); // Intege
    concentration = 1.1*powf(ratio,3)-3.8*powf(ratio,2)+520*ra
    Serial.print(lowpulseoccupancy);
    Serial.print(",");
    Serial.print(ratio);
    Serial.print(",");
    Serial.println(concentration);
    lowpulseoccupancy = 0;
```

```

        starttime = millis();
    }

```

Lets cut it down. Interestingly this code here, jumps up 4K bytes:

```

if ((millis()-starttime) > samplertime_ms)//if the sample time ==
{
    //ratio = lowpulseoccupancy/(samplertime_ms*10.0); // Inte
    //concentration = 1.1*powf(ratio,3)-3.8*powf(ratio,2)+520*
    Serial.print(lowpulseoccupancy);
    Serial.print(",");
    Serial.print(ratio);
    Serial.print(",");
    Serial.println(concentration);
    lowpulseoccupancy = 0;
    starttime = millis();
},

```

even with ratio and concentration cut out. From about 10K to 14K bytes. Wow.

If I do this:

```

if ((millis()-starttime) > samplertime_ms)//if the sample time
{
    //ratio = lowpulseoccupancy/(samplertime_ms*10.0); // Inte
    //concentration = 1.1*powf(ratio,3)-3.8*powf(ratio,2)+520*
    Serial.print(lowpulseoccupancy);
    //Serial.print(",");
    //Serial.print(ratio);
    //Serial.print(",");
    //Serial.println(concentration);
    lowpulseoccupancy = 0;
    starttime = millis();
}

```

Its back to about 10K bytes. So the serial prints, are a bit wild. I actually dont need serial prints at all. Lets cut those out.

```
ratio = lowpulseoccupancy/(sampletime_ms*10.0); // Integer percent
```

this command is 2K bytes added.

The concentration post is simply too much, even by itself. The math is too expensive. Its 7K bytes about. There must be a cheaper way to do the math. Is there a pow alternative (pow gets the exponent, it appears) <https://stackoverflow.com/questions/101439/the-most-efficient-way-to-implement-an-integer-based-power-function-powint-int> seems hopeful. Simple enough.

Now I have:

```
if ((millis()-starttime) > sampletime_ms)//if the sample time ==
{
    ratio = lowpulseoccupancy/(sampletime_ms*10.0); // Integer
    //concentration = 1.1*powf(ratio,3)-3.8*powf(ratio,2)+520*ratio
    concentration = 1.1*ipow(ratio,3)-3.8*ipow(ratio,2)+520*ratio
    //Serial.print(lowpulseoccupancy);
    //Serial.print(",");
    //Serial.print(ratio);
    //Serial.print(",");
    //Serial.println(concentration);
    lowpulseoccupancy = 0;
    starttime = millis();
}
```

Using a leaner integer pow, instead of a float exponent formula. Not sure how it will effect the data, but we will see. And it builds.

## 2.9 Power Dissipation

As far as the power dissipation of the linear vreg I have a lm7805 on there, with a 12V regulator. In Troubleshooting Analog Circuits, Bob Pease mentions the 5 second rule for heat if you can hold your finger (or thumb) on it for five seconds without being burned, its about 85 deg C, and OK. If its hotter, then you have issues. Well, I am right on the line, possibly a little under 5 seconds. I could improve with a 7-9V AC Adapter, or a DC DC switching regulator,

but for now this will do. I should mention, I'm touching the PCB opposite the LM7805 due to the construction. I should add more vias on the bottom of the vreg, also, to get more copper heatsinking.

## 2.10 Network Errors due to lack of Memory

After installing everything, I found that the device was not working longer than a few minutes, due to memory constraints. Will need to use a larger TI part... Or just move to Arduino and use a Mega. Based on what happened here my two options are: 1) Give up on TI and use a more vetted part 2) Continue with Launchpad, using a custom PCB for the chip (instead of a launchpad that will be discontinued), and hopefully the memory issues will be resolved.

I'm leaning towards #1, as I wish only to monitor dust, not to be stuck in microcontroller details.

## 3 End of Year Retrospective

This project hinged on the ENC Library working, as well as availability of the TI dev board. When the ENC library turned out to be unusable, and the dev board discontinued... At this point, I would've avoided these problems by using a more vetted solution like an Uno or Mega. Alternatively, I could've made my own TI board, and substituted a Micro with larger RAM. However, I can't create time, so making a board didn't happen.

## 1 Overview

Test out a KISS battery and solar panel, having the panel charge the battery. Log.

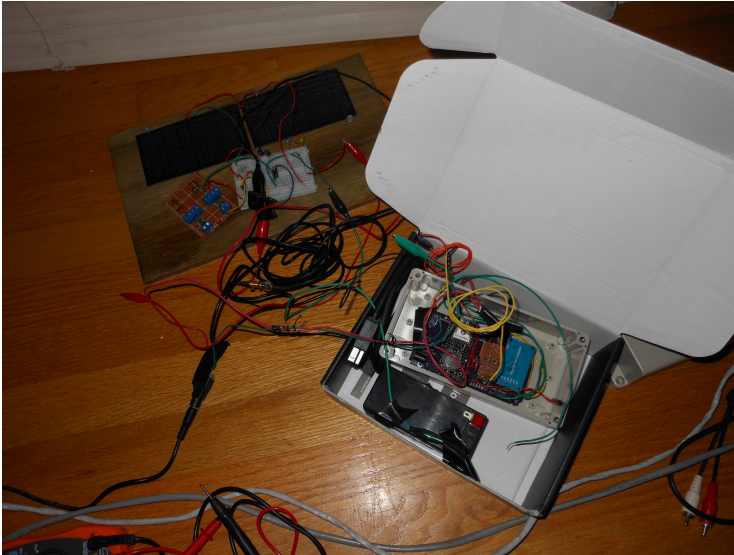


Figure 1: Windmill Data Logger was used with a 12V 1Ah battery. The Regulator used is a somewhat low power AP2204K-ADJTRG1, set to 13.7 or 13.8V

## 2 Work Log

General Build:

There are two solar panels in series, to make about 14 to 16 volts in direct sunlight. They go to a 150mA adjustable voltage regulator (AP2204K-ADJTRG1) on a piece of perfboard which sets the output voltage to be 13.7 or 13.8 volts on a breadboard. There is a diode outputting into the lead battery to prevent any backflow.

There is an LED on the output of the Vreg to signal that power is live. The externally power Arduino Mega and custom Windmill shield tap into the V+ of the battery, and have an ACS712 5A current meter in series with the current output. SD card logs data at about 1 per second. GPS keeps time (see windmill docs for detail on troubleshooting GPS).

Battery used:

A battery made in China with the Duracell brand tacked on. The side of it says distributed by Ascent Battery Supply, LLC from Wisconsin. See photo of the front. It's fairly small. Cost was \$20-25.00 I need to find the data sheet for this battery to see how much current I can pull from it.

Diode:

There is some additional drop across the diode. I have to test other regulators that can go higher than the AP2204K which seems to have a limit around 13.7, in my setup.

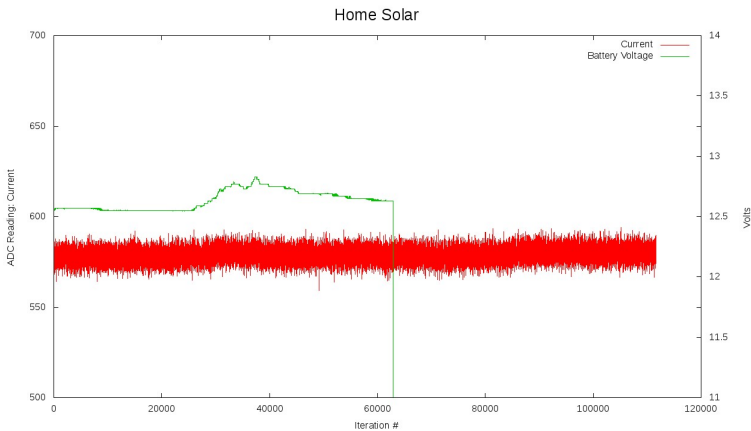


Figure 2: Morning hours on my east facing Window, there is a rise, then a drop off, where self discharge begins. The Sharp dropoff can be ignored - it was due to a poor connection. This data is from 062818, only one day.

Findings:

See the above graphs. Although the data cuts out (I knocked out by accident, the adc line into +) you can see a steady self discharge.



The current meter used here is not sensitive enough to register the max of 10mA that is charging the battery (used a sparkfun breakout for an ACS712, of 5A current meter) but it may show a slight increase when the battery is increasing. How much self discharge do lead batteries have? We are going to test this particular battery and find out exactly how it performs.

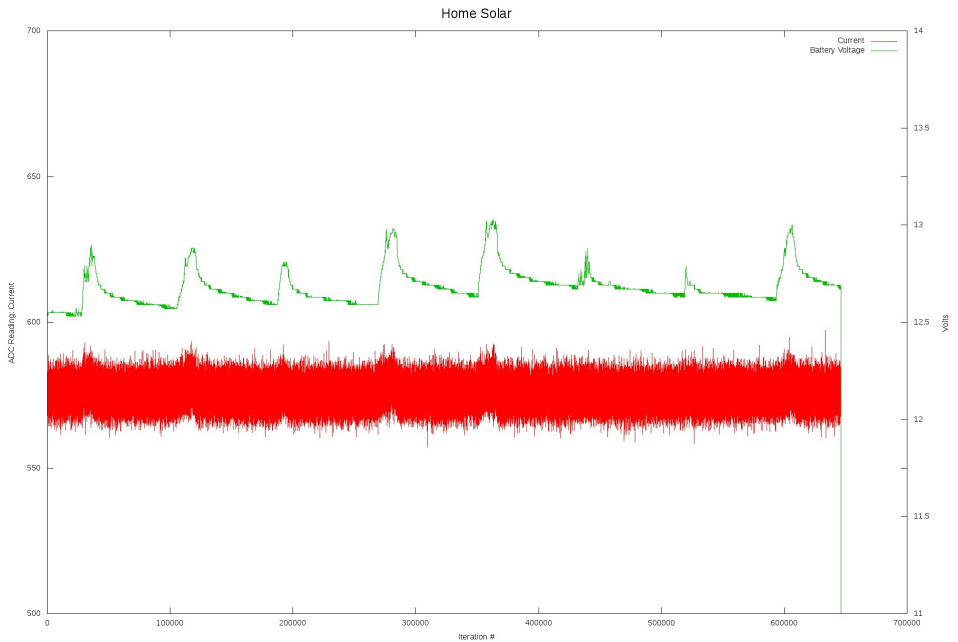


Figure 3: Data from 07-01 to 07-08-18 Note that a few cloudy days, cause the battery to discharge, (overall) with this setup. The current readings, do show a slight increase, though still in the noise. We need more panels.

## 2.1 Work Log 08/2018

I've put everything on one piece of 1/8th inch plywood, and will begin logging again. I may want to have the battery covered up, so

sunlight doesn't heat it up. We are heading into fall now, so I expect sunlight to diminish as we head towards December. See photo. I've added fuses to the battery and to the Logger PSU connector. The additional two panels wired in parallel should give us additional current, and hopefully show greater peaks and troughs in the readings.

## 2.2 Work Log 082818

The data from the past ten days has been collected. I will admit, that I'm doing this fast, so I expect to make mistakes, but I plan to learn from each mistake.

Here the data shows a few things. One the date and time is not included, which is OK for short periods of time, but I can do better.. I'm going to alter the code to include a unix timestamp. This unix timestamp will allow other devices to sync to this, with an easy interval, and conversions are straightforward, I believe. It will hopefully also allow me to graph the date and time better. I'm not quite sure how to approach time and data with Gnuplot yet. Second, I will do a better job of connecting the Voltage monitor. You can see the voltage line drop out, and that isn't from the battery dying, but from the wire being disconnected. I will use wire wrapping or solder to connect them this time. I also have obtained a portable (butane) powered soldering iron, which I can use if I open the windows. The data lines or sensor lines are everything here, so I can't afford to lose one. I could also use a terminal block, if I can find one in my junk box. What I need is a foolproof connection, but also one that I can disconnect when necessary. I considered adding a math conversion for the current, but I'm not entirely worried about how much current is passing through the device yet. Maybe I will add one in addition to the existing ADC however.

Some links that reference the date and time:

[http://gnuplot.sourceforge.net/docs\\_4.2/node76.html](http://gnuplot.sourceforge.net/docs_4.2/node76.html)

<http://lowrank.net/gnuplot/datetime-e.html>

<http://web.archive.org/web/20180216201121/http://lowrank.net:80/gnuplot/e.html>

The lowrank link in particular is helpful:

```
gnuplot> set xdata time
gnuplot> set timefmt "%Y-%m-%d"
gnuplot> plot "sample.dat" using 1:2 with boxes
```



Figure 4: Board in the Window

### 2.3 Work Log 082918

I looked at voltages this morning while the sun was out. It appears that outside of the voltage being disconnected in the last graph (the ground wire was pulled from the breadboard), everything is working. It is floating at a voltage of 12.8, so max voltage has been reached. There is ample current available from the solar panels. The voltages of the panels differ one is about 18 volts, the other 11.5 volts. I should do something to keep them similar (more

notes below). The Vreg seems to be managing the different voltages. Solar cells are photodiodes, so it being a diode, I am making the assumption we should be OK, with a reasonably close voltage. (reference: <https://romikoderbynew.com/2011/02/25/reverse-bias-in-solar-cells/>).

However, looking closely at the two panels, I can see 13mA passing out of the 18V panels, and -12 mA passing into the smaller 11V solar panels, so apparently it is not ok, and that link is not entirely correct. A solution would be either a diode, or tune another Vreg so that they are the same on the panels (maybe both). I don't want to connect them all in series for the Vreg. I read there is danger of them impacting each other if the currents are different enough. One might burn out the other, if the currents are not close. I also don't like one of them breaking or being shadowed, and stopping the others. I could connect up reverse bias diodes, to passover any non working cells, but this is not necessary in this small setup. I think I will pursue two separate Vregs, both set to output a fixed voltage, and the sum of these Vregs will output into the battery. That all being said we have another issue. We need to start using the battery.

#### Load

I have a sparkfun beefcake relay board, I will setup some kind of device to be powered on, by the 12.8V battery (probably another Arduino Uno logging something) for a period of time each day. So this adds more code todo. What would be useful to log for short periods throughout the day, but not constantly? Temperature? Maybe I could take a picture, of outside every ten minutes... I think I will start with Temperature for simplicity sake.

References: <https://www.vishay.com/docs/89398/solarcell.pdf> Solar Cell Bypass Diodes in Silicon Crystalline Photovoltaic - Vishay

# ProCAT Flash and Plover Hax

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## 1 Overview

I want to use a ProCAT flash with Plover. The ProCAT Flash is a stenography machine. It allows for faster typing, and less strain. Plover is a FOSS Stenography project.

## 2 Work Log

### 2.1 Not All ProCAT Flash's will work with Plover

Some of the plover docs mention that a ProCAT flash will work with a RJ11 to DB9 cable, and that the protocol can be set to Baron. My device must be an older firmware as there is no option to change the protocol, and in fact the RJ11 appears to be only for outbound calling... There is a modem option, and it allows you to call a number. It appears to be for actually calling a phone line.

Instead, there is an arduino sketch of someone who has previously tapped into the serial out of the IO Expander (essentially the board that reads the keys), and helpfully outlined the process. By cutting

the motherboard out of the picture, and driving the IO board directly from a 5V Arduino, one can use the ProCAT without the need for its built in modem. Neat.

## 2.2 Backup Plan: Reading from a ProCAT Flash with an Arduino

There is a six pin ribbon cable that can be cut in half, or removed, and then the arduino connected to it. This is a minimally invasive hack. I can always put the cable back. Let's begin.

The ink ribbon can be easily removed to gain better access to the IO board. The Shift Registers are TI 74HC165 which means this board may be able to be repaired, if needed. There is a conformal coating on the board, both sides. Funny how laptops don't bother with conformal coatings for waterproofing.<sup>1</sup>

Vcc is pin 16, and Gnd is 8. Tracing that back to the 6 pin cable to confirm the pinout of the arduino sketch is right,

### 2.2.1 Never Believe the Internet

The pinout of the sketch was wrong, for my flash. To be fair, my flash is not a Stentura 200, so that's why. My pinout is:  
On ribbon cable going from left to right looking from above.

RIBBON CABLE:  
1 SH/LD (shift)  
2 GND  
3 CLK  
4 PWR  
5 Serial Out  
6 ??? Goes to Resistor  
(INSERT PICTURE)

On my IO board, the pins are staggered, so there is 1,2,3,

---

<sup>1</sup>100+ years of electronics engineering advances, billions of dollars of R&D, yet we can't figure out how to keep a laptop safe from a cup of H2O.

then another column of 4,5,6 (columns start at the top, 1 being a square pad). Confusing.

#### IO BOARD PADS

1 ??? Goes to Resistor

2 PWR

3 GND

4 Serial Out

5 CLK (goes underneath a resistor, then to all clocks)

6 SH/LD

(INSERT PICTURE)

These pins on the IO board are also soldered to pads (not holes) and fragile. Shit design. Tiny wires. I disconnected one just trying to follow the wires. Also they put some tape w/grease on the wires, and have them in a different order on the PCB from what the ribbon cable wiring is. Shit. Nothing I can't handle, however.

There are three rails going on the top (bottom?) of the IO board. These are CLOCK, SH/LD, and Power. GND is a copper flood on the top (bottom?) of the IO board. Make sure to double check the pins line up with what you are connecting after building this.

If you look closely on the circuit board for the IO expander, you might see labels for the Pins. I have G for gnd, + for Pwr, C for clk, etc..

### 2.3 Soldering Experience is a plus

I don't need to use the ribbon cable. Instead, let's take off the wires and use my own cable. I might make a PCB to fit inside the Flash... I'll need to edit the Arduino sketch too.

Not only the IO board, but I'll also need to attach wires to the metal chassis or frame somewhere inside. The Pins of the Steno short the IO expander to ground so I need to have the Arduino connected to chassis as well.

Very carefully, I used solder wick to remove all solder from the existig pins. Making sure to tin the tip before using wick each time.

After removing all the solder, I pushed through the pins to remove the conformal coating from the other side. Then I passed some wires through the (fairly thick) PCB. Not too hard, but it helps to have experience here.

## 2.4 steno-arduino sketch is also not compatible with Flash

I made some edits to the Arduino sketch. One thing noteworthy to myself is the

```
/*
    * All inputs are pulled up. Pressing a key shorts
the circuit to
    * ground.
    *
    * We invert the logic here to convert to more
conventional positive
    * logic.
*/
pressed          = !digitalRead(DATA_IN);
```

Haven't see the !variable logic before. Only in booleans, if(!true)...

The mapping of the pins on the ProCAT flash is different from the Stentura, so some deciphering was necessary. I ended up brute forcing some of it, as I couldn't figure out exactly how it was different, with relation to the previous setup.

I also added the debounce logic from one of the repos into the code. And added some serial debug notes. All said and done, the device connected into Plover and worked without issue. Nice.

Here is the mapping that took 1-2 hours to decipher, and the end result (see also arduino folder).

```
void construct_data(char raw_data[], char packed_data[])
{
    packed_data[0] = 0x80;
    packed_data[1] = (raw_data[ 5] << 6) /* S- */ //Have to move
arrays entries around here, if you are going to
```



```

        | (raw_data[ 4] << 4) /* T- */ //change values
Need all 24 bits.
        | (raw_data[ 3] << 3) /* K- */
        | (raw_data[ 2] << 2) /* P- */
        | (raw_data[ 1] << 1) /* W- */
        | (raw_data[ 0] << 0); /* H- */

packed_data[2] = (raw_data[ 15] << 6) /* R- */
                | (raw_data[ 14] << 5) /* A- */
                | (raw_data[ 13] << 4) /* O- */
                | (raw_data[ 12] << 3); /* * */

packed_data[3] = (raw_data[11] << 3) /* -E */
                | (raw_data[10] << 2) /* -U */
                | (raw_data[9] << 1) /* -F */
                | (raw_data[8] << 0); /* -R */

packed_data[4] = (raw_data[23] << 6) /* -P */ // was 14
                | (raw_data[22] << 5) /* -B */ // was dupe 0
                | (raw_data[21] << 4) /* -L */
                | (raw_data[20] << 3) /* -G */
                | (raw_data[19] << 2) /* -T */
                | (raw_data[18] << 1) /* -S */
                | (raw_data[17] << 0); /* -D */

packed_data[5] = (raw_data[6] << 6) /* # */ //
                | (raw_data[16] << 0); /* -Z */
}

```

The Gemini PR protocol is reasonable to deal with, and this hack worked out well. Looking at the above packed\_data, you can see that all the Gemini PR protocol is, is the initial 0x80 byte, followed by the bits either being 0 or 1 for each key. Simple.

### 2.4.1 Simplest Explanation of a Shift In Register

I've used these 4 or 5 times now, but finally I understand a simple enough way to use these.

The **simplest shift register in** code does the following:  
Hold All pins low (CLK,DATA,LATCH)

Bring Latch Up

Enter For Loop

Read DATA bit (into array)

Increment clock up, then down (as long as Micro GPIO is <30MHz  
(30MHz being max speed of shift

Read DATA bit

Increment clock up, then down

Repeat until for loop exhausted

Put Latch Down (now the data will again be read  
by the parallel inputs)

Repeat

That is the simplest explanation for a shift in register, and it is demonstrated here, in the steno-arduino code. Nice.

### 3 Conclusion

The ProCAT Flash is similar to the Stentura 200 but not identical. Due to that, the arduino sketch needed to be customized somewhat to interface with the Shift Registers. Also, the pinout of the ribbon cable was different. Otherwise, thanks to the original efforts of the first steno-arduino sketch, I was able to make this old ProCAT Flash output to Plover without using the internal Motherboard, nor

the RJ11 connection. I now have a real steno machine that cost no more than \$100 including shipping. <sup>2</sup>

I feel using a genuine Steno machine was the right choice to starting down this road, as I don't want to deal with the toys or half baked solutions made by some hackers who are selling home built keyboards.<sup>3</sup> However, I will say, that once I'm comfortable with this, I might get one of those keyboards, add a few extra keys on<sup>4</sup>, and make my own custom keyboard for interfacing with GNU Linux. There is a reason to have both a genuine steno machine, and a custom hacker diy keyboard solution. Why not both?

---

<sup>2</sup>This price is comparable to what it would've cost for a home built keyboard solution. But is the value the same? I doubt it. The machining of the key levers on this ProCAT is miles beyond a PCB and some switches put together in a weekend.

<sup>3</sup>There is also the issue that the switches on these keyboard all require 10-30 something of force for each key, whereas the ProCAT only requires 10-20 of force for the first key, whereas all subsequent keys, are free of strain. A small difference, but the devil is in the details. You can't beat the real thing.

<sup>4</sup>By keys, I mean I plan to make a custom keyboard solution. Rotaries, Slide pots, etc... All the fun interfacing things.

# ZMHW Modector

Steak Electronics

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# 1 Overview

Making and deploying a Motion Sensor for Zoneminder CCTV software installations. These sensors use ZMTrigger.pl ( [wiki.zoneminder.com/ZMTrigger](http://wiki.zoneminder.com/ZMTrigger) ) to activate an alarm on a camera for a period of time. The advantage of hardware motion sensors over the software detection of Zoneminder, is that the hardware motion sensors avoid some of the problems inherent in software detection, such as false positives from day-to-night, bugs, missed detections, and others.

I've tried different motion sensors. Let's start with the Infrared Laser Diode.

## 2 Parts List

- Arduino Uno (official recommended)(DIP recommended)
- ENC28J60 ethernet module
- Passive PoE adaptors for IP Cameras
- Series 1A fuse
- Sick WS15-D1130 Infrared Laser Diode Motion Sensor
- General Purpose Diode (I used 1N4818 diode) (may also use transistor, per data sheet for Sick)
- Jumper Wires
- Copper Wire (22-26 gauge)
- Enclosure
- Ethernet Wire
- (optional) Low Profile one and two gang wall outlet
- (optional) Blank cover plate, for one and two wall gang wall outlet

- (optional) Electrical tape (I prefer halfway decent electrical tape)
- (optional) piezo speaker
- (optional) extras of everything, in case anything fails

Later on we will try a different sensor. The HFS-DC06H. This sensor is a combination of an HB100 radio, with a decoding board that will read the signal and output a logic high or low. You may also want to try PIR sensors.

## 2.1 Other Sensors

- HFS-DC06H
- PIR Sensor
- Any other Laser Diode Sensor you like
- Reflective tape

# 3 Work Log

## 3.1 Sick Motion Sensor

The first tests were with the Sick diode sensor and receiver. This device is good for a doorway, where the door must be opened in order for people to pass. Putting it in the way of the door ensures that it will activate. It has a distance of at a max 15 feet or 3 meters. It is a laser type tripwire, which means it can be avoided, if someone knows where it is.

Device was assembled and using the ZMHW Modector source code. This is simply an Arduino sketch with UIPEthernet (to use the ENC28J60) (make sure CS is pin 10 on Uno). For more details see source code. Explaining the details is out of the spec of this doc.

Simply put, the ENC28J60 is connected, the Sick sensor black wire is connected to Analog input 1, and a speaker is connected.<sup>1</sup>

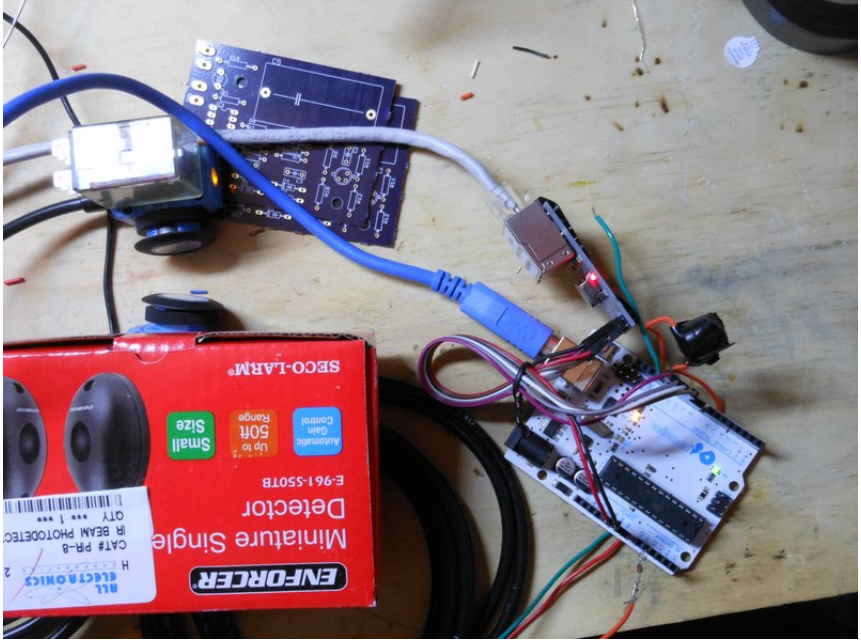


Figure 1: Testing the Sick IR Diode Tripwire

Figure 1 shows two things, first off a diode connected in series with the output of the Sick sensor, and also the orange LED on the top of the sensor. The orange led will be green when there is no connection between the diodes and orange when the Diodes (or LEDs) are lined up correctly. When someone moves across the field of their vision, the orange LED will change to green.<sup>2</sup>

### 3.2 Diode on Output of Sick Sensor instead of Transistor (Hack)

<sup>1</sup>In hindsight, reed magnet switches (you'll often see these used in alarm systems on windows and doors, when the door moves, the magnet disconnects from the reed) would be less work for this application. Only one thing to power.

<sup>2</sup>This will later become important when installing the IR diode and receiver, as they must be lined up correctly.

Some IR diode / receiver pairs output a high or low. Some, like the Sick sensor, output a high or low (depending on whether you connect to white or black wire), however they are meant to be connected to a transistor, and thus if you connect it directly to a micro expecting it to go high or low, it will not. Being lazy, and seeking a quick solution, I put a 1N4819 in series with the output of the Sick sensor. TODO: pictures showing waveforms <sup>3</sup>

Using the black wire, it will be normally low and go high when motion is detected (the white wire is the opposite). If you connect to a micro it will fail to go high (why?). If you put a diode on the end in series, it will turn the normally low to a noisy normally low, and sometimes it will go between 2.5-5 volts in spikes. This allows us to use the ADC to read the Sick sensor, and avoid the use of adding a transistor in. The transistor would allow for a digitalRead to be used, but we have plenty of Analog inputs to use, so let's use one of those.

It's important to line up the emitter and receiver. If they are not lined up precisely, they will not get a sync, and the motion detection will fail. Thankfully, the diode outputs more of a cone, and less of a straight line, so some buffer is there. When the lights are dark, it is possible to see the red IR emitted if the distance is not too much.

### 3.3 Broken ENC28J60 Module

During my testing, I suddenly was unable to get an IP address. I checked the testsuite sketches, which didn't work, then began tearing down my setup, testing another Arduino and ENC module. It turned out, the ENC28J60 module failed on me. Make sure to buy backups.

### 3.4 Installation Log in Pictures

Here is an overview of what installing this in the wall might look like. One side is emitter, the other the receiver.

---

<sup>3</sup>This is possibly an issue of output impedance, but I will admit, at the time, I didn't bother to check.





Figure 2



Figure 3



Figure 4

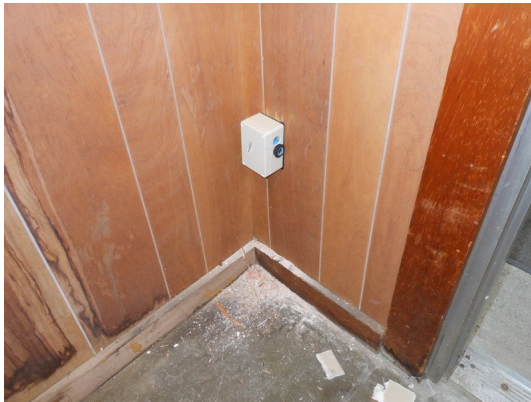


Figure 5: Part 1 of sensor. By mounting it on the right side of a project box, we can get a 90 degree angle.



Figure 6: Arduino and Part 2 of sensor. Lined up with the other part.

## 4 Omrom Photoelectric IR Emit-ter/Receiver

All electronics is currently selling used Omrom photoelectric sensors, they are model: e3f2-r2c4. These types of photoelectric sensors are from a large catalog of different types. Some AC some DC powered. Different max distance, etc... See resources in this git repository for some PDFs.

I tested one without knowing how to use them, but had poor results. I was only able to get the light to flash when I dismantled the device, and put my hand very close to the IR. Teardown pictures are in the photos folder. The devices were not easy to dismantle, and can't really be put back together as they were originally. However, they did seem otherwise well made. <sup>4</sup>

---

<sup>4</sup>Repairs may be difficult.

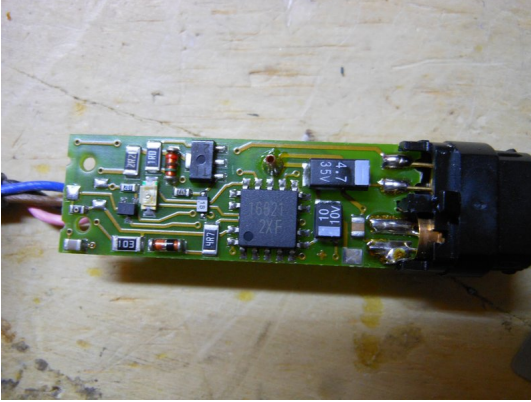


Figure 7: Omron 'Photoelectric' IR Emitter and Receiver Pair. Notice the two diodes behind the black cover on the right side. After finding some documentation on these in the reviews, I found out that the IR emitters require a reflective sticker in order to 'see' their IR beam reflect back. Not just a white surface, but the type of reflector you might see on a construction or night worker orange vest.

Hookup Instructions from All Electronics Comments:

is. To use with 5v ttl (using a second 5v source) wire as such:

Brown to +12V; Blue to ground; Pink to either +12 or ground depending whether you want Light-ON or Dark-ON mode;

Black to a 4.7K resistor with the other side of the resistor connected to a separate +5V source (the arduino). The 5v ttl signal is at the point where the black wire connects to the resistor.

One thing I also noticed, was that used photo electric sensors from brand names can be obtained for discounts on the auction sites, to see if a good deal can be had. When buying them new, they can be relatively expensive for a hobbyist working out of his/her garage.

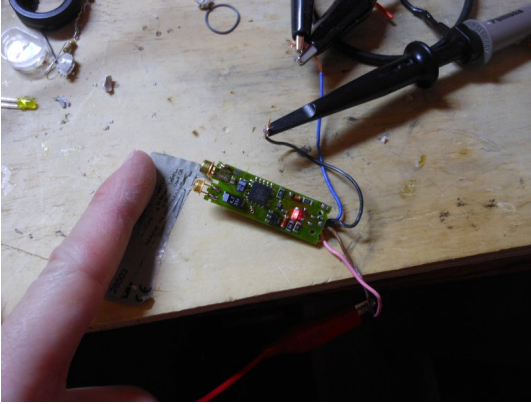


Figure 8: IR in action. (without a reflective sticker, it doesn't go very far!)

## 5 Using the HFS-DC06H Microwave Sensor

As I've tried with the HB100 (just the RF part of this HFS-DC06H), without success, I've moved to the HFS-DC06H microwave sensor which includes the Op Amp and accompanying circuitry (it simply outputs a digital high or low).

During testing, I found that the HFS sensor would not work correctly with my laptops usb 2.0 power supply. I thought it might be RF interference from the metallic perf board something I've seen before with an FM bug radio but it was not. The HFS and the ENC require external power that is greater than my laptop can output.

### 5.1 Uno Memory Limitations

Using ethernet with the Uno is always touchy. Version control is important, to have a functional version to work off of.

When writing my code, I found errors creep in due to using too much of what the Arduino IDE calls dynamic memory. You can see how much dynamic memory is used in Arduino by hitting verify (not upload but verify) and reading the output from the toolchain.

You can also use a tool to see how much SRAM is used (code is online:<https://jeelabs.org/2011/05/22/atmega-memory-use/>) the following function:

Heres a small utility function which determines how much RAM iscur

```
int freeRam () {
  extern int __heap_start, *__brkval;
  int v;
  return (int) &v - (__brkval == 0 ? (int) &__heap_start : (int) _
}
```

And heres a sketch using that code:

```
void setup () {
  Serial.begin(57600);
  Serial.println("\n[memCheck]");
  Serial.println(freeRam());
}
```

```
void loop () {}
```

The result will be:

```
[memCheck]
1846
```

The UIPEthernet code requires significant RAM for the Uno. This is not a new problem for me, but it rears its ugly head again. However, this is a good thing. Limits are good.

An easy resolution for this is to put all serial.print lines into flash memory. You can verify this helps, by taking a serial.print, and commenting it out, and comparing the before and after dynamic memory used in verify. To put serial print lines in flash:

(<https://www.arduino.cc/reference/en/language/functions/communication/serial/>)

(<https://www.arduino.cc/reference/en/language/functions/communication/serial/>)

As I recall, there may be limitations to what you can do with Serial.print(F()), for example, converting variables into it will likely not work without further finesse, and libraries that print through serial likely won't work.

Low RAM errors can creep into strange places. For example, see these two wiresharks, where my code was running, equally as well,

but the new code revision simply didn't work:

As you can see the data packet is mangled in the new rev. I've seen this enough to know, it was low SRAM. Otherwise, the code worked without major error. This small error effectively broke the program! Testing is always important, as well as saving multiple copies as you go, or alternatively version control.

The figure displays two screenshots of the Wireshark network protocol analyzer interface. The top screenshot shows a packet capture with 9 packets. Packet 4 is highlighted, showing a Transmission Control Protocol (TCP) segment with source port 1034 and destination port 6802. The data field shows a 34-byte payload. The bottom screenshot shows a packet capture with 10 packets. Packet 6 is highlighted, showing a TCP segment with source port 1025 and destination port 6802. The data field shows a 2-byte payload (0x00). The interface also shows the packet details pane and the packet bytes pane for both captures.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.1.177	192.168.1.178	TCP	60	8034 → 6802 [SYN] Seq=0 Win=512 Len=0 MSS=512
2	0.000050216	192.168.1.178	192.168.1.177	TCP	58	6802 → 1034 [SYN, ACK] Seq=9 Ack=1 Win=29200
3	0.011193182	192.168.1.177	192.168.1.178	TCP	60	1034 → 6802 [ACK] Seq=1 Ack=1 Win=512 Len=0
4	0.099030833	192.168.1.177	192.168.1.178	TCP	88	1034 → 6802 [PSH, ACK] Seq=1 Ack=1 Win=512 Len=34
5	0.099071740	192.168.1.178	192.168.1.177	TCP	54	6802 → 1034 [ACK] Seq=1 Ack=35 Win=29200 Len=0
6	0.110175950	192.168.1.177	192.168.1.178	TCP	60	1034 → 6802 [FIN, ACK] Seq=35 Ack=1 Win=512 Len=0
7	0.147857966	192.168.1.178	192.168.1.177	TCP	54	6802 → 1034 [ACK] Seq=1 Ack=36 Win=29200 Len=0
8	0.151560544	192.168.1.178	192.168.1.177	TCP	54	6802 → 1034 [FIN, ACK] Seq=1 Ack=36 Win=29200 Len=0
9	0.184108690	192.168.1.177	192.168.1.178	TCP	60	1034 → 6802 [ACK] Seq=36 Ack=2 Win=512 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	d3:5d:be:ef:ee:15	Broadcast	ARP	60	Who has 192.168.1.178? Tell 192.168.1.178
2	0.000046933	Wistron_f0:10:86	d3:5d:be:ef:ee:15	ARP	42	192.168.1.178 is at 00:26:2d:f0:10:86
3	1.002669195	192.168.1.177	192.168.1.178	TCP	60	1025 → 6802 [SYN] Seq=0 Win=512 Len=0
4	1.002747278	192.168.1.178	192.168.1.177	TCP	58	6802 → 1025 [SYN, ACK] Seq=0 Ack=1 Win=512 Len=0
5	1.013855258	192.168.1.177	192.168.1.178	TCP	60	1025 → 6802 [ACK] Seq=1 Ack=1 Win=512 Len=0
6	1.094450636	192.168.1.177	192.168.1.178	TCP	60	1025 → 6802 [PSH, ACK] Seq=1 Ack=1 Win=512 Len=2
7	1.094468026	192.168.1.178	192.168.1.177	TCP	54	6802 → 1025 [ACK] Seq=1 Ack=3 Win=29200 Len=0
8	1.105642274	192.168.1.177	192.168.1.178	TCP	60	1025 → 6802 [FIN, ACK] Seq=3 Ack=1 Win=512 Len=0
9	1.134279368	192.168.1.178	192.168.1.177	TCP	54	6802 → 1025 [FIN, ACK] Seq=1 Ack=4 Win=512 Len=0
10	1.177423894	192.168.1.177	192.168.1.178	TCP	60	1025 → 6802 [ACK] Seq=4 Ack=2 Win=512 Len=0

Figure 9: First capture is correct. Second one, the lack of RAM causes the ENC to fail to send data to ZMTrigger.



## 6 Deployment

Today I deployed both sensor boxes on site, connecting them to the ZM system. They both work<sup>5</sup>. I found that these HFS sensors appear to be fairly directional. I've been unable to get them to fire, when behind a wall, or up a floor, which is good I don't want them to do that. The metal shield they have, seems to work well blocking radio waves from going behind it. I mounted one on the ceiling and one on a wall, setting the cameras to nodect. Success.

However I have seen some issues with these, in the following situations.

- Mice in the ceiling, setting off the alarm
- Flourescent lights being within 2 feet of the installation causing false alarms

Keep in mind, that if anything moves, it can set off the alarms. Including small animals.

I'm not sure exactly what frequency they are, but I think it is around 5GHz, comparable to 5GHz wifi (not going through walls well). I'm also considering putting some copper tape on the inside of the box, to help block anything through the wall it's mounted to, possibly...

When building this new shield I've made for the motion sensor, you can use flush cut pliers (the ones that cut really close to a board, if you are not familiar) and cut the WS2812 RGB LEDs right off of a \$3 RGB ring. You can also buy individual WS2812 LEDs. Cutting them off, is easier, and cheaper (and for those who run on a shoe-string budget) thus what I did here. There is a video I've made in the repo to show this process.

There's some things I'd like to add to the prototypes. First off, a light pipe, from the RGB LED to the box. Perhaps, 3D printed. Second, the RGB LED should change colours, very slightly when motion is detected. Not so much colour change that a casual glance will notice, but enough that if you are watching for it, you will see it.

---

<sup>5</sup>And have continued to work for about a year now

## 6.1 Work Log 1/31/19

I'm assembling three of these for a company today. I can see right away some of the mistakes I made, and it's all DFA, or design for assembly errors.

I made a whole Arduino UNO shield, and that was a bad idea. I don't want to solder all of the 0.1 headers. There's a 10, two 8s, and a 6. It takes say 3-5 minutes per board. Too slow. I need to make the next shield with as few 0.1 headers as possible. Also, possibly a different connector besides these pin headers would be better. Something easier to solder, perhaps reflow possible.

Another option would be to use a nano. Make assembly easy. That is very important. I also might want to consider a micro with built in ethernet, but for simplicity sake, for now Arduino Uno will do. Unos also are as future proof as you can get.

## 6.2 The need for POE

I deployed three of these in one company, and power wiring was an issue for one of them. One of them is going to require it's own 12V wiring (the other two worked with passive POE). Based on this, and knowing that there is a limit to what passive 12V POE can do, I've decided that I will use an 802.11 48v POE board for this application going forward. I don't want to take any chances with power being an issue. POE Injectors are relatively cheap. Back to the drawing board.

## 6.3 HB100 are Sensitive to Fluorescent Lighting and Mains

Do not install these HB100-based sensors near either mains or tube lights. They are sensitive, and will not operate correctly. I found that being within roughly 2 feet was too close. In my case, the logic high of the HB100 would go off randomly.<sup>6</sup>

---

<sup>6</sup>See also my notes on RFID

## 6.4 Switcher Shield

As much as I have a need for POE, I also have a need for speed, so I've decided to add a new shield that manages power, as a quicker solution to the poe problem. I put two different switchers on board. Both jelly bean parts per eevblog forums <sup>7</sup>. I'll try each.

## 6.5 ENC28J60 Power Consumption

The Uno has an LP2985, which is a 3.3v reg, with 150mA max output (per data sheet). The ENC28J60 is spec'd at typical 160mA active ethernet, 120 mA inactive ethernet (Max active can be 180mA).

What to do? I've never had an actual problem with my Uno + ENC modules yet, but this is of concern. I could include onboard 3.3v vreg on the switcher board, or after peeking through the ENC data sheet, I found a sleep mode. I checked online, and someone has covered it here:

<http://blog.derouineau.fr/2011/07/putting-enc28j60-ethernet-controller-in-sleep-mode/>

So this might be worth adding to the code. I don't need the internet active until an alarm is detected<sup>8</sup>. Otherwise the ethernet can be off. Will save some power. And, this is a reasonable compromise for the low power requirements, assuming that the sleep and wake from sleep mode works.

Let's see if the sleep modes are already included in the library I'm using for the ENC... It does. Not called sleep though, it's powerOff, and powerOn. See:

```
Enc28J60Network::powerOff(void)
{
  #if ACTLOGLEVEL>=LOG_DEBUG_V3
    LogObject.uart_send_strln(F("Enc28J60Network::powerOff(void) D
  #endif
```

---

<sup>7</sup><https://www.eevblog.com/forum/beginners/jelly-bean-switching-regulator-alternative-to-7805/msg369867/#msg369867>

<sup>8</sup>Actually, I might, if I want a server...

```

    writeOp(ENC28J60_BIT_FIELD_CLR, ECON1, ECON1_RXEN);
    delay(50);
    writeOp(ENC28J60_BIT_FIELD_SET, ECON2, ECON2_VRPS);
    delay(50);
    writeOp(ENC28J60_BIT_FIELD_SET, ECON2, ECON2_PWRSV);
}

void
Enc28J60Network::powerOn(void)
{
    #if ACTLOGLEVEL>=LOG_DEBUG_V3
        LogObject. uart_send_strln(F("Enc28J60Network::powerOn(void) DE
    #endif
    writeOp(ENC28J60_BIT_FIELD_CLR, ECON2, ECON2_PWRSV);
    delay(50);
    writeOp(ENC28J60_BIT_FIELD_SET, ECON1, ECON1_RXEN);
    delay(50);
}

```

Note that the PowerOff function does not follow the data sheet precisely. The data sheet mentions that after RXEN is cleared, to wait for RXBUSY and TXRTS to be clear. It looks like a 50millisecond delay is considered enough here. Don't like the look of that though. So sleep is included. However, if I include sleep, I won't be able to run the web server on these devices... Save power, or have a web server with info...

A comment with the word 'sleep' would've been nice to have in the code. A grep -r sleep comes up empty, though grep -r power finds it. Maybe instead of the IP address web server, I should just put a label on each modector box with the IP, then I can test the sleep mode to save power.

## 6.6 Staggered switcher and modect board 0.1" headers

I should stagger the headers. The 0.1" headers that go in between two boards, cost more than the standard ones. Solution: stagger

them and then use the standard headers. Don't waste money on the double layer headers.

## 6.7 Other Changes

The 470uf caps I bought don't fit into the footprints. They are probably oversized for capacitance, anyway.

Can use through hole resistors for the divider on these. Easier to assemble.

I need to fix the caps, so they have the same polarity on a given left or right side. Right now on the LM section, they are swapped. Too easy to mess up.

Inductor footprint is a little small, but placing diagonally works well. The single D7 pin header is difficult to solder. Make it a pair.

The fuse footprint should be bigger.

## 6.8 Blowing Fuses

The LM section... I first used a 2Amp smd fuse. No problem on first board assembly.

2 and 3, I used a 1.5Amp smd fuse. Both of them failed, upon 12V PSU input. This is with nothing but the power shield. Must be a current spike into the inductor, and caps, I imagine.. Oh, I also used 470uF filter caps (in and out) on these boards, as its all I had... The first board however, had 220uf caps.

So here's what happened.

- Board 1: 220uf Input filter cap, 470uf output filter cap.
- Board 2: 470uf Input and Output filter cap.

Board 1 blew the 1.5A fuse, but not the 2A fuse. Board 2 blew both the 1.5A and 2A fuse.

The 470uf caps are not what is supposed to be there, but it's all I had bought. They were supposed to be 120uf.

Lesson: caps will blow fuses. Of course they will though, when you think about it. I guess up to 2Amps was short circuiting for a second with the 470uf caps. Something to log with better equipment.

# Flammable Gas Sensor

Steak Electronics

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## 1 Overview

Shop needs a flammable gas sensor, for safety.

## 2 Chip Hunting

I'm looking at the following:

- SGAS711
- 200K fixed resistor
- 1M potentiometer
- Arduino Nano (for speed)
- Ample Power Supply They are recommending 7 Volts for the heater. So, one rated for 1A.
- led notifiers
- Long cables to separate sensor from device. (optional)

### 2.1 Gas Sensor Tuning

The flammable gas sensor has different sensitivities for different gases (see data sheet, Figure 8). I'm going to need to test for something specific, i.e. if the shop needs to watch out for acetone, I should test acetone. Of course, if enough of a flammable gas is in the air, it will set it off no matter what, but I should focus on what the danger is for calibrating.

Based on the resistance chart, I'm going to use a fixed 200K and a 1M pot. Pots are to be avoided, but here we need to calibrate over time. For the response of the v divider, the sensor is not linear, but



closer (though not quite) logarithmic. So what I will do, is have to use some math on the micro, and use the formula they give in the Datasheet, to get a logarithmic output that appears linear (figure 5). For my needs, it is good enough.

**Table 1. Alternative Full-Scale Response Targets for 3.3V System**

Full Scale Response	$R_{\text{FIXED}} [\Omega]$	$V_{\text{OUT (air)}} [V]$	$V_{\text{OUT (full-scale)}} [V]$
0.75	210k	0.133	2.475
0.80	280k	0.175	2.640
0.90	630k	0.369	2.970
0.95	1.33M	0.693	3.135

Figure 1: Application Note resistance table

### 2.1.1 Fixed resistors

If these sensors are consistent enough, possibly I could use fixed resistors later.

### 2.1.2 Gas Sensor Power Usage

Rated at 900mW for 7V, so about 150mA (128mA). I know from prior experience these things heat up, so we need plenty of power.

### 2.1.3 PCB Layout

The gas sensor must be sideways, as there is excessive dust in the shop so, the holes will be on the side. I will do a 90 degree edge mount pcb.

## 2.2 Switcher

STS1024S6V5 Seems like a fair option for now. Output is 6.5 volts which is enough. Will use a module. Need to make a footprint.

## 2.3 Enclosure

We need a box that is tall enough to be a cube. Also want square, not rectangular. I plan to have the leds light from the back of the

pcb. The pcb will be the top cover / front. The top cover / front will be the box, put on its side, so dust doesn't collect on the leds. Need a cube.

### 3 CAD Layout

I found that Kicad step up in Freecad is helpful for making sure your board will fit the enclosure. A very helpful addition to an arsenal. Although I didn't test it until after rev 1.

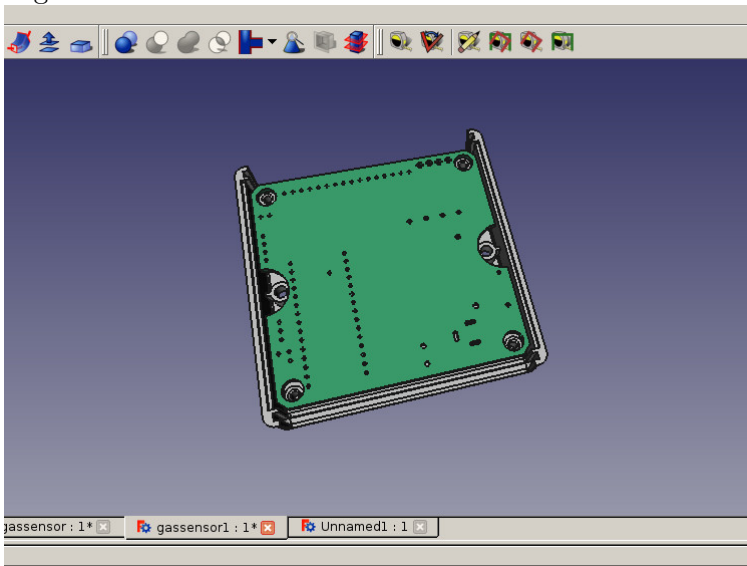


Figure 2: Freecad has the ability to pull in boards from Kicad. Even without step file dependencies you can see how the PCB will fit a case

### 4 PCB Assembly

Most of the board came out ok. Power section is routed right. I need to move the barrel plug further out of the board, so it fits with the case better. The one issue I overlooked was the A6, and A7 pins,

which have no digital circuitry behind them. So I have some pins that can't light up. I'll have to bodge wires in, or respin the board. Simple fix. Oversight on my part, that's all. I assumed GPIO on all pins, but here are two analog pins that can't function as GPIO.

I'll use D7, and D8. Looks like I also missed the wire from VSenseOut of the Gas sensor to the board. So that will go to A6. Technically, I missed a net on the schematic.

One other fail of the enclosure, is that the Arduino nano won't fit with female pin headers holding it in. This means, instead of easily being socketable, I'll have to solder the board in. Not a deal-breaker, but I would prefer the nano to be easily removable. I don't like soldering it on the board. In the future, I need to find a taller enclosure.

## 4.1 Place Sensors on the Floor

Being that at least some flammable gases are heavier than air<sup>1</sup>(in our case, they are, your situation may vary) it is logical for us to put them on the floor. There are no rules, though so why not both? It would be interesting to see the LEDs responding differently at say waist height, and at your feet. That would indicate different gas in the air.

## 5 In Consideration of “Hazardous Locations”

Up to this point, I have not paid any attention to official rules or standards regarding safety<sup>2</sup>. The search term for a device like this that may be in an environment that can dangerous is **hazardous**

---

<sup>1</sup>Reference: Plumbing, Rex Cauldwell, 2006, page 137 - Gas Heater Awareness - Great book.

<sup>2</sup>Our environment is only dangerous when there is a gas leak (extremely rarely), so we are the least strict of the hazardous location types. In the US, this is Class 1, Division 2. Gas (class 1) can be present, but is not normally (division 2). We regularly have dust in our air, however it is silica and therefore inert / not explosive.

**locations.** There are a few books on the subject I found (specifically for electronics in hazardous locations). I downloaded the PDF of a few online, but was not impressed with the writing quality enough to buy them with the exception of *Electrical Installations in Hazardous Locations* by Peter Schram [1]. There is also a succinct Application note which covers a general overview in Linear Technology Magazine September 2009, also accessible online [2]. As a launchoff point, some discussion can also be found online in various forums [3].

## 5.1 What Class is my Company?

Based on [4], we are a Class 1, Division 2. With the Class 1, being Group D, as we would have leaks of those gases. It's possible that certain areas (inside the reactors for example) may be a higher class.

### 5.1.1 Encapsulated Fuses

Encapsulated fuses are also referred to as UL913 online (e.g. in stores). UL913 is UL's *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*. Another term to search for is *intrinsically safe* on the parametric search for fuses. The cheapest intrinsically safe fuse in 1 quantity on Digikey is currently \$4.50. Ouch. Safety requirements sure help some people, just not the buyers. I see a market, for a blobbed fuse at \$1.

## 6 Existing Gas Detectors

We have already purchased a commercial gas detector. This particular model is designed so that the control box is kept separated from the sensor. The sensor has a 30 foot cable. The control box is installed in the ceiling. <sup>3</sup>

## 7 Switching Power Supply

---

<sup>3</sup>See in the git: teardowns 2019, the RKI instruments combustible gas sensor.

In search of a low part count, simple to deploy switcher I came across this in my rss (<https://hackaday.com/2019/08/11/switching-over-to-smtps-for-efficiency/>). The LM2576 is easy enough to use instead of a lm317, and requires only a diode and inductor more. Here I need more power efficiency from the 12V input so that should work. A simple go-to switcher.



Figure 3: Prototype

## 8 Connecting the Sensor by a Wire

Upon showing this to my family co. who wanted it, they mentioned they wanted a cable going to the sensor. I looked at the RKI Instruments flammable gas sensor, which we have a few of, and these used a 22 Gauge 4 conductor cable. That is \$50 for 100' of cable. A more DIY solution is to grab some 4 pair CAT5E or CAT6 and connect two wires to each screw terminal on the board. That is what I will do. Saves money, and should work no issue, up to the 30 feet max that I need. Any small box can be used for the sensors. I might build a pcb mount for those, or perhaps just some hot glue. Depends on what works the best, while being efficient.

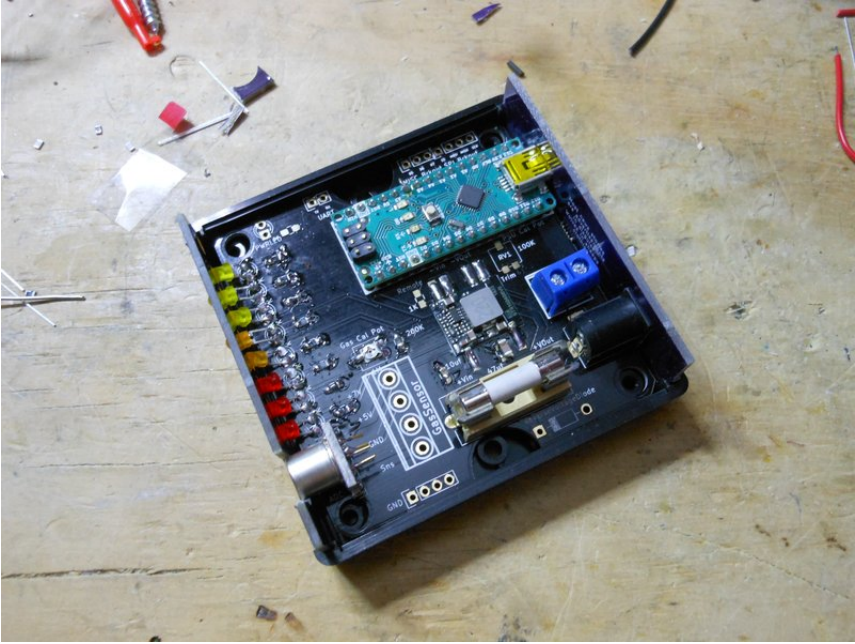


Figure 4: A simple solution.

## 9 Calibration

This is the real task of this project. Making a gas sensor is easy, calibrating it, is another step. Thankfully, some companies sell calibration tanks. For calibration you might calibrate on the LEL or the lowest acceptable level before an alarm should be fired off for a given chemical.

## 10 References

## References

- [1] Peter Schram, *Electrical Installations in Hazardous Locations*, first edition - 1991, National Fire Protection Association (NFPA), ISBN-13: 9780877653561.
- [2] Murphy Pickard, *Surge Stopper IC Simplifies Design of Intrinsic Safety Barrier for Electronics Destined for Hazardous Environments*, Linear Technology Magazine September 2009, <https://www.analog.com/en/technical-articles/surge-stopper-ic-simplifies-design-of-intrinsic-safety-barrier-for-electronics.html> .
- [3] Various, *Electronics Design for Explosive Environment*, EEVBlog Forums, <https://www.eevblog.com/forum/chat/electronics-design-for-explosive-environment/?all>, <http://web.archive.org/web/20190410172437/http://www.eevblog.com/forum/design-for-explosive-environment/?all>.
- [4] Various, *Explosion Protection and Intrinsic Safety 101*, Pepperl Fuchs, [https://www.pepperl-fuchs.com/usa/downloads\\_USA/explosion-protection-and-intrinsic-safety-101.pdf](https://www.pepperl-fuchs.com/usa/downloads_USA/explosion-protection-and-intrinsic-safety-101.pdf), [http://web.archive.org/web/20190721221654/https://www.pepperl-fuchs.com/usa/downloads\\_USA/explosion-protection-and-intrinsic-safety-101.pdf](http://web.archive.org/web/20190721221654/https://www.pepperl-fuchs.com/usa/downloads_USA/explosion-protection-and-intrinsic-safety-101.pdf).

## **Carpentry**

*“Ban dirty Rugs and Worship the Holy Hard Floor. Build primarily function over form. Shun those who live in inferior materials and constructions. A large house, without soul, is not wealth. A modest home is more beautiful. Wealth is bigger than money or property. Live frugally.”*

- Targes Attenuator



# Home Tiling 2018-2019

Winter 2018-2019

## Contents

### 1 Overview

Objective: Rip out rugs, and replace with tile in two closets. My first tile job.

### 2 Work Log



Figure 1: Before Picture. The old rug is 30+ years old! Ough!

Work Log: Rug was ripped out, by pulling at one corner, then ripping off the nails. Using a pick and hook set made removing rug quick.

Flathead screwdriver was used to remove carpet nail lines along border.

At this point, parts for the tiles were purchased. This took a while, but it helps to have everything for tiling in one or two totes. I use a flatter tote for mortar as well. Keeps dust in the box a bit.

## 2.1 Day One

First day of tiling was doing the membrane layers. Put down the right mortar (membranes lower layer require a certain mortar, above is a separate mortar). Put the tape up.

## 2.2 Day Two

Next day is the mortar on top of the membrane. you can't do this on day one, as the mortar underneath will be plastic and pliable.

## 2.3 Day Three

Day Three is the top mortar layer. At this point, you can tile directly on top of the mortar, but I had white marble, which requires white mortar, and the mortar on top of the membrane must either be plastic or not plastic (I think the former, have to check), whereas the only plastic mortar I had was grey. Two layers for me on the top!

## 2.4 Day Four

Now, I put all tiles that were not going to be cut. This turned out to be the first four tiles.



Figure 2: After. In this picture, the back tiles, and the right side are cut, but not actually in mortar. This is just to get a look at how it should appear. Tiles are cut in day five.

## 2.5 Day Five

As working at home is difficult with no room, I did cuts on day five. I used the saw to cut the tiles in the back row, and side. This was a learning experience, but cutting tiles is fun, and not dangerous compared to a wood table saw. Quite fun, lighthearted work. It's really just grinding stone (or ceramic). The nippers also work very well. No trouble at all.

## 2.6 Day Six

This is the last day of tiling. A small amount (don't need much) of mortar in a bucket of water, another bucket of water with a sponge to

cleanup, some newspaper or paper bags near where you are working, and put down not too much mortar down after mixing and letting it slake. As I didn't have a flat surface it came out a bit mixed at the back, but for my first tile job, it's not bad.

I ended up breaking the small part of the cut tile in the back, but it was because my surface was not flat.



Figure 3: This wire wheel easily scraps off mortar or concrete Shows a small wire wheel you can use on the end of a drill. This can be used to sand away areas of concrete or mortar that aren't flat. I should've used this more before I put down the original layer of thinset mortar, before the membrane was down, but because I didn't, I had a non level plane at the end. As this was a closet no big deal, but it didn't look 100 Surface must be flat!!!! Very important.

## 2.7 Day Seven

Grouting and then trim is all that's left.



Figure 4: Grout in place. Now need to add trim. The grain was tried to be placed in a harmonious pattern., although the back pieces were not 100% perfect. The first impression from others was that the grout lines were too big. This may be true, but it looks good even when bending the tradition of small grout lines for marble.

### 3 Tiling Notes from a book

I'm reading a taunton press book on tiles. Taunton's Tiling Complete. Right in the introduction the book tells me that it's NOT going to tell me how to do bathroom showers. Why would it say that? If you've ever worked with a computer you've received the message, Please contact your network administrator. You know what happens when you are the IT guy? Nothing. You are screwed. That message is nothing but insulting. A middle finger to the user's face. What if you are a Tile Contractor trying to get instructions or tips on do-

ing bathroom showers? This book plainly says, Screw you, we are gangsters, you aren't in the club and we are keeping this information secret for our brethren to get their precious shekels.<sup>1</sup> In any case, you can easily go to the internet and get dozens of videos and sites on bathroom tiling. The moral of the story is: Don't tell people what they can and can't do. Though some of the advice is bad in this book. You must read it, remembering to think twice. The book is not authoritative, and the user must know when advice is wrong.<sup>2</sup> E.g. Never make diagonal tiles. Checkerboards, are more pleasing

to the eye. Ignore that they say you should sometimes do diagonal. They are wrong. 90% of tiles are checkerboard. Go out in the world and look. Diagonal tiles are clashing, and they breed unrest in the psyche.

Coloured grout: Grout should match the colour of the tile. Don't contrast too much. They recommend you can use bright colours for artistic effect (though possibly not in houses). Bullshit. Grout should match the tile. If you want stains not to show, get a grout and tile that are dark, brown, or black. Don't put white grout on a dark tile, or dark grout on a light tile. It looks bad. Again, clashing is bad.

Large tile. Seems like an excuse to sell bigger saws. Nothing wrong with big tile, but you need a big saw, and that is big bucks. Small tile is also fine.

In defense of the book, there is a lot of good information included in this book. The basic tools are outlined, and while some bad advice remains (no safety warnings about angle grinders is one cherry picked example) they include some good tips on tools.

---

<sup>1</sup>A mention of contractor codes is in order here as its related. Codes have good intentions, but never underestimate the ability for people to use it for malice.

<sup>2</sup>In fact, this attitude should be brought to all books.

Reciprocating saws have grout removing attachments. Be careful if reapplying grout.

Compound nippers exist.

Some good notes on heated tile. Seems they use ditra everywhere. I like ditra as well. They also use it on edges or trim. However, the heated tile they recommend is the electrical kind, while the old timers around me say that plumbing heat is the right kind to use. Plumbing hot water pipes has no danger of short circuiting, and I agree with them.

The different types of thinset. Try flexible thinset with ditra...

Instead of using backerboard for wood subfloor installs, use metal grating and self leveling compound to get a guaranteed flat floor.  
Pg118

The grain of stone tile should be lined up, if possible. Make sure to mix boxes of different tiles (of a similar set), so the transition is not obvious.

There is a dremel and rotary bit that can be used to remove thinset (and maybe grout?). It's like a fine drill bit. You carefully navigate it into cracks. It's effective, but tedious for big jobs.

I've considered not using epoxy grout as it is not as close to nature as normal tile grout is. <sup>3</sup>

On the use of the term "all natural" , and the saying that everything is natural, technically. . This is true, however, there is a sliding scale of natural to manmade. Some things are closer to occurring in nature, and others are closer to man made. Although things that

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<sup>3</sup>Although I'm not familiar with what they actually put in grout, beyond sand, limestone, and perhaps gypsum which is used for plaster, so I may be completely off base here.



are manmade are technically natural as well, this is semantics, and pedantic, and you know what I mean (when I say natural). Sliding scale natural to manmade. End of discussion. <sup>4</sup>

Stone and glass are the best tile. Polished stone. This is true because drinking out of glass is cleaner than ceramic mugs. By this token, a polished ceramic (porcelain) is better than a rough ceramic. Think of it this way: which surface would you rather eat or drink off of? Now correlate that to breathing oxygen in the same room as the surface. However, the problem with glassy stone tile, is that the glassier the tile, the more it will show a scratch. The closet I built in this article used tiles from Home Depot, and the tiles scratched, and showed it quickly. Next time I will go with less glossy, and higher quality stone. Dedicated flooring and tile shops should be used for any serious work.

Related to the previous passage, you should never seal tiles. Get tiles that don't require sealing, polished stone, porcelain, etc... Putting a chemical coat over a tile is inferior, as the surface is now not the tile. See previous paragraph. Sealing grout is OK.

Be careful choosing colour grouts, as in the future getting that grout may be difficult.

How to know grout is sealed? Water will bead off of it. Though in the practical world, you may not want to be bothered with resealing grout every few months. (how often does it need resealing?)...

Don't buy home cheapo tiles. Get good ones.

## 4 Original Notes

These notes were from the first draft, and are kept here for reference. Objective: Rip out rugs, and replace with tile in two closets.

---

<sup>4</sup>Snake venom remains an all natural alternative to living (that is a joke, please don't take snake venom).

Work Log: Rug was ripped out, by pulling at one corner, then ripping off the nails. Using a pick and hook set made removing rug quick. Flathead screwdriver was used to remove carpet nail lines along border.

At this point, parts for the tiles were purchased.

Surface must be flat!!!! Very important.

# Hardwood Flooring Install

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## 1 Overview

Install prefinished hardwood flooring in house going up for market. Document general steps on how to do hardwood flooring.

## 2 Item List

- Oak finished hardwood (pre-finished not covered here)
- Hardwood Flooring Nailer
- Hardwood flooring nails
- Air Compressor (these are available on CL for \$50-150)

- Pneumatic finish nailer
- Multitool for cutting trim (see pictures)
- Rosin or Felt paper
- Stapler
- Shop Vacuum (these are available on CL for \$20 - 100)
- Miter saw
- clamps of various kinds

1

### 3 Work Log

Wood Floors. Clear floor of all debris first. Get down to plywood subfloor. <sup>2</sup> Must be flat, level floors. Any obvious nails or carpet staples anything that is sticking out from the floor must be removed or flattened first. You want a flat level surface. <sup>3</sup>

---

<sup>1</sup>See tools picture gallery at the end

<sup>2</sup>If you didn't have a plywood subfloor, you would have to put down some. An example might be an apartment or office with a thin concrete subfloor

<sup>3</sup>A flat surface is also important for tiling.



Figure 1: Here the pink Rosin paper has been placed down in sheets, and the first row is being started. Hardwood nailer in foreground.

### 3.1 Rosin or Felt Paper

Get layers of Rosin or Felt paper, and layer them on top of the plywood. Use a stapler to adhere the paper to the plywood. Use a hammer if the staples don't go in all the way. Should be flat. The layers should overlap about 5-6 inches. This paper helps with water protection, and is the membrane between the plywood and the hardwood floor. (Other options besides felt paper, or in addition? Possibly a liquid waterproof membrane?)



Figure 2: Rosin paper stapled to plywood. On the left is the closet, and that gap was later filled in.

### 3.2 Is the room square?

Before you start on the first row of the hardwood flooring you have to check how square the room is. Measure the room to see if one wall is wider (and by how much) than the other. You don't want to start on one curved wall, and have the planks end up going crooked because that wall was not straight and square. You may need to make a chalk or pencil line if necessary. In this house, we were able to hug one wall and go to the other side without a chalk line, or without accounting for too much offset in the wall.

### 3.3 Space hardwood from wall

You should space the plywood some distance from the walls, but in our case, we chose to space the Left and Right sides of the hardwood, while the North and South sides of the hardwood will remain fairly close to the wall (not right against it, but near. You should be putting trim over the edges, so you might have let's say  $1/2$  that you

can spare between the hardwood and the wall. The earth, houses, and walls move, so you don't want to have the wood tight against them. This also applies to tiles.



Figure 3: This was used to cut trim. These range on ebay from \$50-200+

### 3.4 Cutting door trim and mouldings to fit wood

You will want to use a multitool to cut the door trim or mouldings to fit the wood. The actual floor trim was removed, and new ones put in, but the door trim, will need to be sawed off. Cut yourself enough off, so the hardwood fits below, but is not tight. We used a Fein FMM250Q Multimaster pictured here.



Figure 4: Hardwood fitting underneath the door trim. Wall trim has been removed until the floor is in place.

It works well, however, remember that this vibrating blade is dangerous and to show respect for it. It can easily cut into wood and it will easily cut into your leg.

These multitools have a variety of attachments such as sanders, drywall blades, carbide blades (for removing tile grout), etc... I did some quick research and while it might be possible, no one uses it to cut tile. Seems that the vibrations might break more tiles. Most people use angle grinders (this is only for small custom cuts, where a wet tile saw won't work). This is for tiles before they are in place.





Figure 5: Pneumatic (not hardwood) Nailer used for first or second row, because the hardwood nailer won't fit. Nails are put on top of wood. Later, the mallet-powered hardwood nailer will put nails on the edge of the wood at an angle, so they are invisible.

### 3.5 The first row of Hardwood

The first row of hardwood will be too close to a wall to use the hardwood nailer, so you will use a pneumatic finish nailer, and put the nails into the top of the wood planks. Later you can use wood putty (or a putty pencil) to cover the holes. You wipe excess putty off with a damp rag.

In our case we went against this wall fairly closely.

### 3.6 Cutting Planks to Fit

The work goes fastest when you don't cut planks. Cutting them slows you down. If you can, use a plank from the hardwood box that fits the wall with an appropriate amount of space between it and the wall. If you have to make a cut, you can either cut a small end off a piece that is about the right size, or cut a larger piece, where there

will be at least 6-8 inches extra), and then start the next row with that larger piece. Because all the planks have interlocking grooves that fit together, you must be careful to cut the right side. If you cut the wrong side, that plank will not lock into the hardwood.

### 3.7 How to use a hardwood nailer

Watch a video online. You hit it with a rubber mallet. Hit it fairly hard. A reasonably hard hit. You don't need to go fast. Nails in the nailer, often run out, and you should listen as it will sound louder when its empty. If you can lift the plank off of the floor then it is NOT nailed down. Make sure you aren't nailing air, by watching when the nails go in periodically. This also applies to the pneumatic nail gun. We lost 5-10 minutes as we had run out of nails at one point.

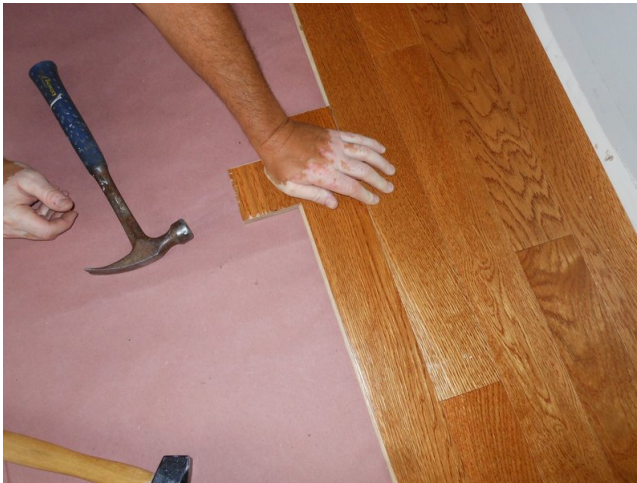


Figure 6: To get the wood to fit correctly, there are a few approaches. You can either use a hammer with a buffer in between to prevent scratches (this is another piece of flooring with corresponding grooves to fit the plank), you can use the rubber mallet to hit the boards in place, and you can use the hardwood nailer, which if hit hard, will slightly push the boards in as it nails. There are also dedicated products sold that help push the boards in. They amount to pieces of metal with a spot for a well aimed hammer to hit.

### 3.8 Miscellaneous Notes

In high traffic areas, avoid breaks between pieces of wood. More breaks mean more squeaks use a rubber mallet to arrange, and tighten pieces together

the first nails are finishing nails, (i.e. trim nails) put into the middle and top. You can use a normal drill, or an pneumatic one is easier. Afterwards you can use a minwax clay pencil (see picture) or some putty to cover up the holes.

After the first and second one you can use the hardwood gun and the hardwood nails, which actually nail into the side of the wood. This goes quick.

Cut trim with a multi tool. Use caution with tool. Leave a little space (not too much) so the wood can breathe and stretch sometimes nails can get stuck in the pneumatic gun. Adjust the nails as needed.

Sometimes you will get a warped one. You hit it in as much as you can on both sides, but one sticks out. What you do is start it on the near side, and then slowly hit it in as you work across. You can use a hammer and a piece of wood as you go across pushing it. Helps to have multiple people. The hardwood nailer will also help push it in, to a degree. If you have a piece with a curved edge, you can cut it off and use it at the end. However, if you cut off a piece, you lose the interlocks, which means you don't want to cut a lot off, as they all have to go at ends.



Figure 7: Cuts are made around hot water heater pipes. Beware of cracking the pipes when working around them. This particular heater pipe has a cover, so this cut did not necessarily need to be precise.

The living room in this house was about 220 sq feet. At 3 4 dollars per sq. foot for wood, it was around \$800. After about 5-6 hours of working (maybe slightly less) we had half the room done. It's a two day job for an average sized room, with maybe one other day of hour or two hours for final touches. Saws are used outdoors if possible. Makes a bit of dust.

Wood stain OM used was Old American (minwax). There was a custom piece of oak, made for the transition that was Old American.

The finish work is the hardest, but don't rush. We saved the final piece of wood against the wall for the last day as we needed to make a long rip cut, but did not have the tools. This leaves the final hour or two of hard work for another day and gives you a break.

### 3.9 Transitions from wood floor to next floor



Figure 8: This transition piece between rooms was custom made.

Here a piece of oak was stained and finished with polyurethane and Old American to make the transition. The picture here shows the result. There was an issue because the floor was not flat, but this can be resolved with either shims (small pieces of wood) or some liquid solution (i.e. liquid nails). The goal is for the transition from the wood floor to the Epoxy kitchen (in this picture) to be flat between the hardwood and the transition piece.

A belt sander could also fit the piece of wood, or some type of cement mud can be placed atop the plywood. In the end, the sander was what was used to fit it.



Figure 9: Some spacew was left on the east and west sides of the wall.



Figure 10: Progression of the wall is generally one line at a time.





Figure 11: When getting to the opposite wall, a hammer can be used to pry or push the wood towards itself. With a buffer piece of wood when possible. Here the pneumatic finishing gun is used, and not the hardwood nailer, as it can't fit. Without the hardwood nailer, it gets difficult to compress these particular planks, so some creative type of spreader was needed. Higher grade hardwood might be easier to use.





Figure 12: Pieces that weren't as good are put in the corners, and in the closet. Higher grade hardwood has less poor or off-colour pieces.

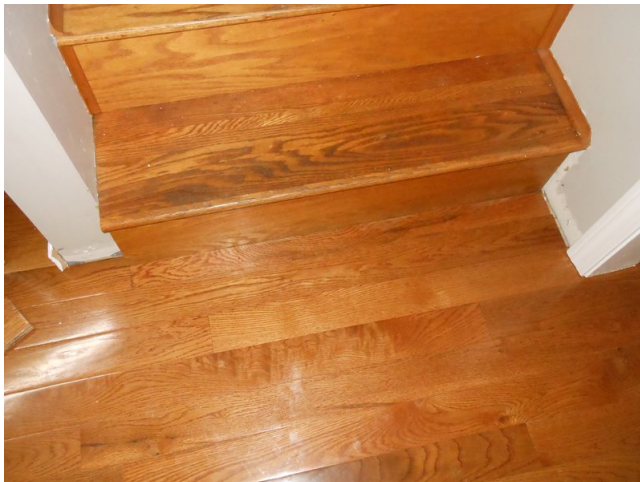


Figure 13: For the piece against the wall, the stairs were about 1/2-3/4" different in depth from one side to the other. First a cut with a jigsaw was made, then a belt sander was used to fine tune the fit. Small moulding (such as seen on the stairs) can be put at the 90 degree right angle to hide any slight imperfections.

## 4 Tools Used

Here are some of the tools that were used for this job.



Figure 14: Air compressor (oversized for this task)



Figure 15: Miter saw to make cross cuts on hardwood planks (table saw could also be used).



Figure 16: Various tools, jigsaw, clamp, belt sander, battery charger... It helps to have a workshop handy.



Figure 17: A pneumatic hardwood nailer, takes a specific type of nail.

#### 4.1 Type of flooring used

This wood was \$3.50 per sq foot, for 220 sq. feet, total of near 800 dollars total to do this moderately sized room.



Figure 18: Brand of Prefinished wood purchased.

## Story Book

*“Much Anger is divinest Sense “*

-Emily Wilkershire

*“School: Attendance is mandatory. Learning is optional.“*

*“Most successful people in life don't admit just how much of their success depended on sheer luck“*

-Targes Attenuator

# Snowboarding Is Inferior to Skiing

## 1 Skiing is better.

I have skied and I have snowboarded. Both for extended periods of time. During this time I have gained a deep understanding of both. Skiing is more practical than snowboarding, and I don't snowboard except for rare occasions.

When skiing, you face forward. In a position similar to walking, with poles to support you and both legs free to move independently. The boots are rigid, but easy to remove and attach to skis. When you enter a ski lift, you walk - or waddle - forward, and sit comfortably in the chair. The ski chair<sup>1</sup> is designed often with foot rests (though not always) and skis fit well, allowing for rest and respite. When you leave the chair - at the top of the lift - you go forward. When skiing downhill, you have two distinct edges to keep you balanced, and again - the poles offer support.

I'm now going to point out a few fundamental flaws of snowboarding that you might notice don't pertain to skiers. Snowboarding is less convenient. Pay attention.

## 2 Snowboarding is worse

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<sup>1</sup>It's not called a snowboard chair, it's a ski chair. This is not a matter of semantics. It was designed before snowboards were commonplace, and thus made for skis.

First, when you are on a snowboard, you are sideways. This is not as intuitive as facing forward. Humans do not walk sideways. There are no poles to balance you, and your feet are locked together - there is less freedom of movement. This is only the beginning.

When you enter a ski lift, you must be sideways. In order to walk in the line, you must unbuckle one boot. Snowboarders spend a lot of time removing and locking in their boots. This is awkward and tedious. Thus, you hop/walk to the ski lift chair. Now, as you are on the lift platform, the chair is approaching behind you, but you are on a board, so you are facing sideways. It's necessary to sit with your foot holding the board at an angle. Your foot is angled.

If you are next to another person, you may happen to hit their skis or board. You have to pay attention so that this doesn't happen. The foot rests for skiers are not convenient for boarders. You can put your board on them but your body is twisted, and it never quite feels comfortable.

We are not done. Now, you are at the top of the lift, it's time to depart. You slide down the lift <sup>2</sup> and now it's time to buckle your boots. Get used to this process, because as a snowboarder you have a curse whereby you will be buckling boots at the top and bottom of every ski lift.<sup>3</sup> Have fun with that. It's a subtle chore but if you snowboard for any large amount of time, you will be spending hours or days buckling boots if it were to be tallied up at the end of your life.

### 3 Sometimes Always do the Opposite of what Popular Culture Says

Snowboarding is considered cool. The reality of it is, that it's less practical and inferior to the 'uncool' skiing. The coolness factor is a warning. Many things that mainstream culture views as cool are truly detrimental or inferior. Driving fast, violence, drinking alcohol,

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<sup>2</sup>Arguably, this process is more difficult for boarders as well, as you are not able to buckle your boot before leaving the chair lift. Departing a lift takes some additional balance, which skiers don't need fret about.

<sup>3</sup>For eternity.



and snowboarding. Sometimes you should always do the opposite of what popular culture says. Skiing is easier and more enjoyable. The rebel culture of snowboarding attracts gullible youngsters who can't see themselves doing the outdated old guy skiing pasttime.

Is snowboarding a complete loss? I have yet to say anything positive about it. No, not completely. However, snowboarding culture needs to own up to its mistakes in promoting an inferior sport. Things like the X games, and skateboarding / snowboarding culture cross overs are bad. Snowboarding is worse. It should be viewed for what it is. Tell the children the truth.

Where is snowboarding superior to skiing? There is at least one example.

Snowboarding in sufficient powder is better than skiing in powder. I can attest from personal experience that a single board on powder offers a superior experience. It is like surfing on snow. That being said, powder is not common. It is especially niche.

At this point, others may advocate for half pipes or stunt parks as being superior on a 'board'. These are a young mans game, and dangerous for any mature individual. Gravity always wins. The dangers of permanent bodily harm from stunt parks and halfpipes are not worth the joys of testing gravity. Again, stunts and culture like the X games attract youngsters, who are nieve to the limits of human anatonmy. There are no old men taking up halfpipes and stunt parks. It is in the best interests of children to pursue a sport which they can do into their old age. Baseball, Soccer, Hockey can all be done at an old age. Halfpipes, big air, BMX, and pursuits where injuries are common can not. Blame the companies who profit off of these pasttimes, and blame people for being young and or stupid.

# On Eating Only Meat

Steak Electronics

## 1 Why I Eat Meat

I eat meat because humans have a carnivorous digestive system, and because I feel happy when I eat meat. I don't believe steer have souls. I don't believe most people have souls given how stupid humans as a 7 billion species are<sup>1</sup>. I refuse to believe I will be punished for eating meat. Humans are an apex predator at the top of the food chain. This is fact. Unrefutable logic. I don't believe that god would be vindictive enough to punish us for being what we are: that of meat eaters.

If god was to punish us for eating meat, when he put us here<sup>2</sup> with meat eating organs, well that would be a petty mind game and I don't think the universe is petty or vindictive.

Meat exists to be eaten. End of discussion. Perhaps in the next life, such vulgarities and questions won't exist, and we can focus on more important things.

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<sup>1</sup>You can give a lot of slack to people making mistakes, but humans are truly stupid animals if you look at the planet, and it doesn't make sense. How else can you explain a species that would destroy its own environment because they couldn't stop reproducing. All people have to do to not destroy themselves, is limit the population, and work together. But humans can't do this. It's as if planet earth is just a joke.

<sup>2</sup>Someone is going to say evolution over creationism. As much as evolution may be an explanation for everything, it remains that fact that some force is creating what we see at any given moment, and that is god, not evolution.

# On Where to Live and Genes

Steak Electronics

- Where you live determines how smart you will be.
- The smartest people in the world are in certain large metropolises', NYC, Tokyo, London, Germany...
- Genes influence how smart a person can be
- A person born in one of these cities, with genes closest to the most successful human ethnic groups will be the smartest, generally.
- There are exceptions.
- Habits and life choices can affect this for better or worse.
- Drugs in excess nullify benefits and reduce intelligence
- Improper diet can reduce intelligence, as can not enough exercise.
- Some amount of drugs is necessary to obtain full intelligence but not too much (ergo, "Doors" of perception).
- Street drugs are often counterfeit and harmful (adulterated with poisons).
- Live near a city, if you can.

# Misc

## Steak Electronics

- Things that make you feel happy and comforted can make you live longer.
- A man looking at a woman's naked breast is good for him.
- A woman looking at a laughing baby, is good for her.
- Pictures that make you happy, make you live longer.
- vice-versa.
- This may carry to imagery, thoughts, events in your life, etc...

# Jobs the World Needs

Steak Electronics

- Not lawyers, not doctors. Computers can do many of these jobs.
- We need a generation of people to fix the roads.

Paving layers, infrastructure techs, home repairers. Why aren't these trades promoted? Instead we have generations of programmers busy mining our private data. Sinners, the lot of them. We need a generation of child educators, better teachers, and no private or for-profit schools.<sup>1</sup>

## 1 Jobs We Need

- Highway builder
- Highway maintenance Engineer
- Birth Control Legislator
- Contraception Educator
- Teacher
- Free public Urinal Installer for Cities
- Home Repair Contractor
- Anything Infrastructure Improvement Related

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<sup>1</sup>Before someone says education can be saved, no it can't. It's far too late for that. Education is a whole 'nother topic for another essay. It's doomed. The whole system needs to be rebuilt. When grades are more important than actually learning, we have made a mistake.

## 2 Jobs We Don't Need

- Programmer of some VC bullshit gadget
- Engineer of a niche product that helps no one or solves a problem already solved, or one that makes something purely recreational with no practical use.
- Lawyer of anything business related
- Doctor that wants a doctor's paycheck
- Marketing
- MBAs
- Stock Market Short Sellers
- CEOs
- Pencil Pushers
- Desk Jockeys
- Busywork jobs that don't do anything

# On Guitar, Bass, and Drums

Steak Electronics

Guitar, bass, and drums are bad for music. This is the classic 'rock' formula. It is flawed.

The bass is a limited instrument, in what it can do. The best bassists (Victor Wooten, Les Claypool) resort to gimmicky not-even-music tricks of whacking on the instrument<sup>1</sup>. While it is a "cool" instrument, it is limited. The bassist should not be. Musicians, if their goal is to make music (and not perform) would be better off as a 2nd guitarist, or synthesizer / keyboard / piano player instead of bass.

Here we have a divide between "music" and what is "popular music". Music is sounds. Limiting yourself to an instrument that can only do low frequency tones is foolish. A guitar can do many of those tones, and also others. Same with the piano. Yet, "popular music" dictates that it must be the three instruments.

Drums, while the most fun instrument, are not music. You can have music without any drums. However drums alone are not music: It is rhythm. Drums are an inferior music education path. Most drummers can be replaced by a drum machine<sup>2</sup>, or omitted entirely<sup>3</sup>, and it may not even affect the music quality at all. A good drummer may enhance a band, but it is still just rhythm. It is not melodies, it is not layers of sound. Ringo was great, but he was #4. This is not debateable.

Guitar is bad as it promotes rockstar ego fantasies, and is not an intuitive instrument. Destroy the guitar. Destroy rock stars.

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<sup>1</sup>In an effort to do something, anything different with the bass

<sup>2</sup>Phil Collins

<sup>3</sup>Most Classical, excluding orchestras

Some of my favorite musicians create everything from synthesizers, sequencers, and other computers, through probably a keyboard. The guitar is a glorified lute. Something a court minstrel or jester might play. People that play guitar (mostly live performances) so they can exhibit their rock star fantasy are bad for music.

I can't understand why people like live music. Most of it is standing around, watching someone else have a good time on stage. Why would you pay to watch someone else have fun? Sure, I would pay to see Jimi Hendrix live, but I wouldn't pay to see 99% of other bands. Live music is loud, chaotic, and noisy. Pure music has no connection to a live performance. A live performance is simply not able to transmit sounds over such a large area, with people talking, and keep the same quality of sound. It makes no sense to me. Yet concerts remain popular.<sup>4</sup>

A better band than Drums, Bass, and Guitar might be something like this: Guitar, Piano, Flute, or Guitar, Piano, Violin. Let's get creative: Accordion, Harpsichord, Viola, etc, etc... These instruments can cover the aural range better, and omit the unnecessary rhythm section. If you have four people, then sure, add a drummer.

These are all superior to drums, bass, and guitar. Why? Because the focus is on the sound, the melody. Music is about layers of sound, and about composition. Let me repeat that last word because it's vital - composition. How you combine and arrange pieces of music together to create a whole picture of sound. But beware of sound fx. Fancy synths don't make music good, you still need the underlying melodies.

The piano was and is the best instrument for composition because it is simple and intuitive to understand. There are no tricks or monkey wrenches, like the fifth string on a guitar which is tuned slightly off. All the notes are laid out, and you can visualize scales and chords clearly. No turning of the head.

All instruments have a place, and the guitar can do things that the piano can't, but I consider that popular music has failed the children, as it promotes the guitar (over the piano), yet the guitar

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<sup>4</sup>This topic is for another essay. Let me get back to the original subject...



is inferior to the piano for music creation. The guitar is 'cool' and that is a red flag. Sometimes always do the opposite of what popular culture says.

Benefits of the guitar, are that it can travel, and can be strummed. Benefits of the piano, are that any instrument can be output from a synth into a computer using a keyboard. The piano can also play more notes at once, and chords/scales are easier to visualize. It may not have the 'cool' factor, but it is nonetheless the superior instrument.

The current image of the guitarist should be abolished<sup>5</sup>. Musicians should remain largely anonymous, to keep the focus on music, and not personalities. The current industry is a sad and crippled picture of what music should be.

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<sup>5</sup>Axe players. A guitar is not an axe, but it sounds cool to say that. Smoke and mirrors perpetuated by popular music. Even the idea of a guitar solo is pure fantasy dreamed up by the industry. It's nonsense. A solo is one thing, but guitarists have taken it to ridiculous extremes. Let's not idolize the man over the music.

# Casino

Went to a casino in the woods, today. There are a few in the Northeast now. They've become legal. When I was a child, they were illegal. A big building with very few windows. Inside, smoking is allowed and ashes pile on the carpeting. Smelly rugs everywhere. Dark rooms that hurt your eyes. The cameras must be IR so they damage your eyes as well (if they are). The food is garbage. Fast food, mostly. The floor is primarily slot machines<sup>1</sup>. The clientele is older. Sad to see people unable to contribute anything of value to humanity. They sit in front of predatory TV screens (You don't even get mechanical slots anymore - as mechanical parts cost more).

Races mix peacefully, but the place is sick. Not much good comes of this building. It's a special type of hell I hope to avoid. What if these people were all in a large hackerspace, building things, helping to create something of value, instead of chasing a dream of greed, or selfish monetary fortune? It's in the same realm as the lottery. People are looking for an easy way out. There is no easy way out.

The whole operation, employees, clientele, owners... It's all insane. A detriment to society. This must've been why they were illegal in the old days. Small casino games may be OK in moderation but this casino is an institution of greed. It's beyond acceptable. They've gone too far. The smoke fills the air, old woman stare at slot tv screens and time marches on.

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<sup>1</sup>This is a misnomer, they are actually big tablets, with wands that are switches. They are not slot machines anymore. What differs is the outside appearance, and the different video that appears on screen. Core functionality is mostly the same from one machine to the next. No variety. At least with pachinko you get to watch a bunch of bells and whistles flip.

It would be a disappointing reality for your life's work to be one of the many varied slot machines.

# Paint

You always want a white or close to white colour. Dark colours take more coats to cover and cost more to change. From white you can go anywhere, easily. Get a quality name brand paint. Don't cheap out. Contractors get paint cheaper than homeowners. Buy contractor only paints (e.g. sherwin, or benjamin). You will need to find a paint store that doesn't markup to walk ins. Or know someone (a business that has an account, or a store that gives you the regular price). Yes, this is a mafia system. It's sick.

Never try to paint a large room you are sleeping in. Sleep somewhere else. A little area in the room you might be able to get away with if the window is open, but a large area - the silica in the paint will irritate your eyes and nose. It takes about two days for a large residential room to cure.

White shows any bugs on the wall, and white rooms are brighter, meaning visibility increases. From white, you can go anywhere. If you have multiple whites, its likely they will mix. Practicality wins over looks. Function over form.

Make everything white.

# Cleaning

To truly understand cleaning, work as a janitor, or take a job where nightly cleaning is required, e.g. a fast food shop.<sup>1</sup> You can clean with as simple as a 5 gallon pail from the hardware store and a cotton rag. Make rags from old clothing or bedding, towels, etc... cut or rip them up. Hot (it must be hot, warm will not do) water and soap or ammonia or bleach (depending on the floor) in the bucket and wipe the floor. You should vacuum or sweep with a broom first. A mop is an alt. to the rags. Hot water is required<sup>2</sup>.

It's important to keep as little furniture as possible in your way. First, the more things you have to move, the more difficult it is. Second, everything and anything not in a closed space (bureau, closet, cabinet) collects dust and must be cleaned. The ideal room is extremely simple, and spartan. Very little furniture, not much if anything on the walls, and very easy and quick to clean. Nothing is left out, tables are bare, and dust does not collect.<sup>3</sup>

Pressurized air can be used to dust. Either from an air compressor, or cans of compressed air. A clean living area influences your lungs, which connect to your bloodstream, so hard floors (wood, tiles) are the best. Rugs and carpets are functionally sponges for dust, and are a sin. Cleaning rooms frequency depends on how active you are

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<sup>1</sup>Reference: Rose of Paracelsus, Pickard, William. He mentions how the buddhist monastery in SF found cleaning toilets to be a humbling experience. One needs only to work in retail food establishments. There is merit to cleaning a toilet. It is not that bad, and cleanliness is godliness.

<sup>2</sup>Just as in washing dishes

<sup>3</sup>This carries over to the robotic vacuums, such as the Roomba, which requires a flat, and navigatable floor plan. Put a rug down, and the robot can't travel as well.

in the room, but for a living area, every 3 to 4 weeks is good. Open the window when you clean for fresh air.

# Alcoholism

Be wary of hard liquor. Alcoholics get the adreneline or euphoria body rush from high concentrate (aka hard liquor) alcohol easier. Beer only or wine only drinkers don't get the same rush and alcoholism is less prevalent. So, if you are going to drink, which you should not, try to avoid hard liquor. The brain is more easily addicted to strong liquor than it is to beer or wine. The human body chemically responds to hard liquor in a more quick, addictive, pleasure seeking fashion. Beer and wine are diluted and require more processing to get the same "feeling".<sup>1</sup>

Do not think you are immune to becoming an alcoholic. It can potentially happen to anyone. Especially with alcohols. Everything in life is this way. Don't think you are immune to becoming a killer, a rapist, or a madman. Everything is a step away, the good and the bad. Be careful.

With alcohol, the negatives outweigh the positives, in my opinion. Abstinence is best. I've seen the damage alcohol can do. Not all normal people have, though. They drink and some even take pride in it. This pride or arrogance could be viewed as ignorance (lack of understanding) of the downsides. It's not worth it. Alcohol is one of the scourges in Pickard's Paracelsus (see Bibliography). Alcohol, Cocaine, Methamphetamine, Heroin... These are some of the drugs that are the most destructive to man. To our communities and neighborhoods. There's a reason AA<sup>2</sup> exists.

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<sup>1</sup>This is why they tell you to hide (vanilla) extracts from alcoholics. Because it is a strong liquor, and if they are desperate, they will drink it.

<sup>2</sup>And MADD. Many a teenager loses his life driving while intoxicated. I've seen it happen multiple times in the towns I've lived in..

Alcohol means hangovers, and nutritional damage (stunted growth for youngsters, lack of healing for adults), relationship problems, brain damage, and others. Some people, however are able to process alcohol better than others. It depends on body chemistry. I have been blessed or cursed with weekend alcohol abuse at a young age which means I find it very difficult to drink daily. I get sick from alcohol easily. Others didn't drink until adulthood, and can drink each day without headaches, and stomach pain. This might not be a good thing.

Tools, not toys. Sometimes always do the opposite of what popular culture says. Don't drink alcohol.



# Stock Market

The stock market is primarily used for people to make money - in that it is solely a tool for human greed. Whenever you see news for this or that company in your feed<sup>1</sup>. (In 2018, the big companies that most often show up in tech feeds are of course: Amazon, Apple, Google, and Microsoft) you need to consider a few, maybe three, things. First, what is the angle of the article - the tone. Is it pro, neutral, or negative - i.e. is there a bias or slant to the article. What is the article trying to convey to you? Most articles are subtle marketing in a pro slant. This new gadget or that new technology that you should buy. Essentially, pro-consumer bullshit. These articles boost stock.

Aspect #2 you must consider is, does a vested interest in this company exist for the author. I.e., if you read this article, then go and buy something from this ACME company, will the stock price increase. Anyone that holds stock in a company has a natural inclination to promote the company, so that their investment increases in value.

Now, to my understanding the stock market is all monopoly money - a type of pyramid scheme - and none of it is real. It's based on what people (whom are not trustworthy or intelligent in mobs) think something is worth. Right now, in 2018, the Tesla company stock is around \$1100 per share. They make a modest number of cars currently. On the other hand, GM, arguably the biggest American auto maker is worth \$40 per share. The stock price is relative to people's whims. It's not directly correlated to annual profits or anything concrete. It's all made up. It's bullshit.

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<sup>1</sup>Use RSS

I mentioned something called a vested interest. Let's go back to that. All stocks have a market cap, which from my limited understanding is how much people have invested in the stock. It's public. This makes the situation dangerous and warped. If person A invests 1 billion in ACME company, you can imagine he will be upset if ACME fails. They might even turn to crime. They may attack competing companies or if he is in such a position of power, use any tools available to him to A) make sure his company doesn't fail, and B) get the stock price to increase.

Now, I said there is greed in the stock market. If you want to find the corruption, follow the money (old saying). This reveals the fundamental flawed nature of stocks. It is an entity that produces, by itself, no value to society. While the money invested in companies does go to companies where they can re-invest it<sup>2</sup>, this I think is overshadowed by people's greedy nature and ability to abuse it for personal gain. There is a whole industry created around shuffling stocks back and forth, like gambling at a casino. I would also put it on the same moral level. Day traders, short sellers, wall street. None of this adds any concrete value to society. It is a pest industry on a level with big business corporate copyright and patent lawyers. And the vested interest of some makes it where some companies simply can't fail.

If someone invests enough, they will fight tooth and nail to stay afloat. This can and certainly does include real violence and crime. On a moral level, the only right choice with the stock market is to not contribute. Instead, go and build something of real value. Every minute you spend in life, thinking about stocks, investing energy to a system of monopoly money with your intention being to "make money" is time that you could spend doing something more constructive for planet earth.

Check your intentions. Want to make money? The answer to how to make money is: "Work Hard". There is no cheating, no short cut. Life does not play dice with the universe<sup>3</sup>.

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<sup>2</sup>Back into development, or whatever they want. Perhaps it is only paying stock holders

<sup>3</sup>Quoted more or less from Einstein, whom I have yet to read any books from.

# Meat Grinder

A meat grinder is for more advanced meat enthusiasts. Here's a question: What cut of meat makes up a hamburger? It's a trick question because the term 'hamburger' doesn't mean anything. It could be any meat. It could be round, it could be ribeye, it could be chuck. A great bamboozling of society is that no one seems to wonder, "what cut of meat is a hamburger, really?"

For the most part, you go to the meat department and grab 1 or 2lbs of hamburger, and that's it. For the average person that's enough. But of course, all cuts of meat taste different. Therefore all hamburgers will taste different depending on the cut of meat. You would think this is important enough to merit being on the label.

This takes the humble "hamburger" to a new level of complexity. I see an opportunity for a burger place to differentiate themselves, by proclaiming out in the open what 'burger' they sell. Give me options. Give me the round, the chuck, the ribeye, the shoulder <sup>1</sup>. Let me try multiple varieties. It is an incentive for people to return multiple times...

Regardless, You can make hamburg yourself with a meat grinder. It's a messy job, and may or may not be worth the time to clean it afterwards, but it is the only way to understand ground meat at a deeper level.

And when it comes to burgers, you can use a frying pan for 1 or 2 burgers<sup>2</sup>, but not any more than that. An outside gas grill is almost required. Otherwise not enough grease is removed.

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<sup>1</sup>No cold shoulder puns please. No time for that.

<sup>2</sup>Preferably the leaner meats

# Art Can't Be Perfect

All art is relative. A moving target. There is no such thing as a finished product, (I mean) it is never perfect. Instead, in heaven there remains only variations. Themes and truths are repeated but the result differs. Take a piece of classical music, or a painting by a classical artist. There is not a rule that says this song is complete, or that painting is perfect. That means there is an allowance for the art to be changed, for better or worse, or neither.

Add an additional accompaniment here, or change that riff slightly there. All art is relative. A finished product is an illusion, a fantasy that does not equate with the storm of life. Using the classical painting as an example, you could change subtle aspects of the Mona Lisa or Starry Night, and the art would remain valid. Variations, are important. Art is not a fixed thing - music and drawings, being the two described herein, but not limited to.<sup>1</sup>

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<sup>1</sup>This is one reason why copyrights for music are a sin. Things MUST be remixed, and must be ALLOWED to be remixed.

## Misc Part Two

The news keeps telling me a new large hadron collider, or crypto currency, or self driving car, or usb 3 type c is the solution that's going to improve our lives. I have yet to see it.

The world is a mess. Look at audio equipment: Why does audio equipment use 9V negative polarity DC adapters? Of course someone is going to plugin a 9V positive DC brick into their device (or worse - 9V AC), and fry it<sup>1</sup>. This is madness.<sup>23</sup> Understanding DC jack polarity is one thing they are supposed to teach kids in school. Humans can't get this right. Fail.

Why are traffic lights so archaic and slow. 15 seconds wasted here, 15 seconds wasted there... Humans can't even get traffic lights right, yet they think cars will be able to drive themselves... This talk only exists when it serves corporate interests.

What will happen if self driving cars, or trucks becomes a reality will be no doubt, a disaster. Not only are people keeping the algorithms behind closed doors, some think robots and sensors have progressed enough to be reliable. I find this doubtful. Life is not predictable, roads undergo road work, there is weather... So many variables. Something will go wrong, it's only a matter of time. Self driving cars, I put in the same seat as interstellar space travel. It's a pipe dream. Not practical.

USB type C is a monster, and is farther than a universal cable than USB has ever been<sup>4</sup>. It is insane. None of these things are going

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<sup>1</sup>DC 12V Positive adapters are the most common adapter, but nearly 90% of them are positive. The rest are AC and negative.

<sup>2</sup>And so is changing subjects abruptly.

<sup>3</sup>See this shit? Stop it. - (common meme).

<sup>4</sup>What USB Type C does do, is fragment support for existing devices. It's

to progress huamnity, they are only being talked about because it serves companies. Humankind is doomed.

The population problem is humanity's biggest issue, and yet progress is nowhere to be seen. Although a lot more apartments are showing up: Someone is making bank. Why aren't we talking about this?

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only needed for cellphones (with frequent disconnections) but it's being pushed everywhere. I don't need USB C on a keyboard I unplug every few months from my laptop. A solution in search of a problem.

# Satire

“Local man sees nothing wrong with wanting to be rich on youtube.”

Strong Clarkson, a retired marketing engineer for kids hanging crib toys today discovered that he feels no guilt in wanting to make money from youtube.

“The fact that one website, which is a central authority with the power to censor material at will, and tapped into by the national government where users every action is recorded, doesn’t bother me.” He continued by explaining how money justifies his work,

“Basically, I want money. I don’t even mind if youtube takes a cut before paying me. My videos cover important subjects, and the top videos of youtube reflect this.”

A swedish video author named toocutetodie also weighed in,

“What we are doing is important work! My video game walk-throughs are some of the best. People and kids need to know how to beat these games. As a human race, we have the obligation to only promote healthy and productive pasttimes. Such as that of video games, and most importantly, watching video games played by directors like myself so that I can afford a BMW before my 19th birthday.”

“Look, it’s just like bitcoin. We are reaping what we sow. When bitcoin exploded, a lot of people made money doing absolutely nothing except being greedy, and that was great! All that greed really paid off. youtube is along those same lines. I deserve to make a living playing video games, and I’m funny and charismatic. I see nothing wrong with that.”

Meanwhile, a spokesperson for the US government security branch espoused on the virtues of youtube,

“You wouldn’t believe how much information we have on people thanks to centralized sites like youtube and the other big media sites. There’s so much personal shit here from people of all countries, we don’t even know what to do with it. We’ve even got the engineers trying to make speakers that respond to voice commands so that we can finally crack the speech recognition problem that’s been plaguing software developers since the 80’s and 90’s. We figure brute force will do it - we hire lots of interns to listen to the speakers live and transcode what people say into the software. Maybe it will work - we don’t really know. We got a lot of voice data, you know? We need automated speech recognition. There’s too much voice data for interns to do, with everyone having cell phones these days.”

A spokesperson from heaven remarked on the apparent lack of moral dignity in humankind,

“They’ve completely fucked up the whole scene, but I suppose we didn’t want life to be that serious anyways. Let them be greedy. In another 100-150 years the economy will collapse under its own overpopulation and nature will take its course in erasing human kind through 40 years of rain and high temperatures.”



# A Lost Opportunity for Wachusett

Wachusett Mountain is a ski area in north central Massachusetts. It is the 2nd closest ski mountain to Boston<sup>1</sup>. It is a good mountain. The skiing is good in the winter, and the hiking in the summer, fall, and spring is pleasant<sup>2</sup>.

In the 1990's, there was talk that new trails would be made. As a kid in the 90's we were excited about the proposal, but it remained in the future, TBA. Apparently there was some political pushback as the trails did not appear, and we eventually gave up hope they would make them. In the early 2000's, an environmentalist<sup>3</sup> climbed up a tree to protest the cutting down that would be done for the trail. There was pushback.<sup>4</sup>

The trails were eventually modified, i.e. neutered, to the point that they serve no purpose. A display of how people botched the utilization of the mountain as a winter skiing and tourist destination - as a source of revenue and enjoyment. Did the environmentalists folk win? No. Because overpopulation is the problem, not how many trees we have on a hill. We are still doomed, the economy and world is continuously on a non sustainable path, and these trees someone is worried about cutting down have zero impact on the reality that is going to fall apart when the ice caps melt, extreme weather becomes common place, and the power grid goes out (because of overpopula-

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<sup>1</sup>The first being Nashoba Valley, however Nashoba is half the size of Wachusett - 500 vertical feet. Wachusett is also small, at 1000 vertical feet.

<sup>2</sup>Although the mosquitos can be ferocious in the summer, if you are in the woods. Stay on the roads unless you are a good runner.

<sup>3</sup>Or a political plant - you can never tell

<sup>4</sup>The environmentalist stayed until winter was close by, then disappeared one day.

tion).

Someone fixated on the environment, which in this case were a few 50-yard wide trails down a mountain that would be razed for recreation while completely missing how there will be no humans around able to utilize these woods in another 100-200 years. They missed the point.<sup>5</sup>

The value in wachusett is when people enjoy it. Our time as humans is limited due to forces beyond our control. Not simply death, but the animal nature of humans which anyone can see will only lead to ruin on planet Earth. Let us enjoy the mountain while we can.

The trails that “could be” wouldn’t even make much of a dent if you look around wachusett. Stand at the top of the mountain, and there are trees as far as the eye can see. We don’t need to save trees an hour outside of Boston, in central MA. If you want to save trees, save some in NYC. There is a place that has a lack of green. I’ve traveled to all 5 major parks and was disappointed.<sup>6</sup> Central park is tiny. NYC is beautiful, but green, it is not.

Someone will argue that these trees on the elevation of Wachusett are unique, being higher in elevation, therefore have value. They currently have labeled this the “Old Growth Forest” on the ski maps<sup>7</sup> I say bullocks. The value in that mountain, as a place of recreation, far exceeds any value of old trees. The economy needs the money, as well. There are truly beautiful experiences to be had skiing down that mountain, but we are not utilizing it to its full potential. Shame.

Life is short. Humans *are* going to self destruct themselves, so we should maximize what we can.

What should’ve been done: Build trails on the backside of the mountain. Trails aren’t going to make the whole mountain bare.

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<sup>5</sup>No puns about forest for trees here...

<sup>6</sup>Cemetaries, are also another vapid waste of land. Respect for the dead is ok, but wasting land is not. Logic wins over emotion, here. I will elaborate in a later article.

<sup>7</sup>Whatever the hell “Old Growth Forest” means. It doesn’t mean anything. Lots of forests are old. So what. I guess the word “old” and “growth” carries a loaded meaning which implies valuable. Loaded language. Bull. A forest isn’t going to be of much value when the grid goes out.

There is still a lot of forest on that hill. It's big. Additionally, there should be a long winding trail. The one thing they lack on this mountain is a long slow trail. The mountain, is one of the few valid tourist attractions in North Central Mass, and they messed it up. Make it better, and get more people on the hill.

# Power Corrupts

“Power Corrupts, and absolute power corrupts absolutely.”

Lawyers hate CEOs because CEOs expect to be paid doing nothing.

Doctors hate lawyers because Lawyers expect to be paid doing bullshit.

Engineers hate Doctors, Lawyers, and CEOs because they don't help produce exportable goods for the economy.

Technicians hate Engineers because they get to do fun stuff while technicians get rote work.

CEOs don't hate anyone, they are just extremely greedy.

# Working For Google

If you work for google, you work for the US gov't. Google's success is directly related to its close ties to the NSA program. Youtube and gmail, along with the search are strategic US assets<sup>1</sup>. Especially if they have full access to traffic in and out.

It doesn't matter if you are a google engineer, someone who puts adwords on their site, or a youtube vlogger. All these are jobs, that directly or indirectly work for the gov't. If that is ok with you, then fine - let it be. But it's been said. I don't like the idea of big gov't, and categorically avoid google whenever possible. I know there are good folk at this company but the success of the company is not authentic.<sup>2</sup>

What do I mean by authentic? Many functions on the web are better suited by P2P. File sharing, video sharing, music sharing.<sup>3</sup> The distributed platforms where a person shares to a person have been undermined by corporations. Through unlawful means, business entities are perverting the internetwork of computers to all connect to a few centralized monopolies. Power to the corporation. Power to the government. That is working for google. Google is successful, because the gov't allows it, not because it is the best option, or because google engineers are the smartest. They may be

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<sup>1</sup>This is why the east tends to host their own web search and video, e.g. Baidu, and Nico Nico Douga. They are well aware of this fact.

<sup>2</sup>You can't run your own email server because spam is a problem - better use gmail. You can't host your own videos because no one will find them - better use youtube. This kills the internet.

<sup>3</sup>Napster was always better than spotify. Even a Napster that is only comprised of creative commons or public domain music would be better than spotify. It doesn't exist, because it's suppressed.

smart, but there are lots of smart people in the world, just that not all the smart ideas are allowed to be.

All that being said, I consider google the least evil of the big tech companies. That doesn't mean I excuse their behavior, but I find myself more worried about the others. Chaotic evil would be ms. Neutral evil would be Apple and Amazon. A lawful evil is the alphabet. None of it is good.

# Dog Face Leashes

Occasionally, you will see someone walking a dog with a face leash. I'm not sure why they are called. Online I see the term head halter. It's a leash that, in order to prevent pulling, puts the leash over the dog's jaw and front face. It's a face leash.

I consider them inhumane.

I also consider shock collars inhumane.

Dogs are stupid. They might not get it. It's not the dog's fault he wants to run, it's the owners. Do not bring a dog into an environment unsuitable for him. Dogs need space to run, and constant companionship. If they are so excited to go outside that they pull on the leash, it's because they don't get out enough. Don't punish the dog with a cruel leash. Choke (Metal chain) collars are also unwise.

Dogs are a big investment, and not to be taken lightly. They live better in the country than in the city. A city life will never be as fun as one able to run outside off leash, and bark whenever he wants <sup>1</sup> They also need easy bathroom access.

A similar truth applies to cats. You should never own a cat if you don't have a place for the cat to spend time outdoors on his own, free to roam. An apartment cat, is a sad thing. They like to hunt, they like to explore. They should be outdoors from a young age<sup>2</sup>.

Shock collars are sick inventions. They use electrical shock (torture, essentially) to impose rules on the dogs. I don't like them. If you need evidence that shocking a dog is a bad idea, try it on yourself, or watch the many videos of alcohol infused (male) adults

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<sup>1</sup>Vonnegut mentions this. Let the dog bark, let him run, let him be a dog, and do dog things.

<sup>2</sup>Be careful introducing homebound cats to the outdoors. Some training is necessary so they are street smart.

putting it on themselves for a laugh. Electricity and animal biology is serious business. Do not mix animals (or people) with electricity. It's bad for them.



# Sports is Wrestling

Sports is wrestling, in that it's all staged. There is too much money on the line for sports to be anything but staged.<sup>1</sup> Therefore anyone who watches sports naive to this thought is a fool. For the record, I don't and have never enjoyed professional sports, however I do enjoy small local games among adults. Something about being closer to the action, and the small crowd makes it enjoyable. Professional sports, on the other hand, has the scent of beer, mainstream appeal, and corruption.

Sometimes always do the opposite of what popular culture says.

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<sup>1</sup>It might not have always been this way, but it must be now.

# Water

Water is the drink of what I consider “The Steak Way”. I love tea, but caffeine disrupts sleep, and tea damages my teeth. Coffee is the same. Alcohol is out of the question, for its subtle destructive capabilities. Empty calories and hangovers are not welcome. Diet sodas increase the preference for sugar, and are also out of the question. Seltzers bother my teeth. What is left? Water is.

But, “How Boring” you might think. Not so. Water can be more exciting than any of the above. I propose the establishment of a water bar. Instead of alcohol or coffee, the steak way is to promote water. It would be refreshing to drink the water of far off lands in a glass bottle (not plastic).

Water can be chilled, it can be given warmth. All ages are welcome at the water bar. Taps of exotic waters can be served to patrons. There is very little downside to slight indulgence of water. It is tolerated better than wine, liquor, or coffee with less side effects. Water is the most precious resource on earth to humans<sup>1</sup>. Water should be promoted, not coffee, not booze. Water has the potential to elevate society. The others are addictive and destructive. Water wins.

Some<sup>2</sup> have mentioned being suspicious of those who promote drinking 8 cups of water a day. I have seen both sides. I have been over hydrated and I have gone 1-2 days without a drink. Dying of thirst is not pleasant. I side with the water drinkers. I will not limit my body’s need to drink water. I will drink until I am satisfied, then I will stop. I will not overindulge, nor underindulge. I will not limit myself nor will I force 8 cups. I will have what water I desire.

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<sup>1</sup>Vonnegut

<sup>2</sup>Black,Lewis

# Free Stuff on the Internet

When you give away free stuff on the internet, do not do first come first serve, and then offer it to multiple people. This is rude. 5 people may travel to your location, spend 10-30 minutes driving there (and back) only for 4/5 of them to be out of luck. It is extremely rude for you to think those people should spend 20-60 minutes of their day just for a chance to receive whatever junk you are giving away.

This is a douche move - don't do it. If you want to leave it on the street, then leave it on the street. But don't tell the world, and then laugh as the sheep try to pick it up. You don't have to give it away to the first person that responds either. You don't want to support the people that spend too much time watching the free lists. Pick a suitable response, and let them have it without making it a game.

Simple courtesy. Time is valuable.

# Jails, Abolish Them

All jails need to be abolished. They hurt the inmates. They hurt our economy, and they have no benefit to society. Instead, we need re-education camps. Criminals go to a place where they learn a trade, or two, and work. Long term inmates can get paid for their work and have adequate comfortable living facilities, as long as they work to the best of their ability. Socialism: from each according to his ability, to each according to his needs. Even if people don't officially follow socialism, it should be followed in spirit.

All drug and non violent offenders are in extremely lenient facilities. They are given internet, allowed their own room and toilet, and must learn a trade or two or three, to help re-integrate them back into society. For profit jails are sick and twisted institutions where profit lies in more prisoners. This isn't logical <sup>1</sup>. Such a business should not be allowed. The prisons must either pay for themselves via the inmates working, or be financed by tax money, or both. Inmates that demonstrate better work ability can be rewarded with better facilities, and rights. But they must be non profit jails. Any profit incentive in a jail allows greed and corruption in, and it will come in... It always does.<sup>2</sup>

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<sup>1</sup>Ironically, there is a video game (multiple it appears, even) about growing a prison. [https://en.wikipedia.org/wiki/Prison\\_Architect](https://en.wikipedia.org/wiki/Prison_Architect) I wonder if the developers of that game ever think what it must like to actually be an inmate? Are they so cushioned from the reality of being caged in, that they can make a mockery of it? It is not funny.

<sup>2</sup>Privitization is a topic for another essay. It is generally corrupted by greed motives. Schools are the latest target. In Massachusetts, we lost the Railway system to private enterprise. Whose? Not the peoples. The highest bidders. So much for the commonwealth.

A note about scandinavian prisons is in order here. In Norway's Haldem - a maximum security prison - each inmate has access to "a fully-equipped kitchen, and a metal and woodworking shop." That's it. They are training the inmates useful life skills. At least, someone got it right. Norway has some of the lowest return rates of prisoners in the world. <sup>3</sup>

Every week I drive by two prisons on the main highway. I think of what life is like in a prison. What it means to be incarcerated, is to be in a dark, crippling light, where you can't exercise your freedom of movement. It's hell. Why would we want to create this on planet earth? It's mean. Someone will say "Well, they shouldn't have done something to get in prison in the first place!" It isn't that simple. Innocent people get into jail. Drug offenders, who hurt only themselves end up there, homeless people, sellers of black market drugs who are trying to supply a demand for substances that have been forced onto the street<sup>4</sup>... The original crime, does not deserve another. Two wrongs don't make a right. Educate - not punish - inmates. It's for the common good.

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<sup>3</sup><https://www.encartele.net/2018/04/what-can-us-correctional-facilities-learn-from-scandinavian-jails/>

<sup>4</sup>This is worthy of another article, but the black market of drugs is another game where all the players lose. The lawmakers create a rule that shoots them selves (by hurting the neighborhood) in the foot. Society loses a working man. And the common man suffers with poisoned substances or jailtime.

# The Solution to Most of the World's Problems

“Lower the Population”

- Global warming slows
- Traffic decreases
- Real estate rates drop

Eventually human kind will either do it on purpose, or global warming will make earth unhabitable / grid will go out, and it will happen by accident.<sup>1</sup>

The new game is sustainability. Technology got us through the 1950's, but technology isn't the answer to our problems anymore. We are not going to “Science the shit out of this” to quote Matt Damon from the movie the Martian.<sup>2</sup> Technology<sup>3</sup> isn't going to help us when the grocery store has no food and the power is out. Lower the population. Focus on making human life on Earth sustainable. Forget about technology being the saving grace. It's a pasttime<sup>4</sup> that is past its prime.

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<sup>1</sup>Asimov, Issac. *Frontiers* - Oddly enough, most of what I've read of Asimov is foolishly optimistic about technology getting us to space and beyond, but he also realized that the population had to stop growing.

<sup>2</sup>I haven't seen it, but it fits here. I generally don't watch movies. There are better things to do with time, and hollywood is rife with corruption.

<sup>3</sup>Postman, Neil. *Technopoly*. (1992)

<sup>4</sup>I would argue that the dream of science and technology explaining & doing everything is an illusion of mankind. People need something to believe. It's a past time paradise. It's folly. I am just as guilty.

# What I Should've Learned in School

School is broken. It can't be fixed. Instead of the liberal arts, I should've studied the liberal trades. I'm referring mostly to high school. Abolish English, Math, Social Studies<sup>1</sup>. and even science. Replace them with Reading Class, Applied Science, and Trades. The trades would consist of various real world jobs such as the home trades (carpentry, plumbing, electrical, etc), the computer trades

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<sup>1</sup>The term "social studies" means absolutely nothing. It would be more aptly named "Rote Studies". Here's what wikipedia has to say, in its embaressingly short page on the term: "In the United States education system, social studies is the integrated study of multiple fields of social science and the humanities, including history, geography, and political science. The term was first coined by American educators around the turn of the twentieth century as a catch-all for these subjects, as well as others which did not fit into the traditional models of lower education in the United States, such as philosophy and psychology.[1]"

First of all, That's bullshit. They made up a word. There's no social studies. Social means people, or friendships, or relationships with people. If anything, social studies would be a branch of anthropology. But look at the definition above... It mentions political science, geography, and history. Oh boy, political science. There's an oxymoron. There's no science in politics. How about political theory. Or political architecture. Science is a loaded word, that sounds better, but there is no science in politics. It's all kickbacks and favoritism. The three systems of US government don't keep anything in check.

Then you have geography and history. If you want to study geography, you study geography. There is nothing social about geography. The same applies to history. The term social studies is a made up word, and Its Bullshit. IT'S BULLSHIT, OK! /end lewis black rant.

You know what social studies really means? Shitty class. That's what it means. No child goes to school, and then gets excited when they see "Social Studies" on their schedule. Because it's a made-up word! At least chemistry is a science. Social studies is whatever the teacher decides to teach on a whim. It's aimless. Too broad. If you don't know where you are going, any road will take you there (Harrison, George - Brainwashed).

(IT, creating instructions for machines<sup>2</sup>, usage of certain programs). Keep physical education. Keep music and art. Combine these last two into one. Make it optional. If kids don't want art, then let them skip it.

Practical skills are what schools should teach. Beyond elementary school, there is no practical math to learn unless it is applied in real world situations. English class will be replaced with reading. The emphasis will be to read books, and not to nitpick spelling, grammar mistakes, or write lengthy essays. A test will be: "What did you learn from this book?". That's it. All students share their answers. No grades.

Another trade, the science trades, can include chemical science, geology, and other related trades. These can be optional. A student can choose to focus in the trades that interest them. There are no math or english trades. Books will be a part of all liberal trades, but reading books, then writing essays will not be required. Essays serve little benefit to the student, other than to accustom them to busywork. If you have not read Aaron Swartz essays on education, you should.<sup>3</sup>

Another trade, the medical trade (health, nutrition, anatomy, drugs and safety, surgery, and medical procedures).

I don't actually believe education can be saved, but this is what I would do. Practical real life skills which they will functionally utilize in adulthood are what is important. Don't train them anything they don't need to know as adults. Train the kids to be able to participate in a real world economy, and no pie in the sky, ivory tower bulls... .

Homework would be abolished, and replaced with apprenticeships in high school. No more beating their heads against their bedroom desk while the midnight lamp burns, kids will be out in the real world, working with other human beings<sup>4</sup> or building projects. Grades, likewise, should not be important. IQ is a myth. Intelligence can not be defined as a number. Intelligence encompasses many attributes. Likewise, trying to define a student with grades, brings anxiety, and

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<sup>2</sup>The term "programming" is loaded language. A buzzword.

<sup>3</sup>Swartz, Aaron. The Boy who Could Change the World. 2016.

<sup>4</sup>Here is a good place for the workshop / hackerspace.



disrupts what is important - the learning.<sup>5</sup>

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<sup>5</sup>What if learning at school was more important than grades.

# How to Run

One breath in, four steps. One breath out, four steps. Repeat for long distance running. Count: 1, 2, 3, 4 and breathe in. 1,2,3,4 Breathe out. Sometimes 4 is 3.

Wear light trail running shoes<sup>1</sup> on soft surfaces such as the forest floor. On pavement, use traditional running shoes.

Some people think the important part of running is moving your legs fast. It's not. That is only for sprinting. Medium to long distance running is all about managing your breathing. The goal is to keep enough fresh oxygen flowing, without overtiring yourself. This is why you 'pace' yourself with your breathing.

If you run for a long enough distance, you will need additional hydration. Water, of course.

---

<sup>1</sup>Light shoes are more agile, and feel better. In a perfect world, everyone would be barefoot running, but it simply isn't practical in the real world, for most surfaces.

# Fear of Impractical Dangers

The news is saying west nile virus is in the mosquitoes. The chance of getting it is very small, yet it makes the news. Fear sells. What it is, is the fear of West Nile Virus, or lyme disease, or [insert pathogen here] can be worse than the illness. Bad things will happen to all of us in our lives. There is no avoiding that. But, to believe the hype, to be afraid of obscure diseases is in itself, a bigger danger than the illnesses themselves. We all have to die, someday.

That doesn't mean you should throw caution to the wayside, and run through bushes in the forest (where ticks might be), or have unprotected sex, or drive fast, but there is a difference. Don't be afraid of unrealistic fears. Terrorism is another unreal fear. Fear of terror is more dangerous than actual madmen. What do you lose, when you believe the fear?

# Most People Have No Idea How to Cook Meat Right

Humanity is a disaster. Cooking meat is one thing the majority don't get right. The rules are simple:

- Don't cook meat much, if at all.
- You can cook rich pieces of meat more than lean pieces.

2000's culture<sup>1</sup> is also injurious to these rules. First, there are rules and warnings at each restaurant you might go to: "Eating undercooked meats and seafoods may lead to sickness." This is true technically, but with an understanding of the rules, it is nonsense. It's like saying "Driving fast in the snow can lead to accidents." Well, yes, obviously. Don't do that. Don't eat raw chicken, and pork. Eat all the rare beef you want.

What happens is that certain sensitive and more timid individuals<sup>2</sup> will read these warnings, and think the sky is going to fall if they get a prime rib steak cooked anything but well done. It's brainwashing.

This kind of a warning doesn't tell the whole story. In 2000's popular culture, there are television shows called reality shows. One

---

<sup>1</sup>Notably, some cultures (Japanese) have propagandized eating of raw meat into their culture. They did it in a clever way - by making it fashionable and calling it sashimi (or sushi). Why can't raw beef or other raw meats be eaten? Is fish somehow better than these? This is a topic for another day - with caveats (see [steakwiki.com](http://steakwiki.com) Rules for Zero Carb Diets), but a simple answer is: animals that are inspected properly can be eaten rare or raw. Typically you wouldn't eat Pork, Chicken, Wild animals, or fresh water fish/eels, however as they are more likely to cause stomach illnesses (from bacteria like salmonella to parasites). Beef, or ocean fish however are typically safe bets.

<sup>2</sup>Note that I did not specifically mention Woman and Children, out of respect.

of them (which future generations will not understand, so I will explain it here) has become a type of meme, or internet joke. It consists of the chef telling all the cooks-in-training that their food is undercooked. He has an excessive emotional response <sup>3</sup> This idea makes it into popular culture, and is harmful.

I noted about the Japanese earlier in a footnote. Let's go back to that. The culture of Nippon popularizes a few types of food. Ramen, Rice, Pocky, Sushi among others... Ramen and rice are grains, and not ideal for the human digestive system<sup>4</sup>, yet Sushi/sashimi, which is a fashionable name for raw ocean fish, is acceptable. A society that eats well will prosper. A successful brainwashing by culture. Where is the rare meat culture in the rest of the world? It can't be sushi, as that is a euphemism for "Expensive Stranged Name Fish" in the west. Sushi is too expensive to be sustainable for the rest of the world.

Yes, there is dangerous meat, but that is for another article. If you live in a first world country, you can eat any inspected meat (beef or ocean fish) rare. Rare is raw. It means the same thing. A synonym. Rich pieces can be cooked more, optionally. Never boil meat fully submerged in water. It ends up well done - every time.<sup>5</sup>

So, look around you. Look at popular culture. Whether it's a picture of cooked meat in the grocery store flyer, or a picture on the internet... Most of them cook meat medium (pink) or well done. Doomed. Humans are doomed.

You will find it difficult to get someone that understands the difference between rare, medium rare, and medium. People think it's a slight difference of color, that somehow there are three colours between rare, medium rare, and medium. There's no such thing. Meat

---

<sup>3</sup><https://knowyourmeme.com/memes/people/gordon-ramsay> " An ongoing theme that is often explored in the series is Ramsay's frustration with undercooked meals and his hyperbolic tirades. On February 7th, 2013, Plebbitor okredrobot submitted an image macro with the caption [This chicken is so uncooked / that a skilled vet could still save him] "

<sup>4</sup>Which is carnivorous not omnivorous. We don't have a large appendix for grains like the omnivorous rat. Instead, we have anatomy like a mountain lion, or housecat.

<sup>5</sup>Cooking meat in a thin layer of heavy dairy cream is however effective.

can't be between medium and medium rare. Rare is raw. Medium is pink. Well done is grey. There is no inbetween. Medium rare, means the inside is rare, and the outside layer (of some thickness) is pink. Rare means, either the whole steak is rare, or the outside is cooked (just the edge, perhaps 5mm) well done, and the inside is fully rare.<sup>6</sup>

The charts that show medium rare, medium, medium well done, and well done, are bulls... . There's uncooked (rare), cooked (pink), overcooked (grey). Keep it simple.<sup>7</sup> How the meat comes out will be a combination of these three colours. There is no magical medium-rare level. What most people think is medium rare, is truly medium.

If it's red, it's rare. If it's pink, it's medium. If it's grey, it's overcooked.

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<sup>6</sup>Notably, any meat cooked beyond rare, will also have this layer of well done meat on the very outside, where it made contact with the pan or oven air.

<sup>7</sup>Once you cook it pink, you have eliminated the value of the proteins. Ditto for well done. The only way to eat lean meat, and get the nutrition from the proteins is by eating it rare. For rich meat, you can cook it pink, or grey, as the fat will still taste good. However, the protein content is less. Eat what tastes good. Fat tastes better cooked. The outside of meat when cooked, always tastes better.

# Telling the Quality of a Stringed Instrument

There are common aspects of string / fretted instruments. Whether it is a guitar, a violin, a bass guitar, etc... If you know what makes one good, you have insight into all of them. I've played good and not as good guitars enough to know the feeling. Note that this is primarily for acoustic instruments.

One, the strings should be as close to the fretboard as possible, without actually hitting it. This means, when your finger pushes down on the string, it doesn't have to travel far. This allows for faster movement. Sometimes a guitar's shape will morph over time, causing strings that were just right, to be too close to the frets. Usually the higher notes (further down the fretboard, where slight misalignments at the top get exaggerated) have more of a problem.

Two, the quality of the strings is important. At some point, the tension from one side to the other is universal among guitars. Every guitar holds the string tight. As long as they are tight, they will resonate at the appropriate frequency and note. So, good strings are better than cheap strings. Don't buy generic, and don't buy counterfeit.

Three, it must be able to hold a tune. If the tuning pegs can't keep the violin tuned, it's faulty. This applies to pianos as well. Essentially, they can't keep the strings tight.

That's all I would start with. You can delve into different instrument bodies for the resonant sound, or the composition of the fretboard... but that is above my income level. I want an instrument that is playable for a fair musician. I can't afford more than that.

# Eagerness to Take Medications

Beware of taking a pill for everything that ails you. Antihistamines for example, may mask symptoms, but the underlying problem remains<sup>1</sup>. Try to let the body independantly heal itself when possible. Medications, such as advil, or tylenol can slow down the healing process. The body should be allowed to run its course when possible. Of course, there are exceptions. When I had mono, I had to take a high dosage of Ibuprofen to survive the sore throat. There was no alternative. But I don't take it unless there is a valid reason to.

Said more or less by a nurse once to me: "The ones who live into old age, tend to not take a lot of medications".

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<sup>1</sup>Citing a tune by Paul Simon, "Run That Body Down" is in order here.



# Insanity in Modern Life: Milk

There are aspects of modern society that are illogical and simply insane. False beliefs, that have no basis in logic. By simple deduction, we can rule these beliefs as wrong. Nonetheless, they have become accepted by the masses.

Cow's milk. Why is it that<sup>1</sup> humans drink cow's milk? It's mandatory at elementary schools, it's considered "Healthy" and it is heavily promoted.

The answer appears to be that historically europeans drank cow's milk because they were herding steer. Steer and dogs being the earliest domesticated animals. We had a lot of steer, and needed food. The steer were able to provide a food source. But that is in the past. We are not limited by how far we can travel by foot anymore. We need to move on.

Humans are not cows. The milk is designed by evolution for a young steer. It is possible to become allergic to milk if you drink too much. It isn't normal human food. There's no reason for a human ever to drink cow's milk.

If a human is going to drink any milk or any animal, which would it be? The answer is from other humans. Due to the stigma of a woman lactating, or the uneasy feeling someone might have drinking milk from another human being, it doesn't happen. These are irrational fears. They impede truth and logic from progressing. Either only babies drink human milk, or adults and babies drink human's milk. Cow's milk is unnecessary in this picture. No reason for it.

---

<sup>1</sup>historically only western europeans, as Africans are generally lactose intolerant, and asians as well. I don't need a reference, this is easily searchable online, but here's one: Reference: <https://web.archive.org/web/20190403134430/https://milk.procon.org/view.resource.php?res>

Continuing to drink cow's milk, while economical, and scalable, is unhealthy overall for society. There are hidden downsides here that the dairy industry is ignoring.

I consider the dairy industry to be not as healthy, as it promotes itself to be. The advertising of milk also needs to stop. Those who advertise milk as beneficial for humans are not innocent. Consider also, all milk readily available at stores is given Vitamin D. It's actually difficult to find milk without Vitamin D. Why is this?<sup>2</sup> Why is there no human's milk? Are we not a mature enough civilization to regulate this as a product?

As human society nears the end of its modern run, and the power grid going out comes ever closer, its questions like these that make you wonder. How can a society be so organized and advanced, yet so foolish in fundamentals...

---

<sup>2</sup>Vitamin D seems to regulate the wake and sleep cycle hormones. Drink enough, or get enough sunlight, and you wake up earlier. Sunlight is better, of course. I'm still investigating this.

# Drugs: A Tool, not a Toy

Drugs are tools, not toys. Play with tools and you will get hurt.

He who builds his life around a drug<sup>1</sup> will have it fall apart.

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<sup>1</sup>Daily or frequent use

# The Garlic Page

This is my garlic page. Garlic should be eaten fresh, and minced.  
I need say no more.

Remember: the Garlic.

## **Magical Book**

*“Every minute gone, is one not coming back. The seconds pass slow on a one way track”*

- Targes Attenuator

# ZoneMinder: RPI3 Install Walkthrough

Steak Electronics

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## 1 Overview

The **Raspberry Pi 3** is a common general purpose ARM computer that can be used to record cameras in ZM.<sup>1</sup> While the resources are limited, the common availability of these RPis, low-cost, and

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<sup>1</sup>SBCs can also be used as cameras, or as ZM Clients. These latter two options may be more advisable [https://wiki.zoneminder.com/Single\\_Board\\_Computers](https://wiki.zoneminder.com/Single_Board_Computers)

their **low power use**, makes them a attractive for ZM. Is it worth going to the effort of setting up ZM for these? Let's find out.

## 2 RPI3 with 1.32.2 and Debian Stretch (9)

This is currently only available in experimental repos as 2018 / Early 2019. It is not recommended for most people to use this - only more advanced admins, who are willing to have a server (usually update) fail on them should use this. I added a 1.32+ RPI to my existing server, and do not update it.<sup>2</sup>

There is some discussion that you can't add the debian repos to the RPI...<sup>3</sup> I had no trouble doing this, and it appears to be possible on the RPI. If they both support armhf, it shouldn't be a problem, but ARM is complicated<sup>4</sup> and its support is not as good as it could be.

### 2.1 Steps

Download the latest RPI Stretch Lite release, install to SD card. Login to Pi, change password, enable ssh (if desired).

```
apt-get update
```

```
apt-get dist-upgrade
```

```
apt-get install dirmngr
```

```
add debian sid repos to /etc/apt/sources.list
```

```
deb http://deb.debian.org/debian sid main
```

---

<sup>2</sup>At least until ZM 1.32+ is in the stable debian repos.

<sup>3</sup><https://raspberrypi.stackexchange.com/questions/28064/install-or-build-experimental-debian-package-for-rpi-networkmanager-1-0> I think why they originally wrote this, it was for an earlier RPI

<sup>4</sup>(armel, armhf, arm64... Let's not even mention cellphones which are a disaster for hobbyists to install Linux on. A real step backwards from i386 compatibility),

```
add debian keyring to remove warnings
apt-get install debian-archive-keyring
```

```
apt-get update
```

```
install 1.32+ from experimentals
apt-get install -t experimental zoneminder
```

follow the rest of the steps in Bbhunges guide, except for the timezone for php which was in 7.3 not 7.0.<sup>5</sup>

6

## 2.2 RPI3 1.32.2 Performance

I'm going to test one Axis camera at various resolutions and frame rates, and report on the system load. Essentially, I will max out a given FPS for a resolution. This might be a benchmark upon which to size other RPIs against. In this table we are using FFMPEG.

Here are some example Modes, Resolutions, FPS<sup>7</sup>, and CPU Loads

Testing of Raspbian Stretch Lite with Debian Sid Repos (December 2018) and Zoneminder 1.32.2 from Experimental.

Mode	Source	PathType	Resolution	FPS	L
Record	FFMPEG	MJPEG	800x600	8	6
Record	FFMPEG	MJPEG	800x600	14(20 limit on camera)	7

---

<sup>5</sup><https://wiki.zoneminder.com/Debian>

<sup>6</sup><https://wiki.debian.org/RaspberryPi3> has a preview image that can be used, and should support the Debian repos out of the box. The Raspbian image (as we saw) needed to have the debian repos added, but worked afterwards, without complaint.

<sup>7</sup>FPS is set at the camera. The actual FPS recorded tends to be a bit lower, when FPS is greater than 5 for 1280x720



This is all single camera recording. The results may differ with multiple cameras. I will now try Modect.

Mode	Source	PathType	Resolution	FPS	L
Modect	FFMPEG	MJPEG	800x600	14(20 limit on camera)	

Something strange has occurred here. First off, I'm using only two cores. There is one zma and one zmc process. Before, with record, there were multiple zma processes, and only one zmc process. The good news is, performance is better with Modect. The bad news is: this is not working as expected. Let's turn it back to record. And as expected, record functions much worse. Seems like a bug.<sup>8</sup>

Here are some screenshots (from the pics directory) that demonstrate this:

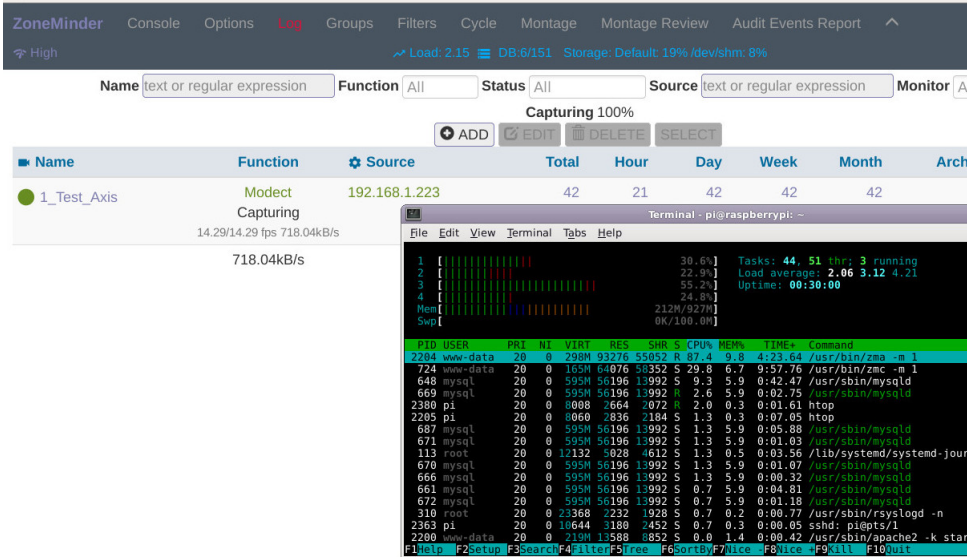


Figure 1: Modect uses little CPU

<sup>8</sup>And it was a bug as I learned later, after posting on the forums.

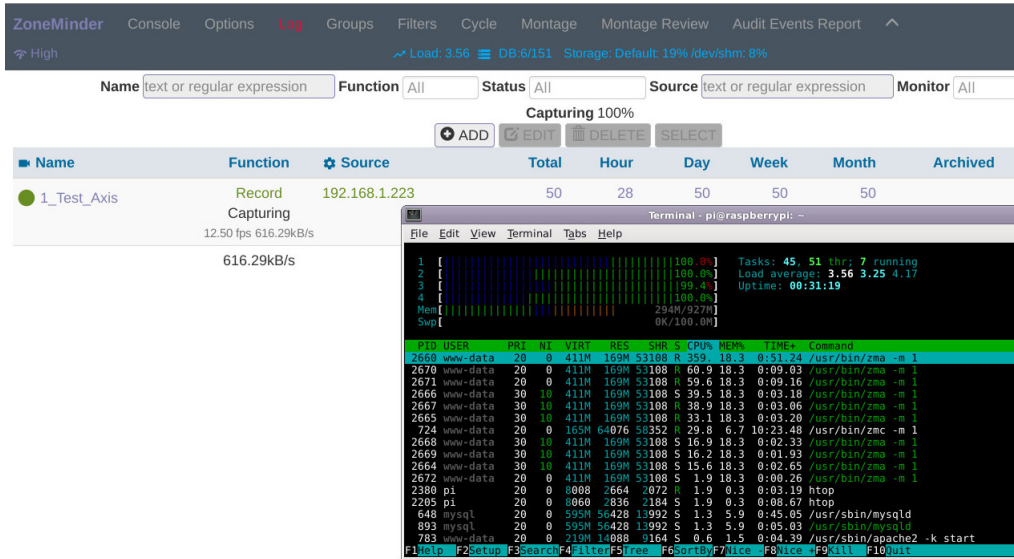


Figure 2: Record seems to have too many zma active

## 2.2.1 Modect vs Record Issues with ZMA

Looking at the logs, there is a warning in Record mode, to slow down analysis, slow down FPS, or increase buffer size. I tried changing buffer size from 20 to 60, and setting Analysis FPS at 4... Neither of these fixes resolved the multiple ZMA issue. The Analysis FPS is not expected to resolve this, as Modect has no such issue with Analyzing 11FPS of 800x600.

## 2.2.2 The bug - Video Writer

After posting on the forums, I discovered that the issue was that by default on 1.32.2, the video writer was set to enabled. However, the video writer doesn't work on ARM, so it's non-active. So this was a bug. It was necessary to manually set the video writer to disabled to get rid of these errors. Note that there was no error with Modect, only with Mocord, Record.

### 2.3 Part Two - Hikvision DS-2CD2025FWD

Picking this up another day, I've decided to do some more testing. Now we have a Hikvision camera. This camera has a default IP of 192.168.1.64, and a main and sub stream. Both streams can have FPS adjusted, and RTSP and MJPEG paths are available<sup>9</sup>

Let's jump to the performance specs. Remember the RPI3 Has 4 cores, so no more than 4 Load max. I tested RTSP and FFMPEG source. JPEG settings are set to save Frames + Analysis. Because this is an RPI, H264 video writer is not possible. I did not test passthrough. These should be taken as a rough estimate.

Mode	Source	PathType	Resolution	FPS	Load
Mocord	FFMPEG	RTSP	352x240	4	0.3
Mocord	FFMPEG	RTSP	352x240	25	1.3
Mocord	FFMPEG	RTSP	640x480	30	2.4
Mocord	FFMPEG	RTSP	1280x720	2	1.3
Mocord	FFMPEG	RTSP	1280x720	4	1.35
Mocord	FFMPEG	RTSP	1280x720	10	2.9
Mocord	FFMPEG	RTSP	1280x960	10	3
Mocord	FFMPEG	RTSP	1920x1080	4	2.6

I tried running the camera at 15 FPS at 1920x1080, but ZM seemed to limit itself to around 9FPS and there was some slowdown in the preview feed. I did not test for a long period of time, and its possible that periodic dropouts will occur (This means, you will get events that are not a full 10 minutes each, as it disconnects & reconnects) as I have seen with previous RPI setups.

## 3 RPI3 with 1.30.4 and Debian Stretch (9)

After the bench marking with 1.32.2, I've decided to hold off, and simply use 1.30.4 for the rest of this document. Testing 1.32+ will

---

<sup>9</sup>For full details, I will post this camera on the wiki in the Hardware Compatibility List.

have to come at a later time. So let's see what the 1.30.4 can do.

**WARNING!!!!!!:**The following steps will first be for 1.30. Then I will show how to add the debian ARM repos for 1.30.4. Note that Raspbian's repos only have 1.30. NOT 1.30.4. If you want the most stable 1.30.4, it is recommended to add Debian's repos.

### 3.1 Install Process for 1.30

Using Raspbian 9 Lite image, copy that to SD card. Logon to the pi, and enable ssh, set a new password for pi.

```
passwd
```

```
sudo /etc/init.d/ssh start
```

Now you can remotely log onto it via ssh.

Update packages list:

```
apt update
```

```
apt upgrade
```

```
apt dist-upgrade
```

Install Zoneminder

```
apt install zoneminder vlc-plugin-base php7.0-gd
```

Install MySQL, set passwords

```
mysql_secure_installation
```

Create Zoneminder database in MySQL (Note: this also creates t  
mysql -uroot -p < /usr/share/zoneminder/db/zm\_create.sql  
mysql -uroot -p -e "grant all on zm.\* to 'zmuser'@localhost identi  
mysqladmin -uroot -p reload

Set permissions of /etc/zm/zm.conf to root:www-data 740  
chmod 740 /etc/zm/zm.conf

```

chown root:www-data /etc/zm/zm.conf
    Enable Zoneminder service to start at boot
systemctl enable zoneminder.service
    Add www-data to the sudo group (to enable use of local video d
adduser www-data video
    Start Zoneminder
systemctl start zoneminder.service
(can also type /etc/init.d/zoneminder start)
    Check to see that Zoneminder is running
systemctl status zoneminder.service
    Enable CGI and Zoneminder configuration in Apache.
a2enmod cgi
a2enmod rewrite
a2enconf zoneminder
    Add timezone to PHP
sed -i "s/;date.timezone =/date.timezone = $(sed 's/\\/\\/\\\\\\\\/' /etc
    Change permissions in /usr/share/zoneminder/
chown -R www-data:www-data /usr/share/zoneminder/

```

```

Restart Apache
service apache2 restart

```

Note that these steps are copied from Bbunge's excellent walk-throughs on <https://wiki.zoneminder.com/Debian>. I have copied the steps for 1.32, mostly. I tested this first on 1.30 on the Raspbian Repos for ZM, and it worked no problem.

## 3.2 Installing or Upgrading to 1.30.4

After following the above steps, you can follow these steps below to install ZM from the debian stretch-backports repos. Those adventurous, could probably merge this below step into the above.

All of these steps are as root.

```

Add the debian repos to /etc/apt/sources.list:
deb http://ftp.debian.org/debian stretch-backports main contrib

```

Note that I am adding only the backports repo. I will leave the

```
apt-get update
apt-get install debian-archive-keyring
Accept the prompt and install it without authentication
apt-get update
update should now complete without warning. Now we will install
apt-get install -t stretch-backports zoneminder
```

And because we upgraded manually, we must upgrade the DB...

```
service zoneminder stop
```

Note that ZM should be stopped.

```
zmupdate.pl
/etc/init.d/zoneminder start
```

And that is it for installing Zoneminder 1.30.4.

### 3.3 Benchmarking ZM 1.30.4

Now, let's do some testing of what this machine can do.

Settings:

32 bit colour depth

FFMPEG (Remote could be used, but it may be phased out in the future)  
use FFMPEG)

Modect/Mocord uses the default Zone.

10 FPS seems to be the limit for what ZM can do with this camera.  
the FPS. It is streaming at 30FPS or so.

Mode	Source	PathType	Resolution	FPS	Load	RAM	
Monitor	FFMPEG	MJPEG	800x600	10	0.4	266M	S
Modect	FFMPEG	MJPEG	800x600	10	1	282M	S
Record	FFMPEG	MJPEG	800x600	10	3	278M	Unstab
Mocord	FFMPEG	MJPEG	800x600	10	3	280M	Unstab
Nodect	FFMPEG	MJPEG	800x600	10	0.4	280M	S

This is with an SD card. In order to get better performance, you

would want to use an SSD connected via USB as the main filesystem.<sup>10</sup> As you can see, the best performance is with Nodect, which remains king. Modect is also good. It looks like the immediate bottleneck, on a default Pi install is the actual writing of the video files.<sup>11</sup>

Let's try again with a lower FPS. I know record is the bottleneck, so let's focus on Record and Mocord.

Mode	Source	PathType	Resolution	FPS	Load	RAM	Not
Record	FFMPEG	MJPEG	800x600	4	2	280M	Stab
Mocord	FFMPEG	MJPEG	800x600	4	2	280M	ZMA cr

## 4 Conclusion

The RPI can be used as a Zoneminder server, but not above a limited level. If you have external alarms or record only, it makes the Pi a bit more practical, though it should be only for a low number of low resolution cameras. Bear in mind, this testing was 1 800x600 camera. The RPI should probably only be used for streams of 320x240, or similar low resolutions. In any case, the RPI is not recommended for Zoneminder, but it can be used, if you understand its limitations, and are willing to work within them.

---

<sup>10</sup>This was recommended to me in a forum post originally which is here: <https://forums.zoneminder.com/viewtopic.php?f=38&t=27873>

<sup>11</sup>Based on earlier testing with 1.32.2, I expect Remote to be comparable to FFMPEG performance wise.

# Kicad Primer

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## 1 Main List

KiCad PCBNew Primer: A quick recap, to refresh my KiCad PCB abilities<sup>1</sup>

Summary: This document should be read before starting on a PCB layout with KiCad. These tips may apply to other PCB software as well.

- Route Power First: Route power first, and pay attention to how many layers you will need. Depending on how many signals, and where they are going, you may need a 4 or higher layer board. 144LQFP was difficult using 100% of the pins, but possible on a 2 layer board.

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<sup>1</sup>Best viewed on actual paper not a computer screen.



- Case and Mounting Holes: Put the mounting holes into the PCB early, to avoid rerouting layer. Same with the case.
- Keyboard Shortcuts: Use keyboard shortcuts. X to choose 'add trace', PageUp and PageDown to cycle through layers, there is a hotkey for changing layer types. O will add a component (enter or left click after selecting O)
- Measuring: There is a ruler in KiCad. Extremely useful.
- Ground Pours: If you want to do a ground pour that is split, there is the keepout area. This keepout area has an option for component or fill keepout. Choose the fill keepout. Test on a blank project to see workflow.
- Via Size, Trace Size, Fab House Guidelines: Set the fab house guidelines into KiCad before starting, otherwise you will have to change items later. e.g. if you set the Vias to be too small, you will have to edit all vias later. There are templates available with DRC guidelines for OSHPark, as an example.
- White Background: In 5.0.0rc2 and newer (assumed) change the background colour to white by clicking on the option. It may be greyed out, but still selects.
- Board Edge: Edge.Cuts and use a 1 mil or .001 inch add graphic lines on the edge cut layer.
- Resources: There are a variety of resources available, [1, 2] on PCB design. Not including textbooks, and forums.
- Modular: Make separate boards, and reuse what you can. Some things are trivial to layout, and don't need separate boards. Anything that is difficult to layout, consider using it's own board.
- Net names: Give net names to tracks. This will make identification easier on layout. E.g. see here how I've added labels to nets that might not need them.

- Component Values: If you are building by hand, add component values to the footprints silk screen to make it easier to identify. See picture.

## 2 Miscellaneous Tips

### 2.1 Silk Screen

Silk screen that goes over the board edge, can cause graphical glitches. Oshpark uses software to ignore anything over the board edge, but other pcb fabs might not.

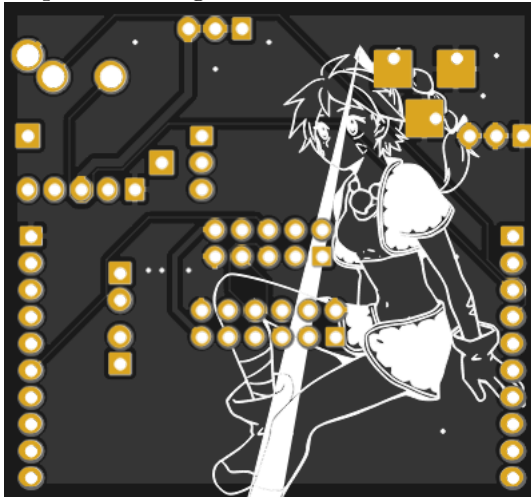


Figure 1: Just one possible gerber error. Here, from Silk Screen being over the board edge.

### 2.2 Net Names

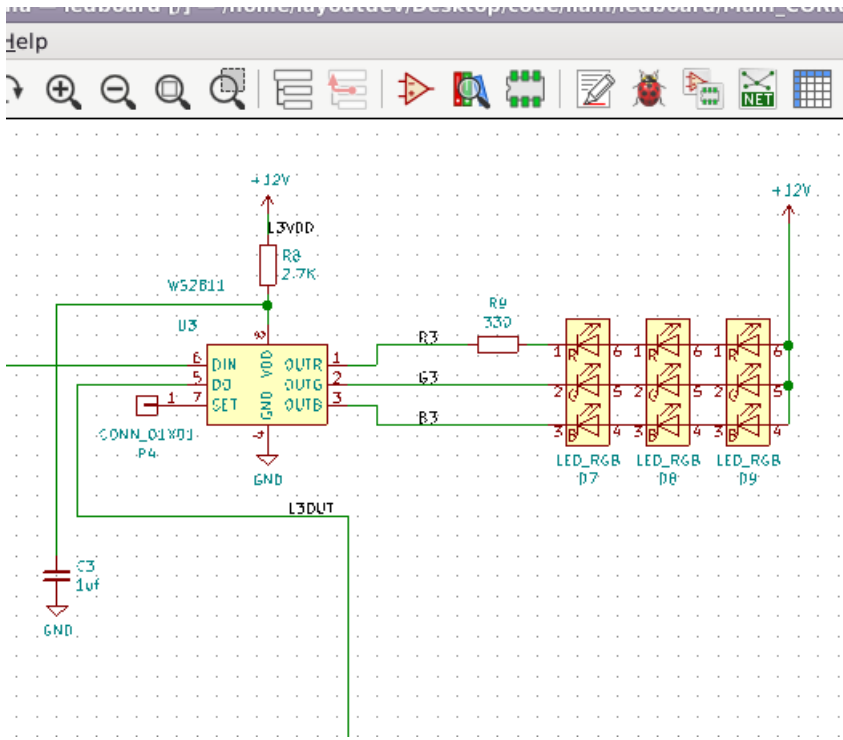


Figure 2: Giving Net Names to nets that may not need them can help in layout later. See these images...

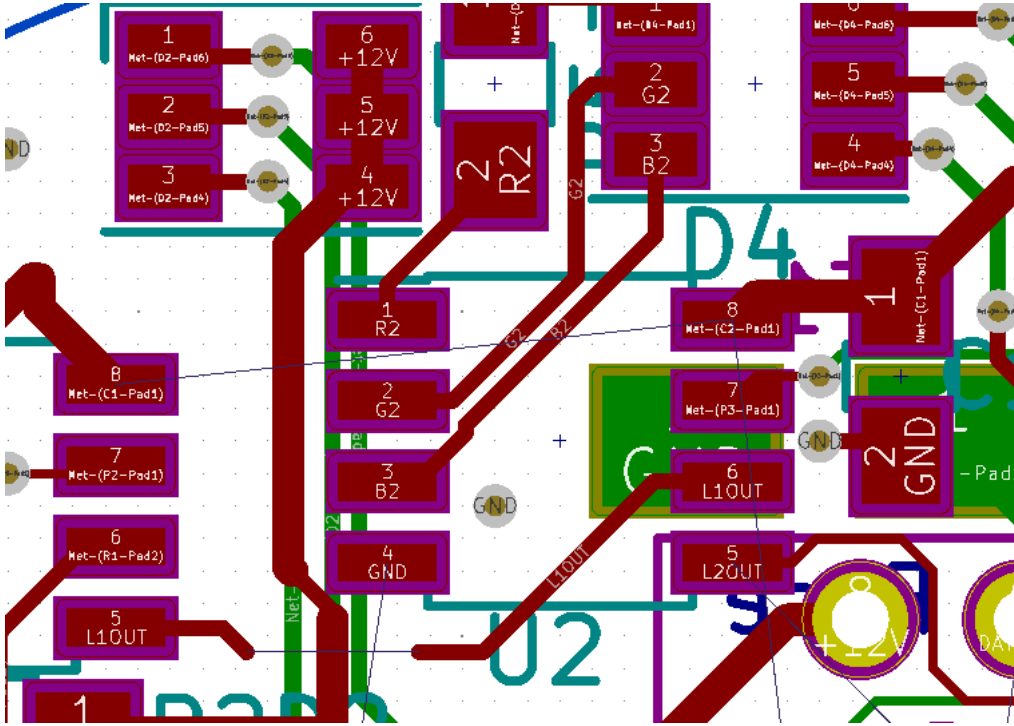


Figure 3: This converts the mystifying names of NET-(P2-Pad4) to something human readable like R2, G2, B2.

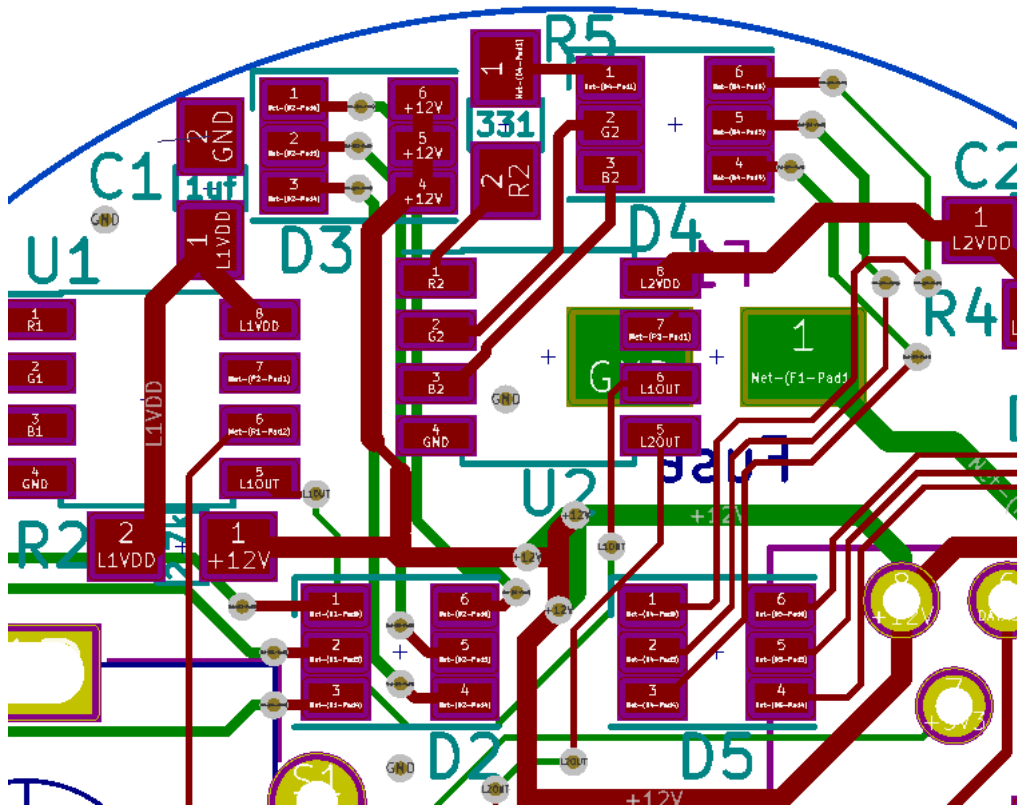


Figure 4: By adding a text of 0.5 size to 0805 footprints, you can easily fit within the provided kicad footprint. This makes assembly easier. See here, labels such as 1uf, or 2.7k.

### 2.3 How to import graphical pictures into Kicad

This is how I convert pictures to silkscreen. First, download any picture that can be converted to Black and White. Monochrome pictures are an option, or you can take a coloured image and convert it in GIMP. To convert a coloured image in GIMP do the following:

- Open picture in GIMP
- Set **image - mode** to **Greyscale** (top menu)
- Now we get a preview, but this is varying levels of Black and white, we want only two colours, so choose **colours - threshold** (top menu) and choose the amount you want (the defaults are usually acceptable)
- Use the **Select By Color Tool** from the tools menu and choose the black that will be turned into white for the silkscreen.
- Copy that (top menu - edit - copy)
- Paste it as a new layer (top menu - edit - paste as new layer)
- Hide the old layer.
- Select all the black on the new layer with the color tool
- **edit - fill with bg colour**, if the bg colour is white.
- Resize if needed, and export as png

A short synopsis of what this process entails for those more intimate with photo editing programs is:

Get a black and white picture. Make the part you want white. Make the background transparent. You should now have only a white ink layer of what the silk screen will be, with a transparent background. Save as png. Import into bitmap 2 component.

See here how I've named the conn\_01x08 to be Max6675. Since I didn't bother making a symbol for it, just used the connector, I need some way to identify what component it is when assigning a footprint, and also when doing layout. Note how I need to name the P12 connector here.

Identifying on layout where chips come from Here is another trick. When you are laying out, and placing components, keep eeschema open it will show what schematic and where the component goes. This is especially helpful in modular schematics.

## 2.4 Kicad outline issues

Make the edge cuts layer to a very small number, so you can see when the 3d viewer errors out, where the gap is. The default is too big. Try 0.01, not 0.1. **Important !!!** Especially if you are making a circle or something unusual. The secret to getting circles (with cutouts) done right is to set the edge cuts layer to 0.01, then use the smallest grid that kicad has (0.1 mils), and align.

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- [2] David Jones PCBDesignTutorialRevA, <http://alternatezone.com/electronics/pcbdesign.htm>, <http://alternatezone.com/electronics/files/PCBDesignTutorialRevA.pdf>

## 1 Overview

Document harvesting of plants to improve future harvests.

## 2 Safety

Cannabis is a delierient, and it will make you lazy, damage your short term memory, and stunt growth in juveniles, if used too much. Do not use cannabis often. Use rarely. Drugs are tools, not a toy. Play with tools, and you will get hurt.

## 3 Work Log

Notes: Plant was one of three out of four that made it to adulthood. These were bubble gum (female) seeds germinated and planted in Early May. They were kept inside for about a month, under a poor lighting condition. This stressed them to some degree and they didn't grow more than a few inches under the light as sprouts. I do not like artificial lighting for plants.





Figure 1: Habitual Use of Cannabis will cause you to be slovenly in your habits. Use sparingly. Here the top is all orange hairs.

This was a mistake. They should've been germinated at the third week of May, and then put outside within a week. Or brighter indoor lights could've been used. Lesson learned.

The seeds were obtained from Seed Supreme, which is a distributor. The actual company that provides the bubble gum seeds is:

EDIT: need to lookup. There are a few vendors that sell bubble gum. These were also auto flowering.



Figure 2: The middle of the plant is primarily white hairs. Was it pulled too early?

Upon putting outside, one of them died. They grew to different heights. This harvested plant was the shortest, at about one and a half to two feet. The other is about two feet, and the one that has yet to flower is three plus feet (As of 07/20/18). As of the start of July, one of them started flowering. The other followed about a week after. In July 21st or so, the first plant was pulled, to test harvest time. See pictures. It is necessary to plan for plant deaths outdoors and to grow more than you need.



Figure 3: After Drying.

## 4 Germination

I have grown plants in the past, although never much beyond seeds. Plants don't do well in the forest, where squirrels and beetles will nibble at them. Most of the time I have simply germinated seeds. To germinate a seed, you will want to put it between some wet paper towel, that is generously wet, but not so wet as to suffocate the seed. Putting seeds in a cup of water will not work, and will only drown the seed.

Keep the seeds in a wet/moist paper towel in a plastic bag, and in a cool dark place. They should germinate within a couple of days.



Figure 4: Nothing fancy is required for drying. A fan will suffice. Here I put a fan through a fish tank, but even the tank is optional. Air drying via a fan will do the job. Once the aroma is no longer present, after drying, they should not be dried further. Overdrying is detrimental, I have been told.

## 5 Timing of Planting Manure

A final note on this. I have been told that planting manure a few weeks or months before putting the plants into the ground results in better crops. This would be opposed to putting the manure in at the same time or just before planting.

## Poison Ivy Guide

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### 1 Overview

Poison ivy is everywhere! Anyone who works near the woods will eventually get a case of this stuff. I've had it a few times in my life, and here's what I have learned. Don't panic. Let this information help you get through the ivy.

## 2 Basics

There are some basic rules with Poison Ivy to follow, when you catch it.

1) Don't itch it any more than you have to. Excessive itching will make it spread. Early on, you might get to a point where you absolutely have to scratch it. Go ahead! You may see the blisters leak (they call it weeping), that is normal. But then when you can stop, you should stop.<sup>1</sup> After the initial rush, it will be easier not to itch. At this point, you should avoid any itching or stimulation of the rash.<sup>2</sup>

2) Clean all items that may have gotten the oil (urushiol) on them. Wash bed sheets, clothes, tools, shoes, etc...

3) Have patience. It takes time to recover. You might need to take time off of work.

4) Stay in cool, or cold environments. Fans, or AC will help keep the itching down.

## 3 Onset

When you get poison ivy, it takes time for it to soak in. So let's say you notice yourself walk into some ivy. You can attempt to wash yourself with soap, but you will need the right soap. The oil

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<sup>1</sup>Calamine lotion is good at solidifying the leaking blister liquid.

<sup>2</sup>Don't go crazy trying not to itch, just don't itch more than you have to. When you are satisfied, stop.

is reportedly like motor oil, and hand soap won't do the job. You have about 30-60 minutes before it soaks into your skin, when you can clean it off. Try laundry detergent, dish soap, etc... Put sand in with the soap. More on this below.

After you see the rash appear on your skin, there will be 2 or so days of ramping up where the main rash spreads. The first day you see the rash is deceiving. The end rash will be worse than that. And then after the two days, you will have some more spots show up for another 3-4 days (moderate case, longer for severe cases). This is normal, don't panic. The biggest rashes will appear in 2-3 days from start of exposure.<sup>3</sup> Don't be afraid and think you will never get rid of the rash. Small amounts of rash showing up (think one blister) are normal for about a week or 9 days after the initial rash (for my moderate case of 2019). Have patience. The oil is not absorbed in soap and water. You need better cleaners than that. See below.

## 4 Tips

### 4.1 Cold temperatures help

If you are in the summer, stay around the AC. Going out into hot, humid, summer air will aggravate the rash. Fans help too.

### 4.2 Oatmeal is not worth it

Don't bother with the oatmeal baths. Use a cream instead. Also, don't try to make your own oatmeal with a blender, from whole oats. It won't be fine enough as the store oatmeal bath product.

### 4.3 Cortisol creams - the stress hormone

Hydrocortizone works. The OTC is 1%. Prescription has one of a higher strength - 2.5%. Contact your doctor and get a script.<sup>4</sup> Another cream/liquid is calamine lotion which may be healthier, but

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<sup>3</sup>Keep in mind that you can also get reinfected from any items that were exposed to the oil, so clean everything. Rule #2

<sup>4</sup>I also found that the prescription creams were made of better ingredients than OTC. The cream was easier to wash off.

might not be as effective. The stress hormone will lower your immune system response helping to heal, and help dampen the itch. You will actually feel slightly more stressed, as well. Be aware you are playing with body chemistry here, so use caution. There is also a second line cream, which is Triamcinolone. This appears to be more powerful than cortisol, but functionally similar. <sup>5</sup>

#### 4.3.1 Safety of Cortisol

Everything affects everything. With cortisol, there is some warnings here:

<https://en.wikipedia.org/wiki/Glucocorticoid#Withdrawal> In any case, I think you should go without the cream when possible. Don't use hydrocortizone for long periods of time. This is an easy mistake to make. I once treated a (admittedly small) rash with cortizone for 2-3 months. That is bad! Don't do that. It is possible to notice that testosterone production in males goes down. Men will notice a lowering of libido. That may be a possible measure of side effects. The danger in literature online, appears to be if you suppress the libido (adrenal glands) for a long period of time.

#### 4.4 On reapplying creams

When reapplying cream, wash the skin where the previous cream was off first, then apply the cream. Cool water and soap. Lightly clean the skin. Do not rub or itch. Try to take breaks from having oils covering your skin. The skin is porous, and blocking it 24/7 is bad (see below).

#### 4.5 The appearance of the Poison Ivy plant can change!

Don't assume you know what the leaves look like. Depending on where poison ivy is, it can take on different appearances, for example, if it gets a lot of sun, it will appear different, or if it's on a tree as a vine.

#### 4.6 Never trust the gov't

From wiki

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<sup>5</sup>Triamcinolone has been around since the 1950's so it should be fairly well vetted, in terms of safety.

In a 1992 press release, the U.S. Food and Drug Administration announced that no proof had been submitted showing calamine to be safe for use or effective in treating bug bites, stings, and rashes from poison ivy, poison oak, and poison sumac.[15]

In a September 2, 2008 document, the U.S. Food and Drug Administration recommended applying topical over-the-counter skin protectants, such as calamine, to relieve the itch caused by poisonous plants such as poison ivy, poison oak, and poison sumac.[16]

In my experience, the only effective itch blocking for moderate to severe cases is the diphenhydramine creams or AC. Use those. (see anti-histamine). There is a product named Ivarest which is calamine and diphenhydramine. That is a good product.

#### **4.7 Don't move the rash too much**

If you move the area that is affected, it will aggravate and symptoms will get worse. Take a time off work when the rash is at its worst, if needed.

#### **4.8 Stress Hormone vs. Calamine - Which is better?**

Calamine may be better for the endocrine system overall. Cortisol does work though, and it works better than calamine in my experience (it seems to heal faster, though itch blocking may be about equal). I would recommend for small infections, to use calamine, and for moderate infections go with the cortisol. So, calamine is the everyday cure, and cortisol is the once a year cure.

Calamine, is not bad. It effectively reduces the itch to a manageable amount, and it does a good job of solidifying the soil from leaking blisters. The type I have used is Ivarest, which is a product by Blistex of 14% calamine, some benzyl alcohol (sanitization), and diphenhydramine (aka benedryl, to slow the allergic reaction). The diphenhydramine makes you sleepy, so don't be surprised at that.

#### **4.9 Are blisters the ivy oil?**

Most say no... I tested putting some blister oil on an exposed part of my body and no rash appeared there. I don't think they are. Don't be afraid of the blisters.



## 4.10 What soap to remove oil from skin before rash?

Some say fancy soaps... Some say water is enough. I don't believe urushiol is water soluble. It is a plant oil. It bonds to skin. I'd say either get what a mechanic uses (think the orange smelling sand soaps that they have at a gas station repair bay with sand), or try laundry or dish detergent, with some abrasive like sand. Just be careful putting the sand in your drain pipes. If you can soak your hands outside, do that. A wise idea would be to invest in the OTC poison ivy soaps, and keep some in the cupboard. Well worth the investment.

## 4.11 Diphenhydramine - benedryl, aka Histamine blocker

Histamine is your brains sense of itch. You have many more senses than 5. The sense of tiredness, is not a sense of touch. The sense of thirst is not a sense of taste. Diphenhydramine is the secret weapon for blocking itch in Poison Ivy. There are pills you can take, but they get ingested via the stomach and liver, and thus don't operate as close to the site as the creams do. They also make you slightly drunk, and confused.<sup>6</sup> Use the creams, instead. They are the most effective. Sometimes with drugs, where you apply then can have an effect on where the impact is felt the greatest.<sup>7</sup> If you want to sooth the skin, applying on the skin is best. If you decide to take the pills, you will find them not quite as effective as the creams, and they also have a more heavy body affect on your brain. Again, I recommend the cream. I don't recommend the pills, as the side effects are potentially dangerous. And all that said and done, a cool environment or fan may be more effective (and healthier).

## 4.12 Let the skin breathe

From time to time you should try to have a break from any creams and let the skin breathe. The skin has pores, and oils will clog them, backing them up.

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<sup>6</sup>I don't recommend pill based antihistamines.

<sup>7</sup>It has been said that if you want to see visual hallucinations with that famous 1960's drug, you put it in your eye.

### 4.13 Time for skin to start peeling, and start anew

Case 1: Poison Ivy gotten on Monday. Symptoms were light first 3-4 days. By day 5 poison ivy was bad. Day 8, Poison Ivy was worse. On the second week's Thursday, the first signs of peeling skin were observed. That is about 10 days.

### 4.14 Location, Location, Location

Some places for the rash are worse than others, but none are good. A rash on the ankles, means you will end up essentially stuck at your desk. A rash on your hands, means you can move, but working with your hands will aggravate the rash. Wear socks when you are working in the woods.

### 4.15 Don't touch it!

After you get through the initial rush where you can't help but scratch it once or twice, you will get to a point where lingering itch (histamine sense) remains. Don't touch the rash, as much as reasonably possible. If the itch blocks sleep, use diphenhydramine creams. If the itch doesn't block sleep, use hydrocortizone creams. Beware that the antihistamine will null your sense of itch, so try not to stimulate the rash while you are on it. Avoid moving affected areas.

### 4.16 Swelling doesn't mean it's an infection

It's possible to get swelling for moderate to severe effected areas. Don't assume that swelling is an infection (from bacteria getting into the rash, say after scratching). Swelling can occur from Poison Ivy alone. <sup>8</sup> One thing to note, it's a good idea to wipe any areas you scratch with alcohol.

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<sup>8</sup>As a side story, I was once directed to go to the ER by a clinical nurse whom mistakenly believed swelling was always an infection. She was young... One thing a person will learn about medicine, is that things are not always as simple as you may believe. I didn't end up going to the ER as I suspected and later confirmed she was wrong, in this case.



Figure 1: Here the left foot has moderate swelling, due to the lymphatic system. Note the ballooning appearance near the toes. To my elementary understanding, the lymph nodes pull in water to assist in fighting the poison ivy. This is normal, and does not necessarily mean there is a bacterial infection. The red patch on the left leg is not streaking but the poison ivy rash. With swelling on the left foot, walking was more difficult.



Figure 2: Day 13. After 4-6 days of the previous picture, the swelling vanished, and the rash was healing. Here you can see fading of the rash, as well as the veins again visible in the left foot.

#### 4.17 Cold Water can Help

The rash seems to itch when it heats up. This means, being out in high temperatures, or even sleeping under blankets can cause the itch to act up. Sleep with the exposed area outside blankets. A fan can help. Cold showers are also helpful. You don't want hot water, as it will aggravate the rash. However, I end up using Ivarest to really keep the rash down. It seems to be the only thing that allows sleep.

## 5 Conclusion

Poison Ivy is serious business. It is reported to be able to kill people, and I believe it. With the guide above, at least you will know what to expect for a moderate infection. Don't underestimate urushiol.

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*“Which will you go for,  
Which will you love,  
Which will you choose from,  
From the stars above...  
Which will you answer,  
Which will you call,  
Which will you take for,  
For your one and all...  
And tell me now,  
Which will you love the best.”*

- Nick Drake

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