



# openpilot

the documentation project

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# Introduction

An open source documentation project for [openpilot](#) written for you by fellow members of the Comma community.

## Help us create documentation

Your contributions to the documentation are always welcome and will continue to make this a necessary resource for newcomers and veterans alike.

[About Contributing](#)

[build](#) [error](#)

# Installing Openpilot on EON

## Required Hardware

Some hardware is required for [Openpilot](#) to work. Currently you must run it on the [EON](#). But you'll also need a [Panda](#), and a [Giraffe](#).

## Preface

It's important to note that some of these steps and screens may change as the software updates change so please bare with me as I keep this up to date as quickly as possible. Use your imagination if some things are different.

## Guide

### 1. Plug in the EON

Using the provided USB power adapter and cable plug in the [EON](#) to power. This will trigger the [EON](#) to boot up.



### 2. Welcome to EON

The initial setup just sets up the initial dashcam software.

We will get to the installation of [OpenPilot](#) next.

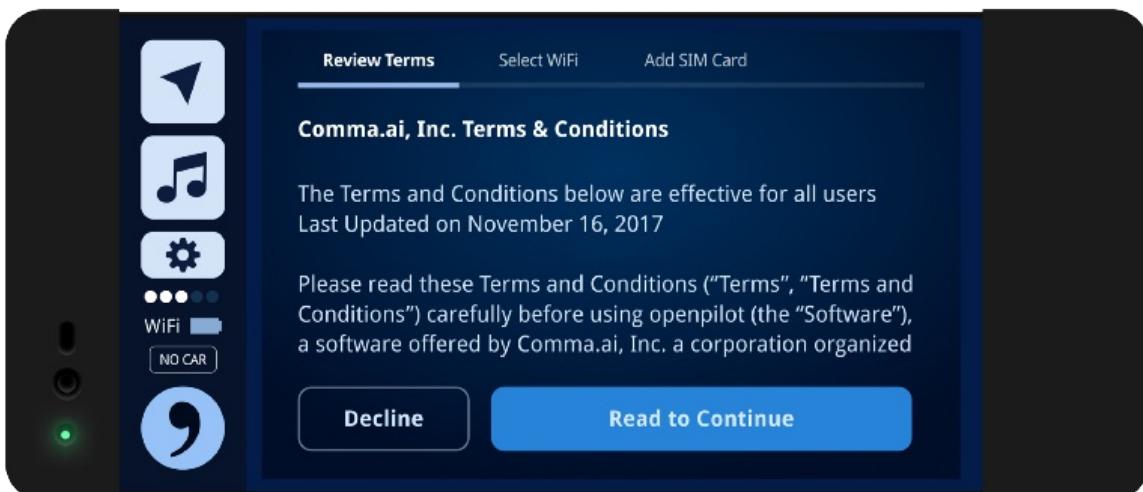
Tap the [Set up your EON](#) button to continue.



### 3. Review the terms

Read through the terms & conditions by scrolling down with your finger until you get to the bottom.

Then click **I agree**.

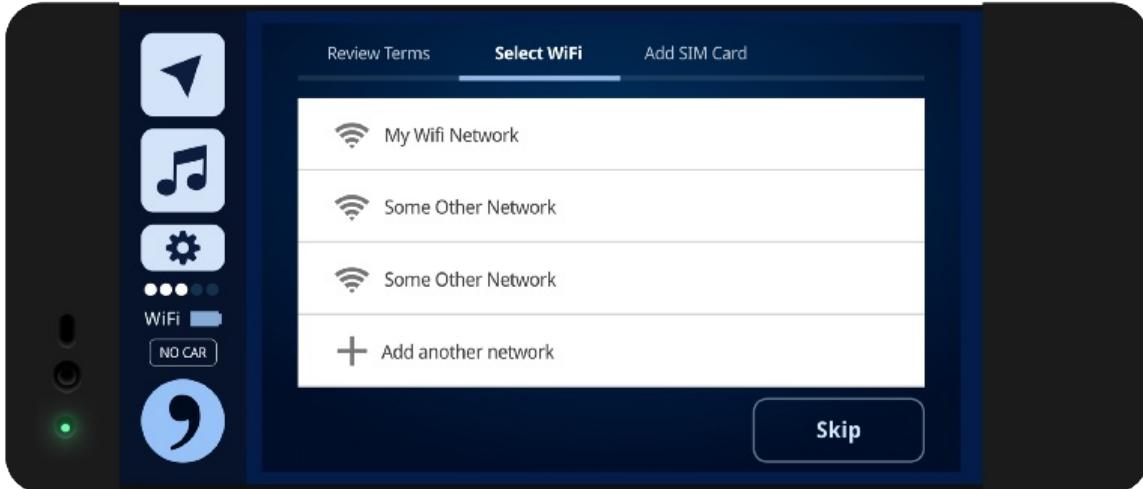


### 4. Select your WiFi

This step may not be available in some versions of [OpenPilot](#).

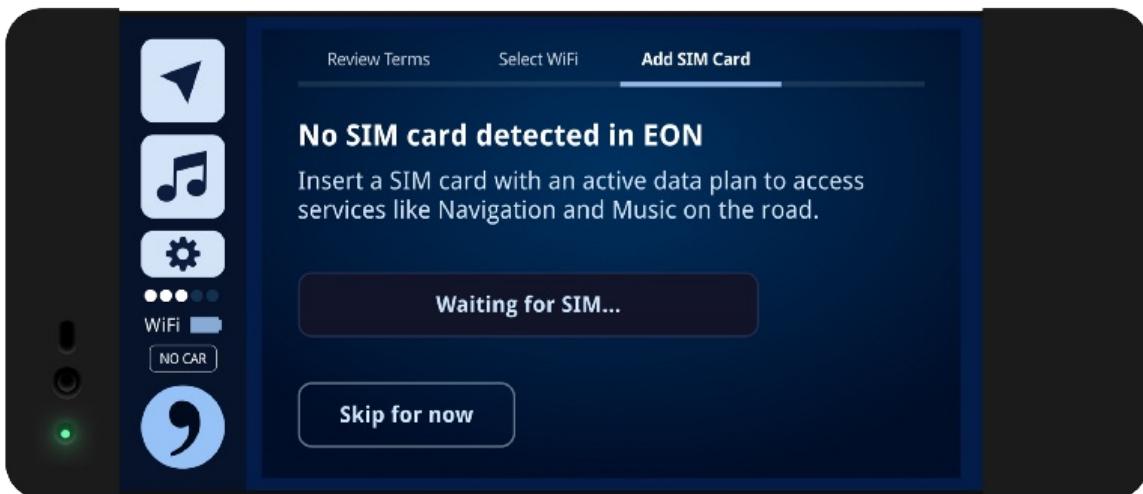
I've seen it get skipped in some cases but if it shows for you, feel free to select your WiFi and connect.

If it does automatically skip for some reason, no fear—you can add this later.

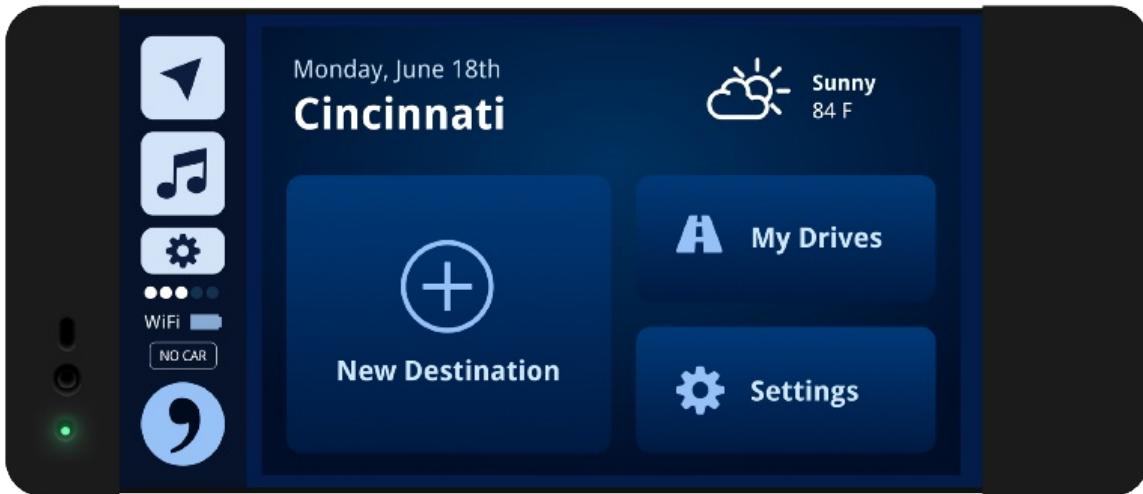


## 5. Adding a SIM Card

If you have a SIM card with an active data plan, insert it into the slot on the side of the [EON](#). If not, no worries—you can either roll without a SIM card and upload via WiFi (like I do) or you can go get one later.



## 6. The EON Dashboard



This is the basic “Home” screen you’ll see whenever [EON](#) comes on.

The [New Destination](#) and [My Drives](#) buttons are for [Chffrplus](#).

If you’re seriously just using the [EON](#) for [Chffrplus](#), then you can stop now with this guide and enjoy.

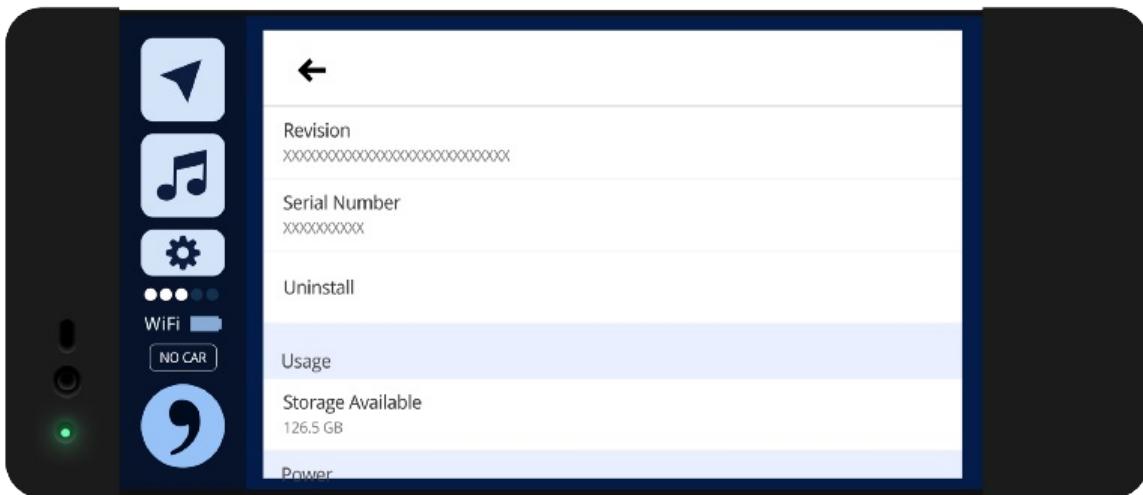
If you’re planning to use [OpenPilot](#), you probably won’t ever use the buttons on this screen very often.

## 7. Uninstall Chffrplus

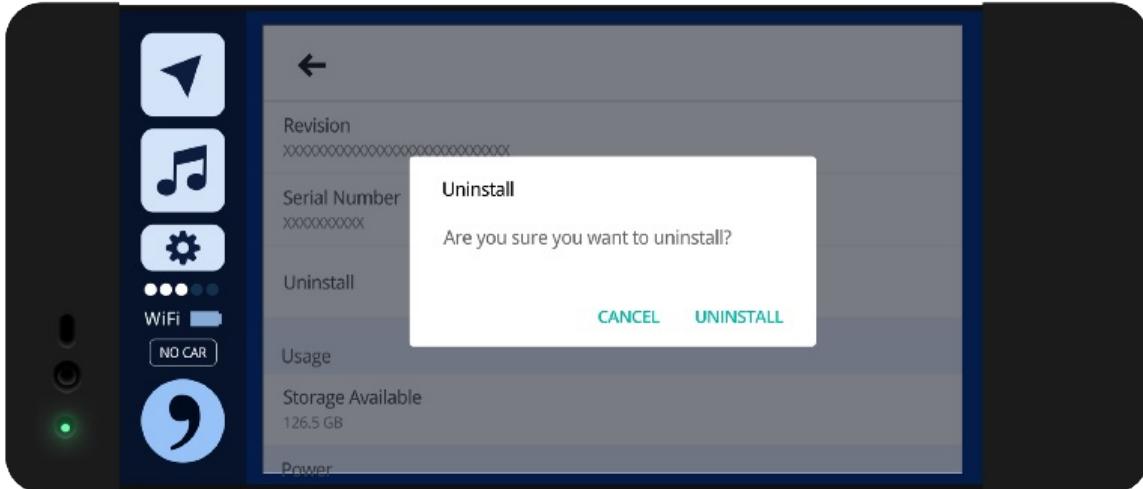
In order to install [OpenPilot](#), we must first uninstall the existing [Chffrplus](#) software. In the end, [Chffrplus](#) is just [OpenPilot](#) minus a basic setting... but this is the friendly installer so we must go through this process.

Tap on **Settings** on the home screen.

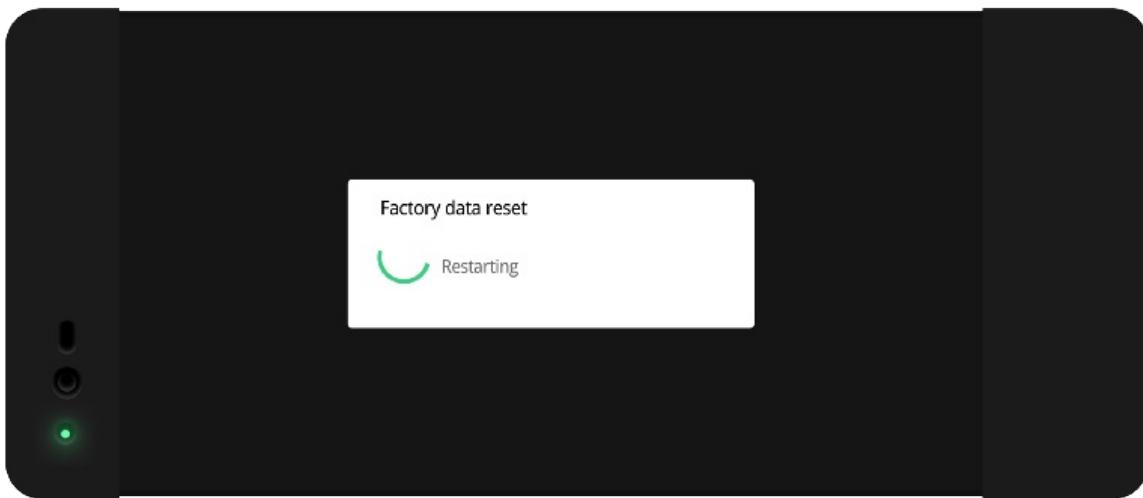
Scroll down the setting screen and tap on **Uninstall**



Confirm your choice by tapping [Uninstall](#) once more.



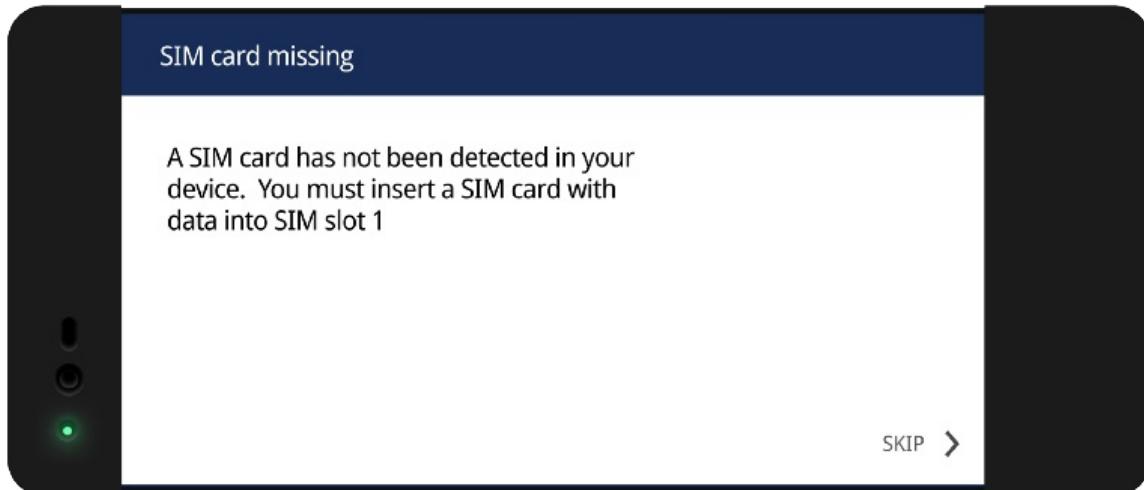
Your EON will restart.



Now you will be taken through a series of prompts.

## 8. SIM card prompt

If you did not insert a SIM card earlier, you will probably get prompted again for this. You can just skip it as you could before.



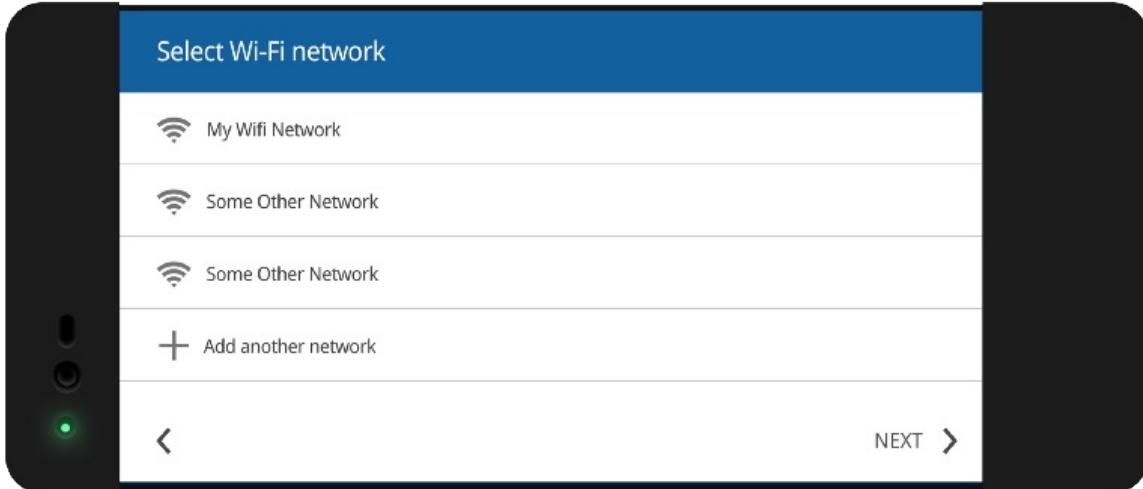
In some versions of [OpenPilot](#) there is a prompt like this that temporarily displays. It'll go away on its own I believe, or just hit Skip.



## 9. Select Wi-Fi network

You will be definitely need to connect to Wi-Fi at this point since the next step requires a download from Comma.

Enter that now.



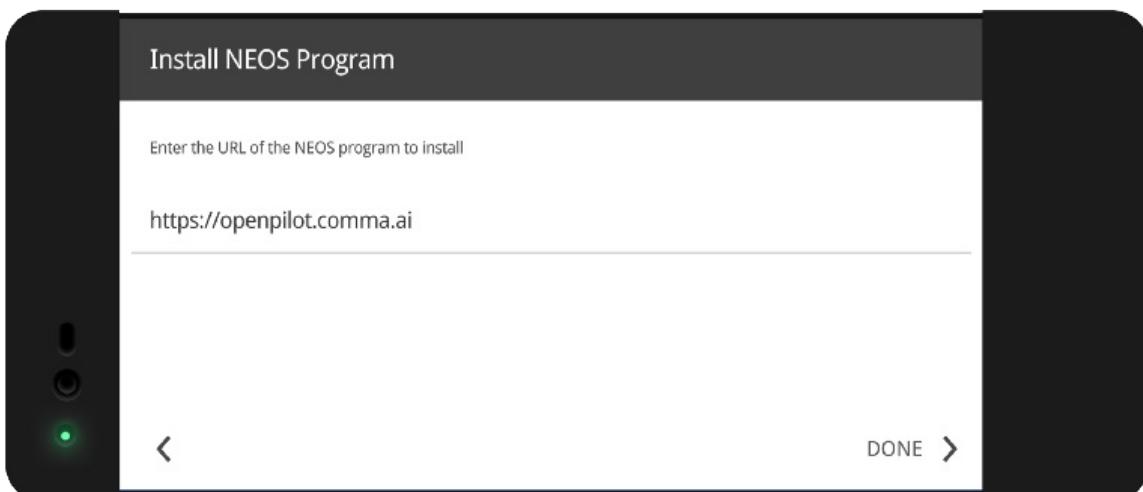
## 10. Install NEOS Program

A NEOS Program as of right now is just [OpenPilot](#).

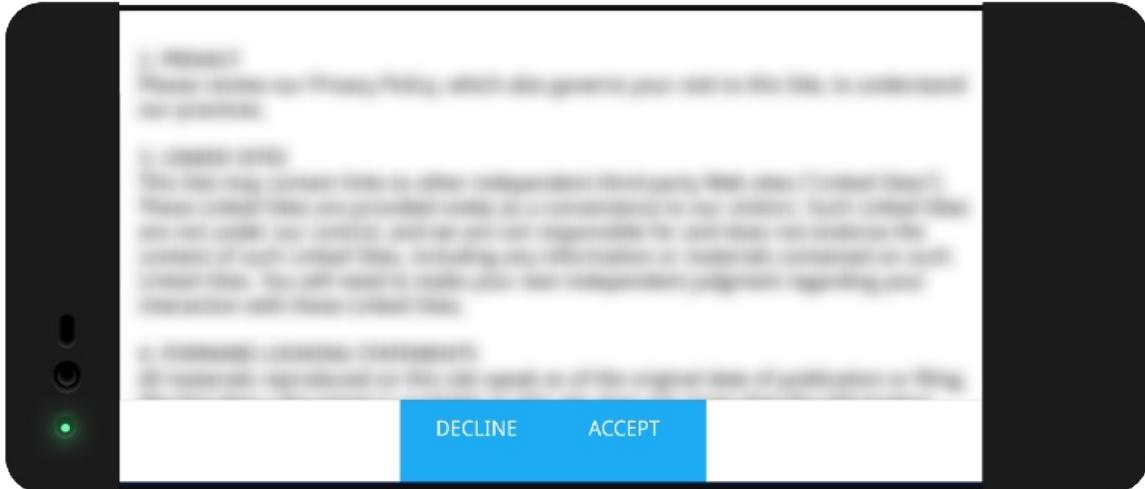
Enter the following address in the box:

```
https://openpilot.comma.ai
```

Press **Done** to continue.

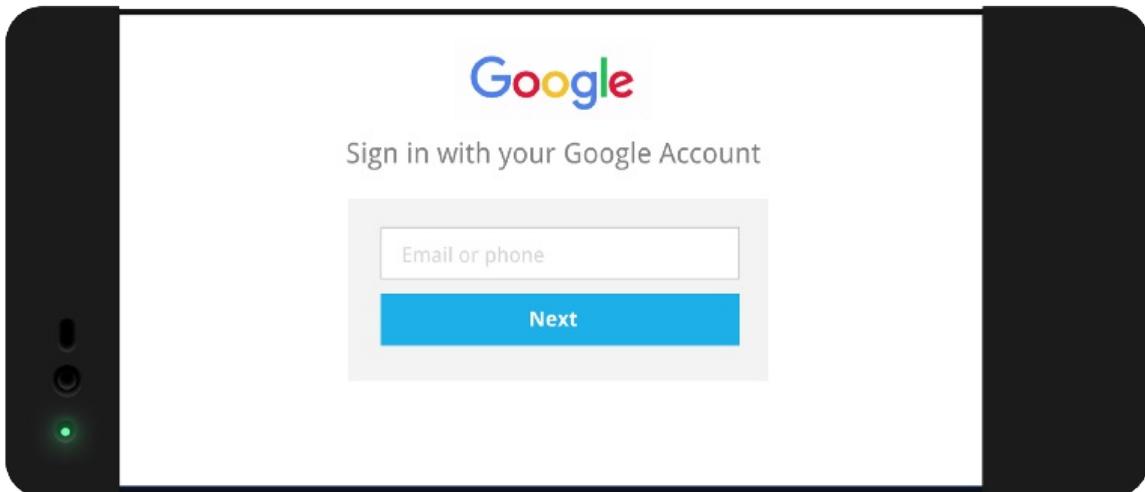


Review the Terms & Conditions and press **Accept**.



Now you will be taken back to the Dashboard screen where you will press Sign In, which will load a prompt to Google Login.

You will need a Google Login to continue as of today. This may change later I'm sure as Comma's system matures.



Once logged in, that's it! You should now be running [OpenPilot](#).

It looks a lot like [Chffrplus](#), the only difference is—when plugged into a [Giraffe](#) / [Panda](#), you will enable LKAS / ACC features of [OpenPilot](#) when you start your car and it's plugged in correctly.

A special thanks to the original author of this write up found here:

Comma EON: Initial Setup with OpenPilot <https://medium.com/@jfrux/comma-eon-initial-setup-with-openpilot-2b5ea58354a>

## **Acura**

## ILX

### Supported Models

#### 2016 Acura ILX w/ Acura Watch

- Due to use of the cruise control for gas, it can only be enabled above 25 mph

### Videos

<https://www.youtube.com/watch?v=YuKAmsMg2ZE>

# RDX

## Supported Models

### 2018 Acura RDX w/ AcuraWatch Plus

- Alpha level support as of July 8th, 2018
- Can only be enabled above 25 mph

## Videos

<https://www.youtube.com/watch?v=9lFvn-hlqZw>

## Cadillac

Support for Cadillac is extremely limited.

Only confirmed support we have at the moment is of the 2018 CT6.

Checkout the [CT6 page](#) for more information.

# CT6

## Supported Models

### 2018 Cadillac CT6

This is very alpha, not necessarily even officially released yet we don't think.

## Videos

<https://www.youtube.com/watch?v=dPTBbl3LHA8>

<https://www.youtube.com/watch?v=UJyMB6u5sHM>

## Chevrolet

Support for Chevrolet is limited to the Volt at the moment but has made great strides over the past year. Checkout the [Volt page](#) for more information.

## Volt

### Supported Models

#### 2017+ Chevrolet Volt Premier w/ Driver Confidence II

- Read the [installation guide](#)

### Videos

<https://www.youtube.com/watch?v=lYa5vQQEX2w>

[https://www.youtube.com/watch?v=HltlRXw\\_QI4](https://www.youtube.com/watch?v=HltlRXw_QI4)

<https://www.youtube.com/watch?v=O6qe24ILFL0>

## Honda

Most modern Honda vehicles are supported as long as they have Honda Sensing package.

The [Civic](#) seems to have the most support and works the best from our experiences.

# Accord

## Supported Models

### 2018 Honda Accord w/ Honda Sensing

- Alpha level support is given currently as of July 5th, 2018.
- Uses stock Honda Sensing for longitudinal control

## Videos

<https://www.youtube.com/watch?v=1zCtj3ckGFo>

# Civic

## Supported Models

### 2016+ Honda Civic w/ Honda Sensing

- Due to limitations in steering firmware, steering is disabled below 12 mph
- Note that the hatchback model is not supported

### 2017+ Honda Civic Hatchback w/ Honda Sensing

- Alpha level support is given currently as of July 5th, 2018.
- Due to limitations in steering firmware, steering is disabled below 12 mph
- Uses stock Honda Sensing for longitudinal control

## Videos

<https://www.youtube.com/watch?v=62NIAyTxcjk>

<https://www.youtube.com/watch?v=9TDi0BHgXyo>

[https://www.youtube.com/watch?v=XaVs\\_\\_Bmhms](https://www.youtube.com/watch?v=XaVs__Bmhms)

<https://www.youtube.com/watch?v=IHjEqAKDqjM>

## CR-V

### Supported Models

#### 2017-2018 Honda CR-V w/ Honda Sensing

- Alpha level support as of July 8th, 2018
- Due to limitations in steering firmware, steering is disabled below 12 mph
- Uses stock Honda Sensing for longitudinal control

#### 2015-2016 Honda CR-V Touring

- Can only be enabled above 25 mph

### Videos

<https://www.youtube.com/watch?v=HZBZ0On9hK8>

<https://www.youtube.com/watch?v=KrphqTCmoNk>

## Odyssey

### Supported Models

#### 2018 Honda Odyssey w/ Honda Sensing

- Alpha level support as of July 5th, 2018
- Can only be enabled above 25 mph

### Videos

<https://www.youtube.com/watch?v=JmlhA390cxo>

## Pilot

### **2016+ Honda Pilot with Honda Sensing**

- Alpha level support as of July 5th, 2018
- Can only be enabled above 27 mph

## Videos

<https://youtu.be/PySMKW3tbDs>

## Ridgeline

### **2016+ Honda Ridgeline with Honda Sensing**

- Alpha level support as of July 5th, 2018
- Can only be enabled above 27 mph

## Videos

<https://www.youtube.com/watch?v=L2CF0jHyMxY>

## Lexus

Lexus support is limited to the [RX](#) at the moment. Find details about the [RX here](#).

# RX

## Supported Models

### 2017+ Lexus RX Hybrid

- Alpha level support as of July 8th, 2018
- By default it uses stock Lexus ACC for longitudinal control
- [openpilot](#) longitudinal control available after unplugging the [Driving Support ECU](#)

## Videos

[https://www.youtube.com/watch?v=\\_oX3ec45yew](https://www.youtube.com/watch?v=_oX3ec45yew)

<https://www.youtube.com/watch?v=vK2bMxMXVLM>

<https://www.youtube.com/watch?v=F8OwdVbwps4>

# Tesla

## Model S

### Supported Models

Pre-autopilot 2013, 2014's.

### Repository

<https://github.com/jeankalud/openpilot>

### Video

<https://www.youtube.com/watch?v=v3jjzRYBsJl>

<https://www.youtube.com/watch?v=iRkz7FuJsA8>

<https://www.youtube.com/watch?v=UkS-iJ5auD4>

<https://www.youtube.com/watch?v=F8OwdVbwps4>

## Toyota

Many great modern Toyota models have received support in the past year.

They must have at least the TSS-P package.

Browse the models to find out more details.

## Corolla

### Supported Models

#### 2017+ Toyota Corolla

- By default the Corolla uses stock Toyota ACC for longitudinal control.
- Openpilot longitudinal control can be made available after unplugging the [Driving Support ECU](#). Control can be enabled above 20 mph.

### Videos

<https://www.youtube.com/watch?v=OikZ6J1YDII>

# Prius

## Supported Models

### 2017+ Toyota Prius

- By default it uses stock Toyota ACC for longitudinal control
- [openpilot](#) longitudinal control available after unplugging the [Driving Support ECU](#)
- Lateral control needs improvements

## Videos

<https://www.youtube.com/watch?v=yJAS-xeoTc0>

## RAV-4

### Supported Models

#### 2016+ Toyota RAV-4 Non-Hybrid w/ TSS-P

- By default it uses stock Toyota ACC for longitudinal control
- [openpilot](#) longitudinal control available after unplugging the [Driving Support ECU](#) and can be enabled above 20 mph

#### 2017+ Toyota RAV-4 Hybrid

- By default it uses stock Toyota ACC for longitudinal control
- [openpilot](#) longitudinal control available after unplugging the [Driving Support ECU](#) and can do stop and go

### Videos

<https://www.youtube.com/watch?v=jGNMsypQd8Q>

## EON

The [EON](#) is sold as a Dashcam by Comma.ai, Inc. However, it is commonly not purchased for that purpose, rather; is used by motivated people to install third-party open source software on it known as [openpilot](#).

### What is it made of?

You'll notice that it looks like a cellphone with a funny case on it.

That's because that is precisely what it is in essence. This is an [OmniPlus 3T](#) mobile smart phone loaded with a custom version of Android maintained by the team at [Comma.ai, Inc.](#).



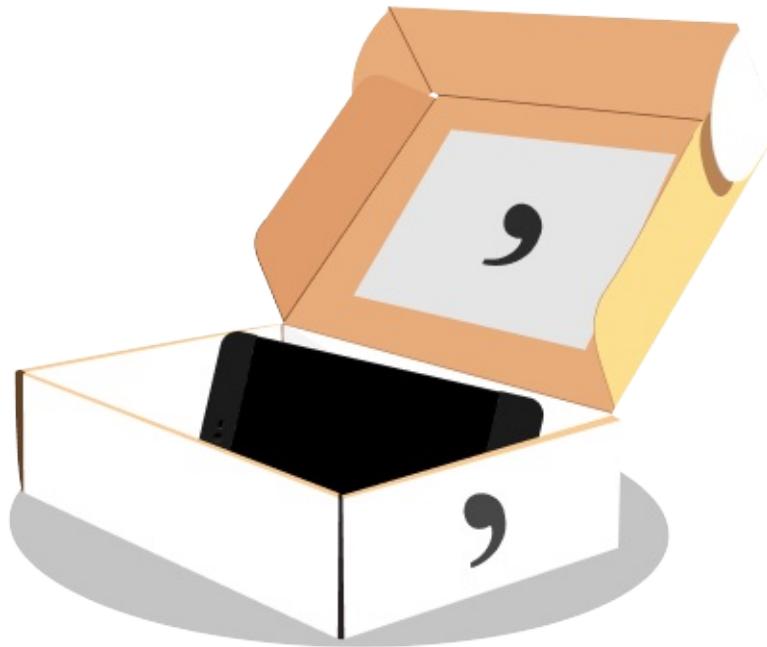
Mounted to the back of it, and held on but 3D Printed ABS panels and pieces is a custom PCB board with a fan and large heat sync used to regulate the device from overheating because of how the CPU is clocked to do things it wasn't really ever designed to do. Which although sounds bad, is actually an amazing thing for a smartphone and its job is very important so that's why it exists.



## Get an EON

### Purchasing an EON

The [EON](#) is sold exclusively at [shop.comma.ai](https://shop.comma.ai).



### Build an EON yourself

Well, it is entirely possible to build it yourself but it may end up costing you about the same as the [EON](#).

I recommend checking out the [Comma Wiki](#) and the [Comma Neo Repository](#) for information on the pieces needed to make it work.

### Examples of some builds

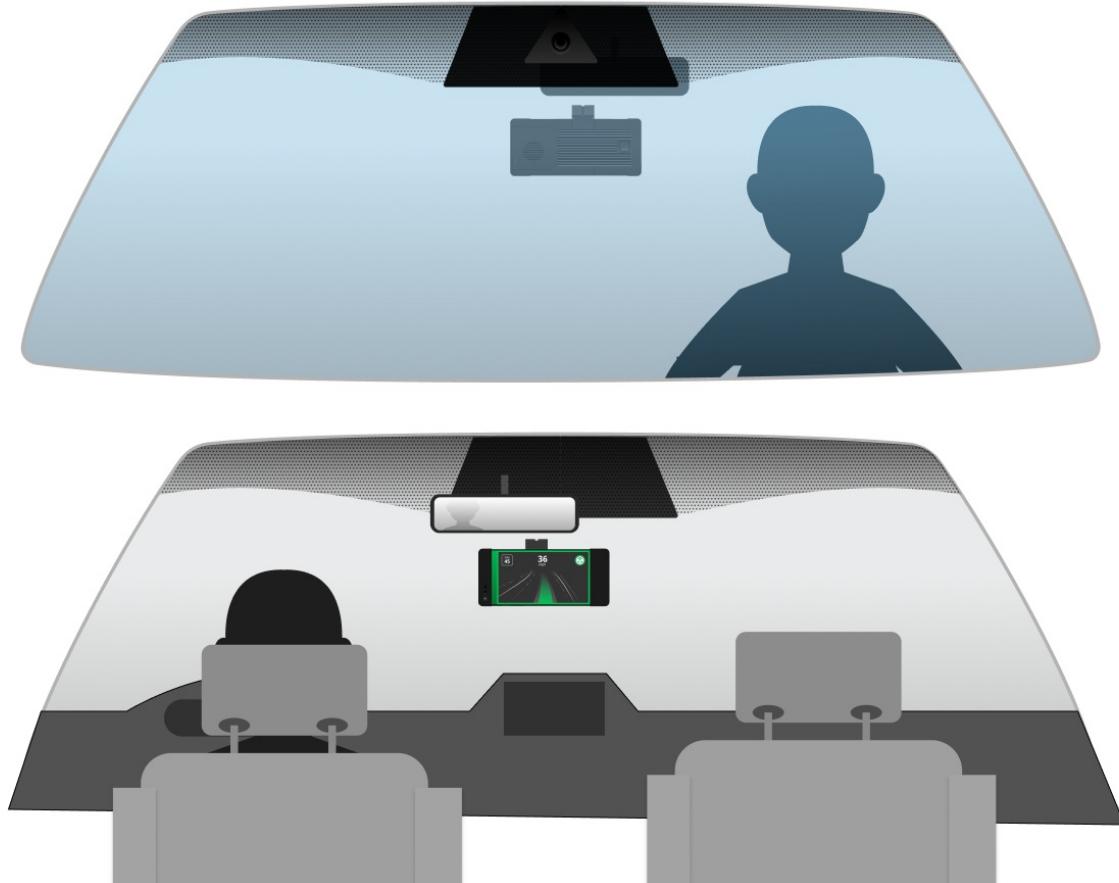






## Installation

Installing the [EON](#) is easy and is as simple as pealing some 3M tape backing off and finding the best spot for it on your windshield. The [EON](#) slides in and out of the mount cleanly and snuggly.



[EON](#)'s shipping today have a mount already attached in the correct position. There are two positions for it on both sides of the device but you shouldn't need the other side. In fact, they may stop shipping the with the flipping option.

It should look similar to the following image.



## Videos

### Honda

For installation in a Honda, see this [<https://www.youtube.com/watch?v=62NIAyTxcjk> tutorial video to find out correct placement and installation with a [panda](#) and [giraffe](#).]

### Toyota

For installation in a Toyota, see this [<https://youtu.be/jGNMsypQd8Q> instruction video].

## Mounting the EON

# How to Mount the EON

This page contains tips and suggestions originally from [medium/@jfrux](#).

Feel free to PR your suggestions.



I know there is a *wealth* of information available on the [Comma Wiki](#) but there are just some things that seem to be overlooked or misunderstood by some users and I want to hopefully help remedy this by getting this article out there.

## The Problem (but not really)

If you're like me, you probably didn't put much initial thought into mounting your **EON**. You probably mounted it initially without thought or question and then you startup **EON** and OP and start driving, and for one reason or another the **EON** is not tracking or is pulling to one side, even after "calibration".

*By the way, the calibration step is mainly a safety feature to keep you from engaging [openpilot](#) while the car is not tracking lane lines and cars yet. If you ever move your **EON** it will need some time to realign and calibrate (without hitting Reset Calibration)*

After realizing this, they stop driving and end up in the [Comma Slack](#) channel. And other user's responses have always been "Well it's probably the yaw, or pitch or your face ...".

And the truth is, more often than not it's mounted just fine.

Stop worrying, breathe.

It's fairly common sense and most people understand that it should be as visually straight as possible... that's kind of the general idea, but the responses in Slack about "Yaw" and "Pitch" cause people to spend days doubting their purchase, as well as doubting themselves and how straight their [EON](#) is.

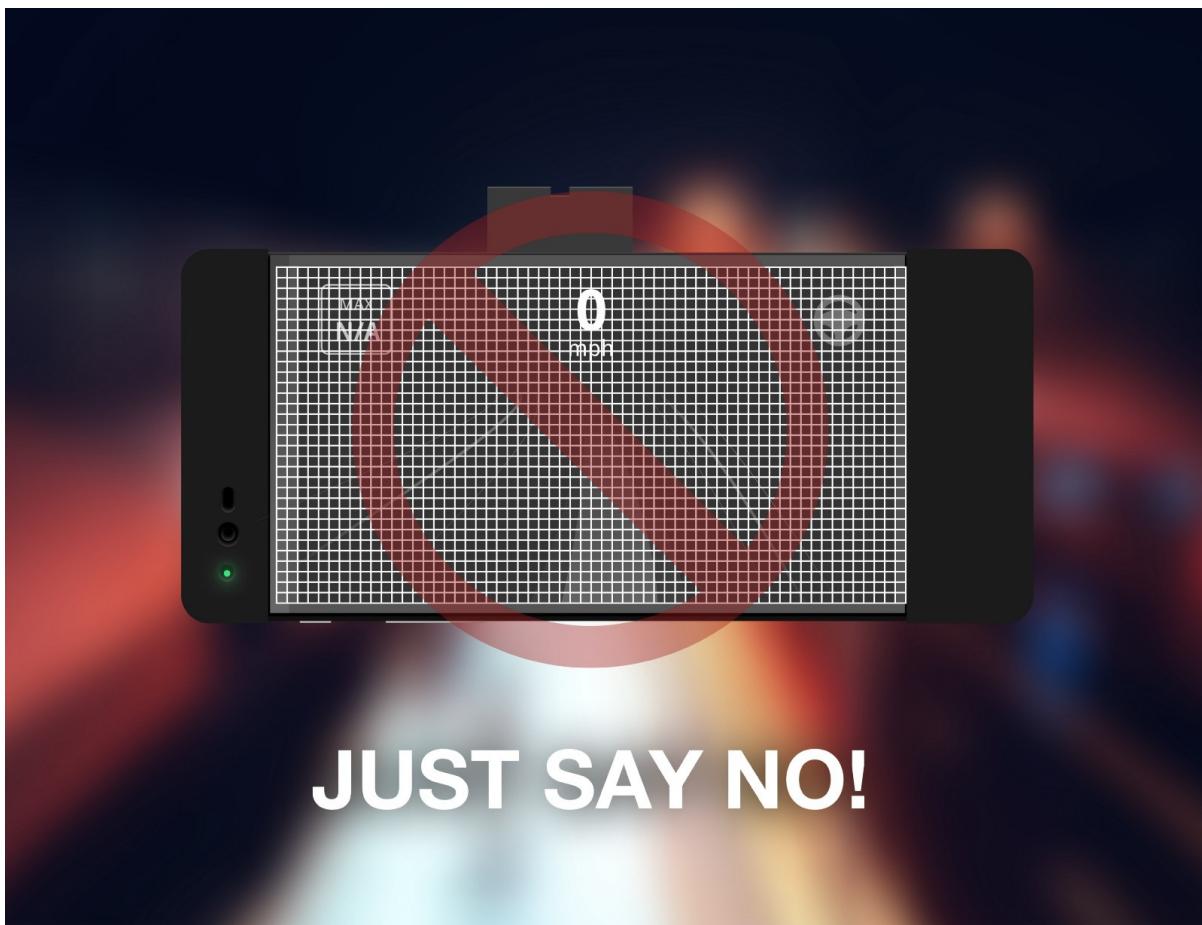
## The Solution

Eyeball it and make it as straight on and as perpendicular as you can under your mirror.

Your vehicle's stock camera is generally centered but not always, so don't think that's the best placement or that you should concern yourself with that.

### Things you should NOT to try:

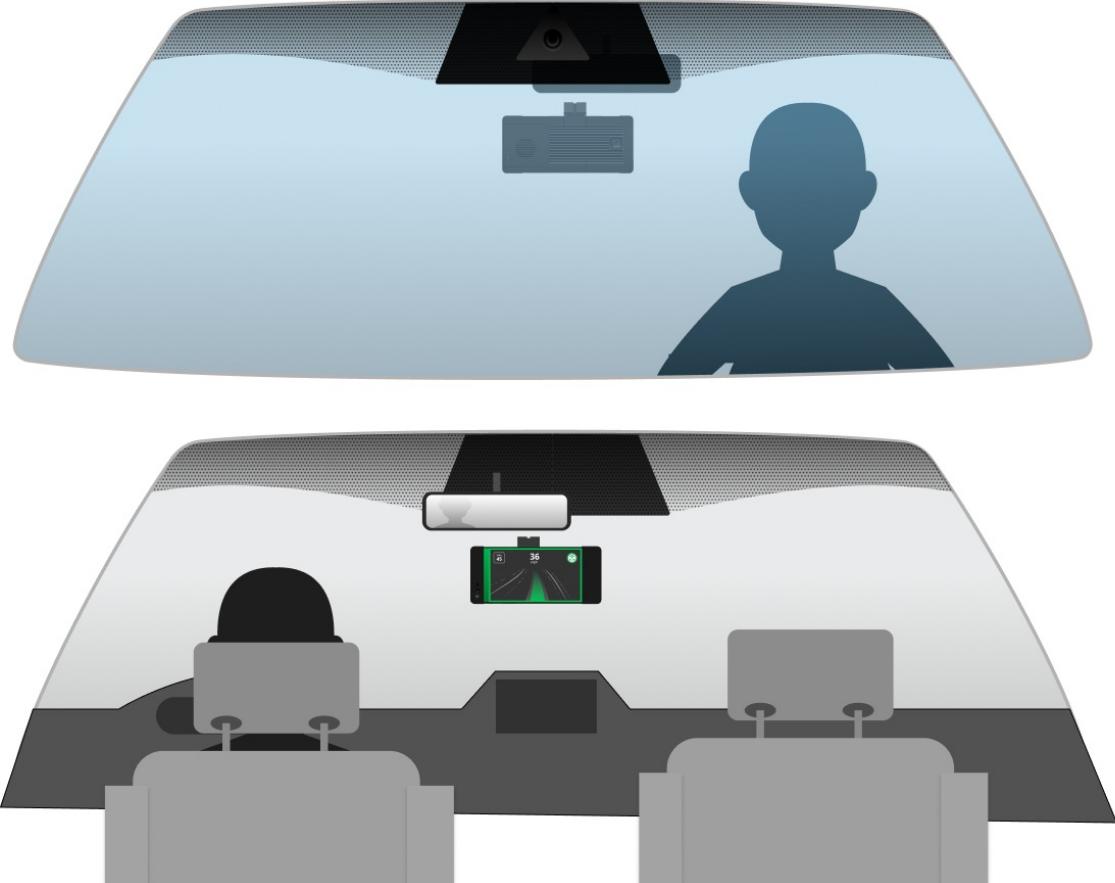
- **Do NOT** get all technical about it. It's just not necessary. One way to find out if you're overthinking it is ask yourself: "Do I have a ruler, measuring tape, or some other modern sophisticated measuring device in the palm of my hand?" If you answer yes to any of those, you're overthinking it.
- **Do NOT** try to park your car in a street somewhere to use the lane lines as a guide. The [EON](#) will not always track the lane lines when you first get your [openpilot](#) running and you can't friggin' mount it and watch the lane lines at the same time. *This may have been useful at one point, but it's just a waste and not safe.*
- **Do NOT** SSH into your device and turn on GRIDDED UI. The grid is so dense that you won't be able to see anything or make any real judgements on things still. *This may also have been useful at one point but it's just not that important now. It's clear as mud. See below.*



### Things you SHOULD try:

- **Do** mount the [EON](#) on the correct angled bracket for your windshield. I believe Comma provides a 22deg and a 28deg. The correct mount is the one that makes the [EON](#) as vertically level to the ground as possible. As perpendicular to the ground as possible. If you were to put a bubble level on it (if you could fit it on top, as center

bubbled as possible).



- **Do** try to get the **EON** as perpendicular (or square) with the front of your car as much as possible (eyeball it). You'll just have to use your best judgement and if things look fairly square then you're good.



- **Do** get a small roll of 3M VHB double-sided gray tape with red backing. Or comparable. It's a foam core based double-sided tape that is very strong and heat resistance and doesn't gunk up like clear alternatives and doesn't move or jar when you bump it. It's also easy to remove later with a metal putty knife. <http://a.co/gaQx2rM>



- **Do** try to get the **EON** as parallel with the Earth as possible. You can even carefully use a small bubble level on the top of the **EON** to get assurance that it's level. The perpendicular with the car part, (eyeball it) and as center to the window as possible (maybe even slightly left for the inward facing camera to see you).

You should try to get your **EON** as perpendicular (or square) with the front of your car as much as possible and as parallel with the Earth as possible. You can even carefully use a small bubble level on the top of the **EON** to get assurance that it's level. The perpendicular with the car part, you'll just have to use your best judgement.

My recommendation for mounting tape for the **EON** is this stuff, or something extremely similar. The reason I say this is that this stuff doesn't budge and jar the **EON** when you hit rough road ways. It holds very strong and doesn't fall off at all or melt in high temps.**3M Scotch 5952 VHB Tape: 1 in. x 15 ft. (Black)**

[\\_3M 5952 Heavy Duty Mounting VHB Tape](#) is black, double-coated VHB adhesive tape with an acrylic foam core. A modified...[\\_a.co](#)

## Calibration

Initial calibration most likely will ever only need to be done one time.

After that, as long as your mount position stays the same—OP should be able to see the lane lines and cars just fine.

### Go on a long-ish drive

Sometimes it can take awhile for OP to get good at what it does.

It must run your roadways through its machine learning model to get really good and that usually takes like 20–40 miles of express way driving I've found. The more you drive, the better it should get in the end.

I highly recommend express way driving for getting [openpilot](#) properly calibrated. Don't try to run OP on backroads and expect it to stay put upon initial calibration.

After mounting [EON](#), give it a few days of commuting / long driving before considering moving it again. Chances are you probably have it right the first time.

### After repositioning [EON](#) mount

If you move your mount, you shouldn't need to recalibrate or reset calibration. Just take a nice drive on an express way and ensure [openpilot](#) is seeing lane lines and seeing the cars properly before engaging [openpilot](#).

Keep it up and it'll get better!

## Universal Ball Mount

### Universal Ball Mount for EON Dashcam DevKit

This is a universal ball bracket for mounting the [Eon](#) Dashcam Kit to any windshield. The [Eon](#) Dashcam Devkit is a piece of hardware sold by Comma.ai that runs [Chffr](#), a tool that is helping to train a computer model to drive cars like Humans. Also useful for running the open source [Openpilot](#) autonomous driving software package, available on GitHub.

### Link to 3D Model

Thingiverse: [Universal Ball Mount for Eon Dashcam](#)

## Giraffe

The [Giraffe](#) is a piece of hardware that allows [Panda](#) to get access to the vehicle's control buses that are generally not exposed via the standard diagnostics port. Usually the LKAS and ACC sensors and commands live on these buses.

## Get a Giraffe

### Purchase directly from Comma

There are many ways to acquire a [Giraffe](#) but the easiest way by far is to purchase it directly from [shop.comma.ai](#). Devices purchased from [shop.comma.ai](#) are personally built, tested, and shipped directly from the team in San Francisco. It is the only "official" place to purchase one.

### Purchase from a community member

Another option is to find one that is no longer needed or one that is built by a community member.

You can interact with the community directly by joining the [Comma Slack](#) channel and getting to know the people there. Lots of fun times.

### Build it yourself

The last and possibly the least popular of the options is building it yourself. The [Giraffe](#) is open source hardware and the schematics for building your own are posted to the comma GitHub account in the [commaai/neo](#) repository.

## Installation

## Removing Giraffe from Vehicle

Removing [Giraffe](#) is usually not necessary, but if you feel the need to remove it for whatever reason, here is a quick guide.

- From the back of the [Giraffe](#)
- Follow it up from the bottom
- There is a tab to depress
- [Giraffe](#) slides out

We've found that using a flat head screw driver gently to reach the tab it tends to just pop right out with very light pressure.



# Types of Giraffes

## Types

There are 3 types of [Giraffe](#)'s you can buy from Comma.ai but many community members have built custom ones for other members as well.

### Honda (Nidec)

#### Description

This [giraffe](#) is designed for new model year Honda/Acura cars that have Honda Sensing/AcuraWatch Plus and Nidec hardware, which is found on the following cars; Honda Civic (non hatchback), 2015/16 Honda CR-V, Honda Odyssey (connector is upside down), Honda Pilot, Honda Ridgeline, Acura ILX, Acura RDX. It may also work on other cars with the same connector.



#### Where to buy?

This is open source hardware.

You may build it yourself, or order an official module from [Comma.ai](#).

### Honda (Bosch)

#### Description

This [giraffe](#) is designed for new model year Honda/Acura cars that have Honda Sensing/AcuraWatch Plus and Bosch hardware, which is found on the following cars Honda Civic Hatchback, 2017+ Honda CR-V, and 2018+ Honda Accord. It may also work on other cars with the same connector.

*(Honda Bosch ships in 2-8 weeks as of July 2nd, 2018)*



## Where to buy?

This is open source hardware.

You may build it yourself, or order an official module from [Comma.ai](#).

## Toyota

### Description

This [giraffe](#) is designed for new model year Toyota cars with TSS-P, which is found on the following cars; Toyota RAV-4, Toyota RAV-4 Hybrid, Toyota Prius, Toyota, Corolla, and Lexus RX Hybrid. It may also work on other cars with the same connector, probably all TSS-P Toyota. Verified fit on 2017 models.



## Where to buy?

This is open source hardware.

You may build it yourself, or order an official module from [Comma.ai](#).

## Panda

The [Panda](#) is a universal interface for your car.

It helps you to connect a computer directly to your car, allowing you to send and receive signals over Wi-Fi or USB directly to/from the available BUSes available in your vehicle

To put it simply... [Panda](#)'s allow you to talk to your car over USB and WiFi.

[Panda](#) supports 3 CAN buses, 2 LIN buses, and 1 GMLAN.

The software for [Panda](#) is 100% open source so that programmers (possibly like yourself) can easily pull down the code base and see what is going on under the hood.

## Videos

<https://www.youtube.com/watch?v=VPZtihs3s48>

## Get a Panda

### Grey Panda

The Grey [Panda](#) is the future and will be the only supported [Panda](#) for [openpilot](#) when v0.6.x drops.

It is sold exclusively on the [Comma.ai Shop](#).

### White Panda

The White [Panda](#) is sold as the best ODB-II interface for your car. It supports WiFi and USB for sending CAN messages to your computer or phone. It also is the primary companion to your [Chffr](#) DashCam app for iOS and Android.

You have two options to purchase the White [Panda](#) and they are:

- [Amazon](#)
- [Comma.ai Shop](#)

## **Troubleshooting**

### **Panda only flashes green**

[https://community.comma.ai/wiki/index.php/Panda\\_Flashing](https://community.comma.ai/wiki/index.php/Panda_Flashing)

## **Panda just flashes green**

## Pedal

The [Pedal](#) is not a physical gas [pedal](#) or brake [pedal](#), it's an interceptor device used to send small signals to your car to apply the gas during times when your stock vehicle otherwise would not.

[Go to Guides](#)

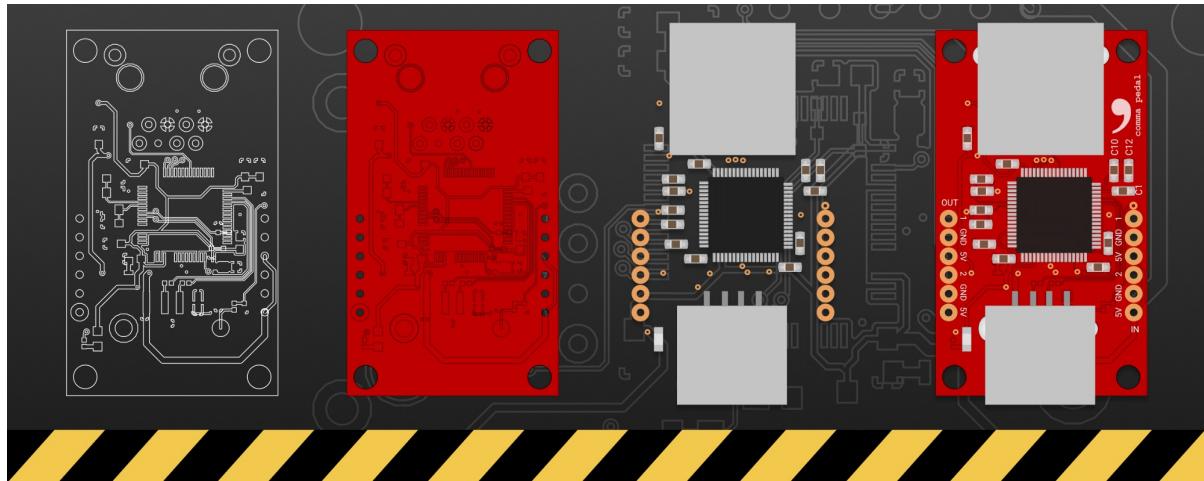
## Get a Pedal

Getting a Comma [Pedal](#) is NOT EASY, nor should it be. It's not exactly a polished and warranted product and it can be dangerous or even deadly to alter the way your car was manufactured. In fact, it doesn't really even work... that is, unless you build it, flash firmware, and wire it inline with your car's Accelerator [pedal](#) (of which has to be already fitted with some sort of ACC modules) and ensure [OpenPilot](#) code exists to run it.

[Building Comma Pedal with Macrofab](#)

## Pedal Guides

# Comma Pedal: Building with MacroFab



Getting a Comma [Pedal](#) is NOT EASY, nor should it be. It's not exactly a polished and warranted product and it can be dangerous or even deadly to alter the way your car was manufactured. In fact, it doesn't really even work... that is, unless you build it, flash firmware, and wire it inline with your car's Accelerator [pedal](#) (of which has to be already fitted with some sort of ACC modules) and ensure [OpenPilot](#) code exists to run it. But for those of us who love this stuff (and want to punish ourselves)... we forge on.

## MacroFab

My first experience with MacroFab (and ordering PCB's in general) was when I went to order my [Comma Pedal](#). I had sent things to MacroFab before, but I didn't do it myself—someone more inclined always had. My background for the past 20 years is in computer science (mainly software development), but that's where most of my focus ended. I never really got into electrical engineering, soldering PCB's, or the physical side of computing all that much. I built a computer from NewEgg but that's hardly the same.

So when I heard I could order my own Comma [Pedal](#) from a company like MacroFab I thought, wow that sounds easy... well its not. And that isn't MacroFab's fault, it's just difficult if you don't know what you're doing. So that's why I'm writing this article.

The rest of this guide will have to do with the latest version of MacroFab's website so feel free to CMD+CLICK / CTRL+CLICK to open it in a new tab so you can keep the guide open below: [MacroFab.com](#)

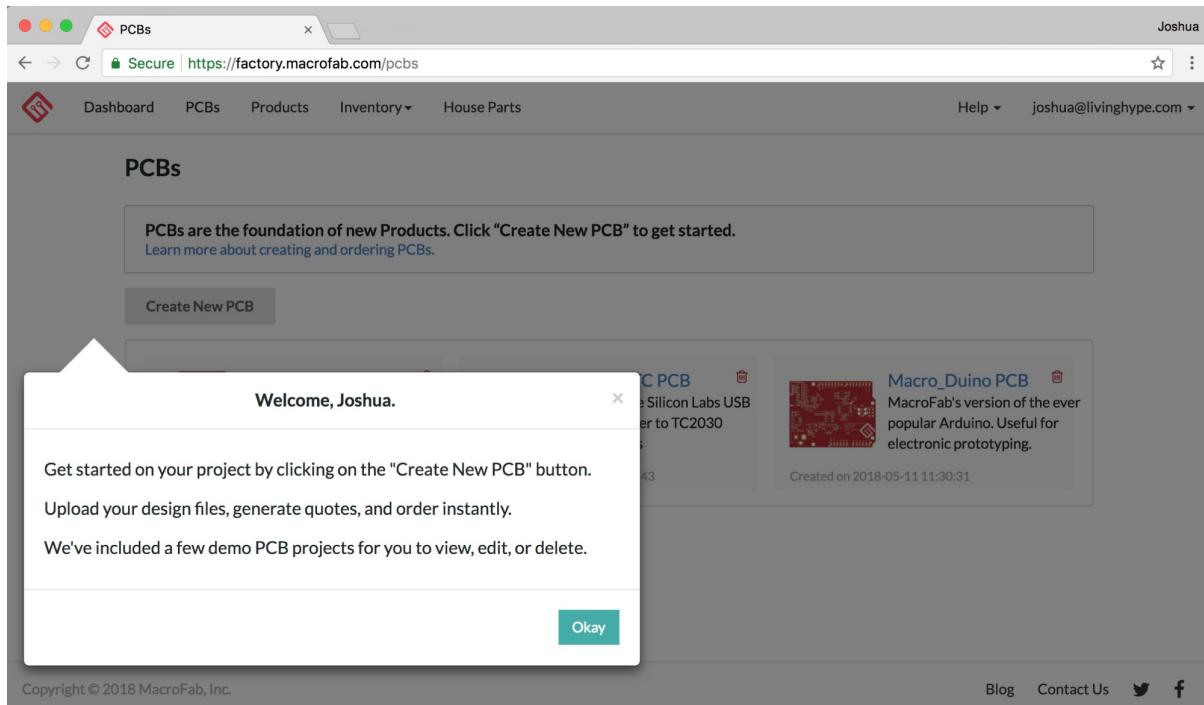
## Guide

### 01. Getting Started

You should already have a tab opened since you so obviously read my preface above... you did right? You better have, that's just rude to scroll down to the words "Getting Started" and miss all of my fluff.

Log in or Sign up first, might as well get that out of the way.

Once you're logged in for the first time, you will be taken to your dashboard and be greeted with a friendly Welcome message.



## Welcome to MacroFab

Now, the first thing you should notice is that the arrow of the popover does not line up with the Create New PCB button. Oh you didn't notice? Sorry, inner UX voice is speaking aloud again. Ignore this.

After clicking Okay, instead of Thank you... because we're rude like that... we will need to start creating our PCB. This ought to be interesting considering I don't even know what PCB stands for.

The screenshot shows the "New PCB v1 - Design" page. At the top, it displays "10 DAYS" (due May 25, 2018) and a total cost of "\$17.09". The "Quantity" is set to 1. Below this, the "Version 1" and "Created on May 11, 2018" are shown, along with a "Description: A short description." section. There are four tabs at the bottom: "Design" (which is selected), "Bill of Materials", "Part Placement", and "Quote & Order". A "Upload Files" button is located above the "Or simply drop your PCB files here." section. The "Or simply drop your PCB files here." section contains a note about supported formats (Eagle, KiCad, DipTrace, Altium, PADS, Gerber, MacroFab XYRS, and Standalone Bill of Materials) and a bulleted list of file types for each format.

Drop my PCB files? I was not told there would be files involved in this guide... awkward. Okay, I'm out.

Alright so, we got our order started and it's already going to be \$17.09 and take 10 days to build even though I haven't really given them anything yet... Well, like your favorite tax software, these numbers can and will change as you move through the steps.

## 02. Find the build files

So I lied, we won't ONLY be on MacroFab's website for the remainder of the article. Quick detour...

Head on over to `commiaai/neo` repo on GitHub, or follow the link below:

<https://github.com/commiaai/neo/tree/master/pedal>

This is the link for the HARDWARE side of your Comma [Pedal](#). It has all of the files needed to build your PCB.

### Finding the Board Files

Click on the `board` link and then click the `interceptor.brd` then click on the **Raw** button.

### GitHub File Preview of interceptor.brd

Go to File > Save As or (CMD+S or CTRL+S).

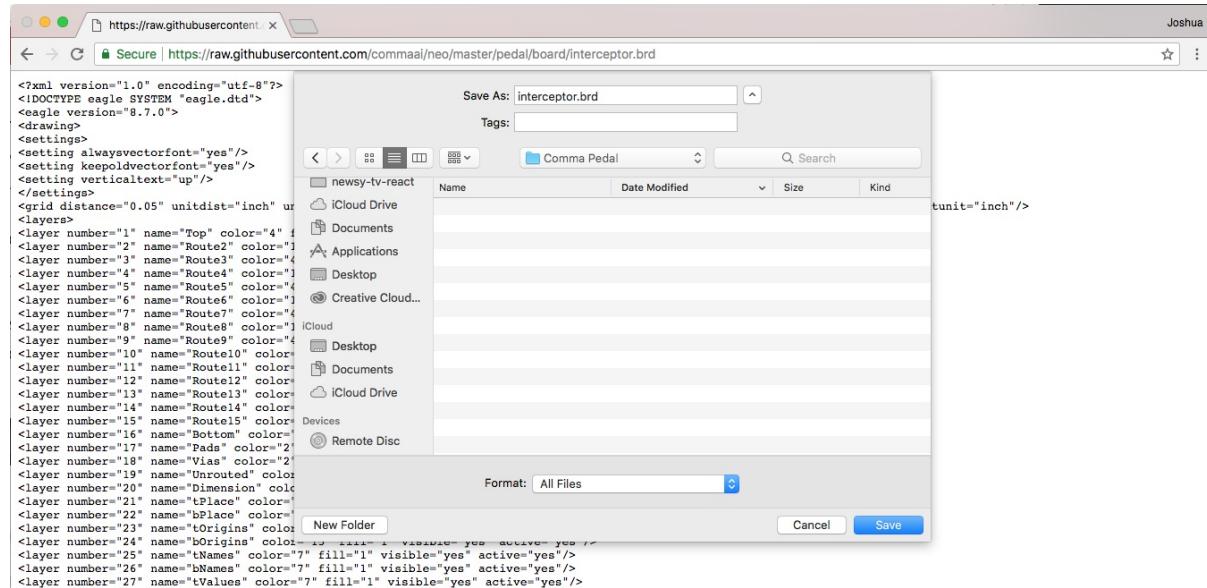


Diagram of File &gt; Save As

I had to do it this way, right clicking and going to **Save Link As** did not bode well on MacroFab, it didn't like the file type or something. Make sure you remove .txt file extension from the Save As: box, and change Format to All Files so it saves as an actual `**.brd**` instead of `.brd.txt`

Now do the same for the `BOM.csv` file. No worries, it's not an actual bom, I've already verified it won't blow anything up by using spelling.

Now, flip back over to that droopy MacroFab tab and drag that freshly downloaded `interceptor.brd` file onto the website to upload.

After you see some processing of the file happening (aka hamsters), we're finally getting somewhere exciting!

Wow, believe it or not, that was the easy part.

Now on to the next tab, which is **Bill of Materials**

## 03. Sourcing the materials

On the Bill of Materials tab, you'll be responsible for selecting the parts needed to produce this PCB.

The screenshot shows the MacroFab Bill of Materials interface. At the top, there's a navigation bar with links for Dashboard, PCBs, Products, Inventory, House Parts, Help, and user Joshua. Below the navigation is a summary box showing "10 DAYS MAY 25, 2018", "\$20.46 TOTAL", "Quantity 1", and a warning about 4 issues with the PCB. The main area has tabs for Design, Bill of Materials (which is selected), Part Placement, and Quote & Order. The Bill of Materials table has columns for Descriptors, Manufacturer Part Number, Value, Package, Quantity, Total Cost, Stock, Lead Time, and DNP. A red vertical bar highlights the first row, which contains part designators C5-C6, C8-C11, C13, C15, C26. The table also includes a "Parts" section, "Populated Parts" icon, "Form Factor" icon, and "Origin" icon. A "Hide Filters" button is located at the bottom right of the table.

Designators	Manufacturer Part Number	Value	Package	Quantity	Total Cost	Stock	Lead Time	DNP
C5 - C6, C8 - C11, C13, C15, C26	N/A No part selected.	<input type="button" value="🔍"/>	100nF	0603-C	9	-		<input type="checkbox"/>
C12	N/A No part selected.	<input type="button" value="🔍"/>	4.7uF	0603-C	1	-		<input type="checkbox"/>
C1 - C2, C16	N/A No part selected.	<input type="button" value="🔍"/>	2.2uF	0603-C	3	-		<input type="checkbox"/>
C3 - C4	N/A No part selected.	<input type="button" value="🔍"/>	12pF	0603-C	2	-		<input type="checkbox"/>
J15	N/A No part selected.	<input type="button" value="🔍"/>	RJ45 to OBDII	RA-RJ45	1	-		<input type="checkbox"/>
J1 - J2	N/A No part selected.	<input type="button" value="🔍"/>		1X06_NO_SILK_YES_STOP	2	-		<input type="checkbox"/>
J3	N/A No part selected.	<input type="button" value="🔍"/>	USB-ASMD-F	USB-A-S	1	-		<input type="checkbox"/>

Damn, you mean it didn't automatically search and locate all the parts I need? Unfortunately not.

Luckily for you, that's what the BOM.csv file was we downloaded earlier. Ahhh datz what da bom stands for.

Open up BOM.csv and reference each line to each part.

I found it was easiest to click the Magnifying glass next to the N/A No part selected. In the search box, copy / paste the MPN number from the BOM.csv file into the search box as seen below.

The screenshot shows the MacroFab Bill of Materials interface with a search overlay. The search bar at the top contains the text "GCM188R71C104KA37D". Below the search bar, a message says "1 result found." A table displays the search results with columns for Component, Package, Price Range, Unit Price, Total Unit Price, Stock, Lead Time, and Preferred. The first result is for component GCM188R71C104KA37D, package 0603, price range \$0.008 - \$0.123, unit price \$0.118, total unit price \$1.062, stock 1, lead time -, and preferred vendor Yes. There are also rows for parts C12 and C1-C2, C16 with their respective details.

Component	Package	Price Range	Unit Price	Total Unit Price	Stock	Lead Time	Preferred
GCM188R71C104KA37D 0603 0.1 uF 16 V ±10 % Tolerance X7R Surf...	0603	\$0.008 - \$0.123	\$0.118	\$1.062	-	-	Yes
C12	N/A No part selected.	<input type="button" value="🔍"/>	4.7uF	0603-C	1	-	<input type="checkbox"/>
C1 - C2, C16	N/A No part selected.	<input type="button" value="🔍"/>	2.2uF	0603-C	3	-	<input type="checkbox"/>

Then click the Select button on the matched item.

Repeat this for all parts in the list, except for the J1, J2, and HONDA-6PIN.

Check the DNP box next to the J1-J2.

<input type="checkbox"/>	Designators	Manufacturer Part Number	Value	Package	Quantity	Total Cost	Stock	Lead Time	DNP
<input type="checkbox"/>	C5 - C6, C8 - C11, C13, C15, C26	GRM188R71C104JA01D 0603 0.1uF 16V ±5% Tolerance X7R SMT ... <a href="#">Q</a>	100nF	0603-C	9+ 11 overage	-	-	Unknown	<input type="checkbox"/>
<input type="checkbox"/>	C12	CL10A475KQBNNNC CL10 Series 4.7 uF 6.3V ±10 % Tolerance X... <a href="#">Q</a>	4.7uF	0603-C	1+ 11 overage	\$1.58	1,006 units		<input type="checkbox"/>
<input type="checkbox"/>	C1 - C2, C16	EMK107B225KA-T 0603 2.2 uF 16 V ±10% Tolerance X5R SMT ... <a href="#">Q</a>	2.2uF	0603-C	3+ 11 overage	\$2.63	126,812 units		<input type="checkbox"/>
<input type="checkbox"/>	C3 - C4	C1608COG1H120J080AA Eia Case Size: 0603, Voltage: 50, Cap Value: ... <a href="#">Q</a>	12pF	0603-C	2+ 11 overage	\$1.85	928,709 units		<input type="checkbox"/>
<input type="checkbox"/>	J15	A-2004-2-4-LPS-N-R Single Port 90° 8p8c Through Hole Board L... <a href="#">Q</a>	RJ45	RA-RJ45	1	\$1.49	43,656 units		<input type="checkbox"/>
<input type="checkbox"/>	J1 - J2	N/A No part selected. <a href="#">Q</a>		1X06_NO_SILK_YES_STOP	2	-			<input checked="" type="checkbox"/>
<input type="checkbox"/>	J3	87583-2010BLF Conn USB 2.0 Type A RCP 4 POS 2mm/2.5... <a href="#">Q</a>	USB-ASMD-F	USB-A-S	1	\$1.36	50,730 units		<input type="checkbox"/>
<input type="checkbox"/>	LED1	LG R971-KN-1 LED Uni-Color Green 572nm 2-Pin SMD T/R <a href="#">Q</a>	GREEN	CHIPLED_0805	1+ 11 overage	\$3.42	2,952,826 units		<input type="checkbox"/>
<input type="checkbox"/>	R13	RC0402FR-07220RL Surface Mount Thick Film Resistor, Rc Serie... <a href="#">Q</a>	220	0402-R	1+ 11 overage	\$1.58	2,898,725 units		<input type="checkbox"/>
<input type="checkbox"/>	R16 - R17	RC0402FR-0722RL Res Thick Film 1.0 x 0.5 mm 22 Ohm 1% 0... <a href="#">Q</a>	22	0402-R	2+ 11 overage	\$1.85	11,378 units		<input type="checkbox"/>
<input type="checkbox"/>	R1 - R4, R7 - R8	ERA-2AEB103X Res Thin Film 0402 10K Ohm 0.1% 0.063W... <a href="#">Q</a>	10k, 0.1%	0402-R	6+ 1 overage	\$4.68	2,508,796 units		<input type="checkbox"/>
<input type="checkbox"/>	R23 - R26	ERA-2AEB102X Res Thin Film 0402 1K Ohm 0.1% 1/16W Å... <a href="#">Q</a>	1k, 0.1%	0402-R	4+ 1 overage	\$3.30	1,731,671 units		<input type="checkbox"/>
<input type="checkbox"/>	R5 - R6	RC0402JR-0710KL Res Thick Film 1.0 x 0.5 mm 10K Ohm 5% 0... <a href="#">Q</a>	10k	0402-R	2+ 11 overage	-	-	Unknown	<input type="checkbox"/>

If you find that any of the parts are not available or require too large of a minimum order, there are alternatives. For instance, for I had to substitute `GCM188R71C104KA37D` with `GRM188R71C104JA01D` which is slightly different but should work fine for this application. You may have to replace the same part if it ends up applying to you.

Just try to check in the Slack channel or leave a comment below if you have a question on whether a part will work as a replacement or not. I ended up finding the alternative on DigiKey, and then searching for the new part on MacroFab.

Now we're moving on to Part Placement.

## 04. Part Placement

On my attempt, I didn't have to adjust the part placement, the MacroFab system did a fairly good job of overlaying the orange boxes over the parts.

You will probably have to confirm each part's position before you can submit your order. Follow the prompts in the Part Placement tab to approve each part's placement. If you see something isn't aligned properly, ensure you nudge it over a little to line up.

Continue doing so until all your parts are approved.

## 05. Quote & Order

This is where you may find that certain parts are Unavailable for `Prototype Class Service` which you will want to use unless you're ordering a zillion of them.

▼ Components		\$36.69		\$36.69
GRM188R71C104JA01D (turnkey)	20 units (11 overage)	Unavailable	20 units (11 overage)	Unavailable
RC0402JR-0710KL (turnkey)	13 units (11 overage)	Unavailable	13 units (11 overage)	Unavailable
CL10A475KQ8NNNC (turnkey)	12 units (11 overage)	\$1.42	12 units (11 overage)	\$1.42
EMK107BJ225KA-T (turnkey)	14 units (11 overage)	\$2.15	14 units (11 overage)	\$2.15

As suspected, some of the parts are not available.

For the first one in the list, the capacitors are a bit trickier sometimes. I find they aren't in stock most of the time or are unavailable. I had to get creative by searching for the specs of the capacitor such as 0603 0.1 uF 16 V ±5% Tolerance X7R SMT until I found an acceptable part. The original was +10% and the one I ended up going with was +5%.

For the 2nd one, I did a quick Google search for the part number \*\*RC0402JR-0710KL\*\* which lead me to this DigiKey link:

The screenshot shows the Digi-Key product page for the Yageo RC0402JR-0710KL chip resistor. The page includes the following sections:

- Product Overview:** Shows the Digi-Key Part Number (311-10KJRCT-ND), Quantity Available (0), Manufacturer (Yageo), Manufacturer Part Number (RC0402JR-0710KL), Description (RES SMD 10K OHM 5% 1/16W 0402), Lead Free Status / RoHS Status (Lead free / RoHS Compliant), Moisture Sensitivity Level (MSL) (1 (Unlimited)), Manufacturer Standard Lead Time (23 Weeks), and Detailed Description (10 kOhms ±5% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film).
- Price & Procurement:** Allows users to enter a quantity (1), select a part number (311-10KJRCT-ND), and click "Add to Cart". It also displays a table of price breaks and extended prices.
- Direct Substitute:** Lists three direct substitutes with their respective part numbers and manufacturer information.
- Alternate Package:** Shows an alternate package (Tape & Reel (TR)) with part number 311-10KJRTR-ND, minimum quantity 10,000, and unit price \$0.00139.

Which I then began using the Direct Substitute list to search within MacroFab Bill of Materials area for the ones marked with lowest quantities—Immediate availability. Use the Manufacturer Part Number to search.

Now check back on the Quote & Order tab to see if your Unavailable went away. For me, it went away after the first try.

Repeat those steps for each of the Unavailable items on your list until they all go away.

It can take a little bit of finesse to source all of the parts so don't feel bad if you're unsure and need to leave a comment below or hop in the [#pedal](#) channel of the [Comma Slack](#).

I think you understand the next steps... Simply checkout and submit your order / pay for your PCB.

## 06. Additional parts needed

You'll also need to order the HONDA connectors, or the connectors needed for your respective vehicle. Please seek advice from others in the [#pedal](#) slack channel at [comma.slack.com](#).

For Honda's, you can find them on AliExpress via the link below: <https://www.aliexpress.com/item/Female-Male-6-Pin-Electrical-Accelerator-Pedal-Sensor-Connector-Auto-Plug-For-Honda-Acura-Nissan-7287/32829238822.html?spm=a2g0s.9042311.0.0.bhl0rv>

## 07. Board & parts arrive

My board took a couple of weeks to manufacturer and finally arrive to my doorstep, but it was well worth it. My board was built with the best of quality and I can't complain. It looks and works great!

Here is a photo of my finished board.

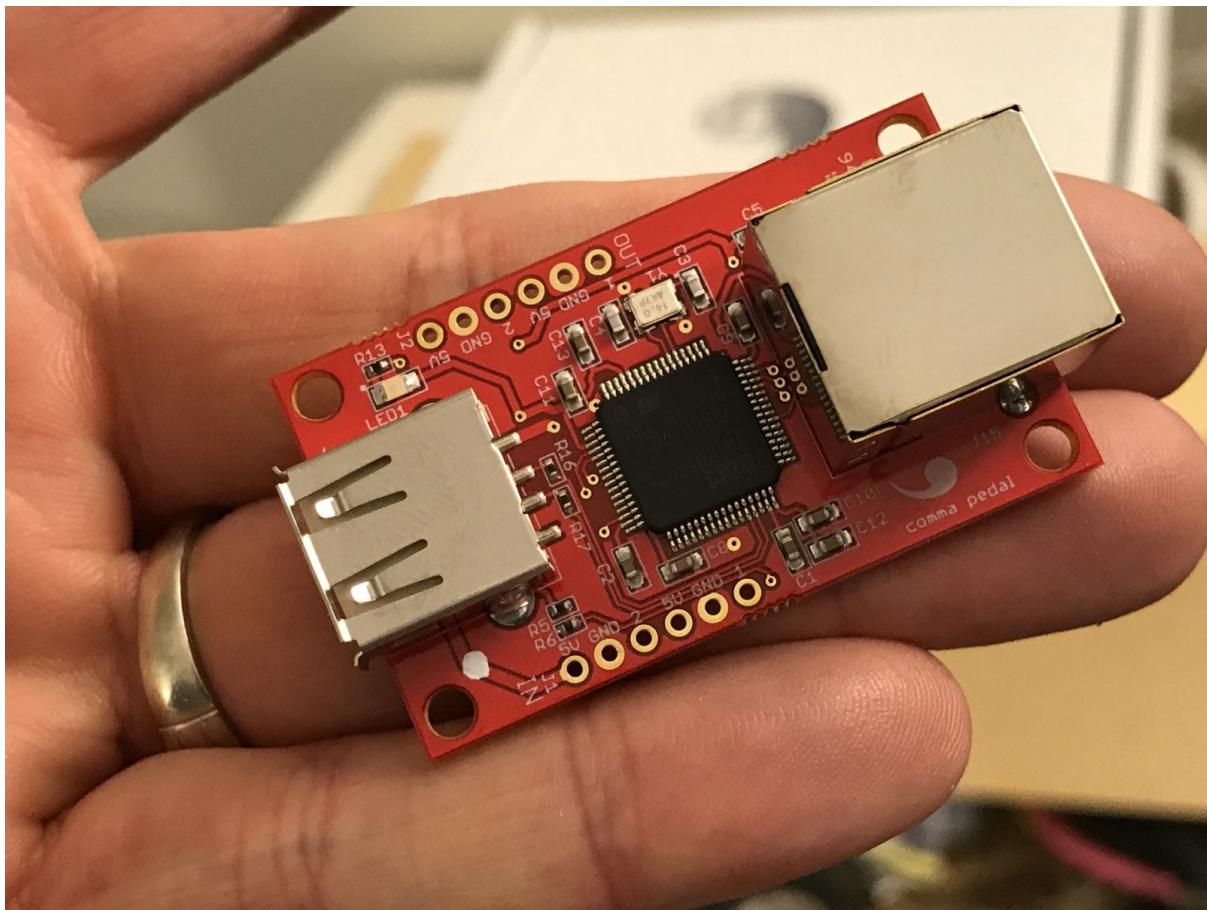


Photo of My Comma [Pedal](#) from MacroFab

Now let's wire it up!

Follow my guide at [here](#) to learn about [Wiring the Connectors](#).

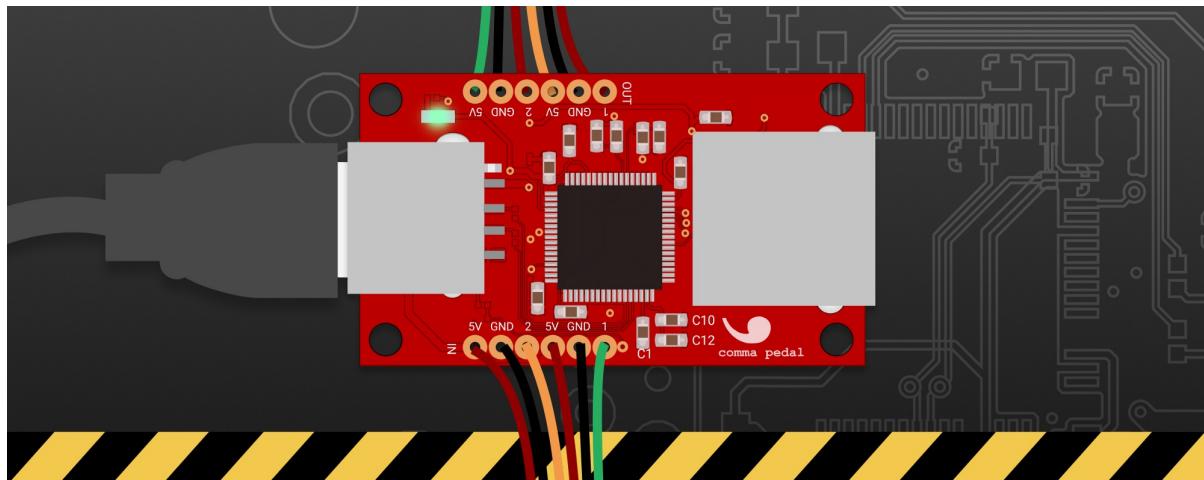
And you'll need to Flash the Firmware.

I hope you enjoyed this and have your very own Comma [Pedal](#) now on order.

Pricing can range from \$65—\$130 USD depending on how parts are sourced but I find you'll be happy you did.  
Building your own is not easy and I don't recommend it.

Enjoy!

# Comma Pedal: Flashing the Firmware



So you just received your [Comma Pedal from MacroFab](#) or manufactured it yourself, but have no idea what to do next... well the next step is to get this board in DFU Mode that allows us to flash it with firmware. It's presently an empty computer with nothing on it. Think of this like installing software on a computer. Right now it doesn't even have an "operating system" so to speak.

## Requirements

- A solid understanding of Terminal, Unix-based environments, Git / GitHub, compiling and installing dependencies, etc. is required for this article. If you don't feel confident in these things, I'd find your closest computer programming nerd-friend to help.
- This article assumes you're running Ubuntu Linux, but most of these instructions should apply in other environments too if you're so inclined.
- This article also assumes you already have Git installed. Please ensure those things before proceeding.

**DISCLAIMER:** This is not to be considered official documentation on the Comma [Pedal](#). This is not an official work of Comma, Inc. and is unaffiliated with their company and platform. Proceed at your own risk. Comma, Inc. nor myself warrants this to any degree. Always keep your hands on the wheel and eyes on the road.

## Guide

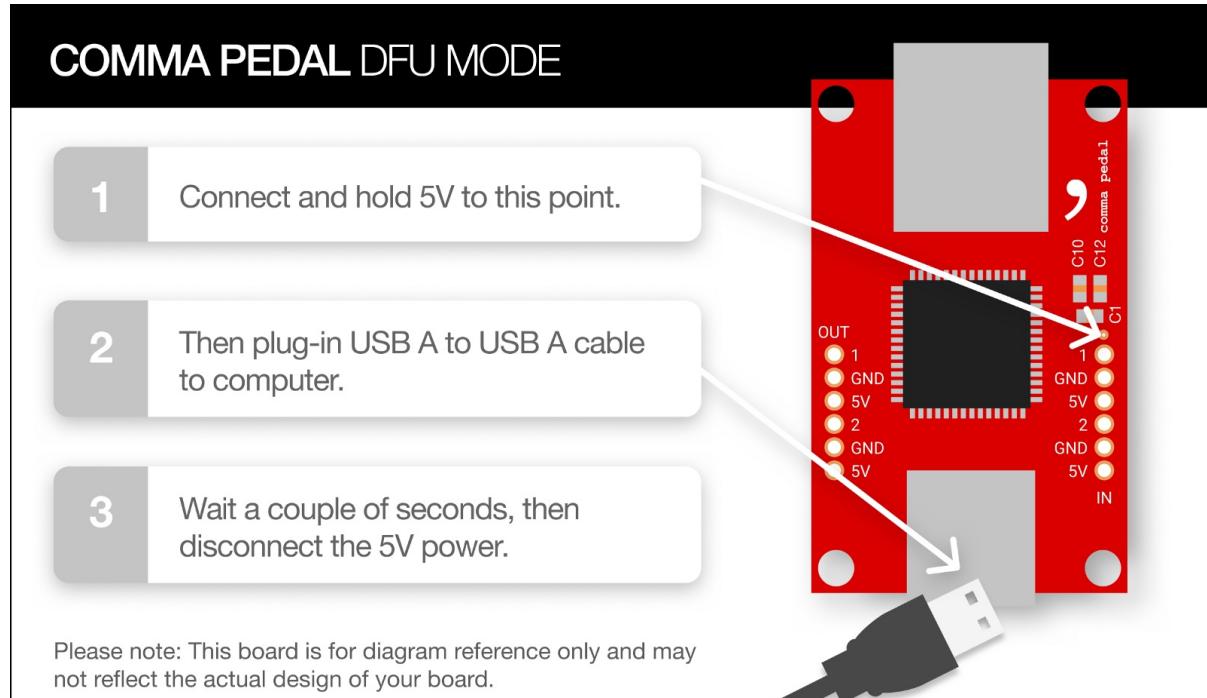
### 01. Getting Started

#### Cloning the [Panda](#) code repository & install dependencies

```
$ git clone https://github.com/commaai/panda.git
$ cd panda/board/
$ ./get_sdk.sh
$ cd ../
$ sudo pip install .
$ pip install pandacan
$ sudo apt-get install dfu-util
```

### 02. Entering DFU Mode on the Pedal Board

There are apparently two ways to enter DFU Mode on this board... one involves having a [Panda Paw](#) from <https://shop.comma.ai/> and the other is applying voltage to the board itself until it enters the bootloader. This article will be covering the voltage method.



Confirm that your Comma Pedal is connected to your computer by running

```
$ sudo dfu-util -l
```

Output of this command should look something like this:

```
dfu-util 0.8
```

```
Copyright 2005-2009 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2014 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY
Please report bugs to dfu-util@lists.gnumonks.org
```

```
Found DFU: [0483:df11] ver=2200, devnum=4, cfg=1, intf=0, alt=3, name="@Device Feature/0xFFFF0000/01*004 e", serial="345D396E3137"
Found DFU: [0483:df11] ver=2200, devnum=4, cfg=1, intf=0, alt=2, name="@OTP Memory /0x1FFF7800/01*512 e,01*016 e", serial="345D396E3137"
Found DFU: [0483:df11] ver=2200, devnum=4, cfg=1, intf=0, alt=1, name="@Option Bytes /0x1FFFC000/01*016 e", serial="345D396E3137"
Found DFU: [0483:df11] ver=2200, devnum=4, cfg=1, intf=0, alt=0, name="@Internal Flash /0x08000000/04*016Kg,01*064Kg,07*128Kg", serial="345D396E3137"
```

0483:df11 is the signature for the Comma Pedal so this is correct.

Moving on...

### 03. Transferring firmware to the board

Now that your board is in DFU Mode, and dependencies are installed, you SHOULD be able to transfer the firmware to the board.

```
$ cd panda/board/pedal
$ sudo make recover
```

The result of this command should look similar to below...

```
..../tests/pedal/enter_canloader.py --recover; sleep 0.5
Traceback (most recent call last):
  File "..../tests/pedal/enter_canloader.py", line 55, in <module>
    p = Panda()
  File "/usr/local/lib/python2.7/dist-packages/panda/__init__.py", line 127, in __init__
    self.connect(claim)
  File "/usr/local/lib/python2.7/dist-packages/panda/__init__.py", line 171, in connect
    assert(self._handle != None)
AssertionError
"dfu-util" -d 0483:df11 -a 0 -s 0x08004000 -D obj/comma.bin
dfu-util 0.8
```

```
Copyright 2005-2009 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2014 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY
Please report bugs to dfu-util@lists.gnumonks.org
```

```
dfu-util: Invalid DFU suffix signature
dfu-util: A valid DFU suffix will be required in a future dfu-util release!!!
Opening DFU capable USB device...
ID 0483:df11
Run-time device DFU version 011a
Claiming USB DFU Interface...
Setting Alternate Setting #0 ...
Determining device status: state = dfuERROR, status = 10
dfuERROR, clearing status
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
DFU mode device DFU version 011a
Device returned transfer size 2048
DfuSe interface name: "Internal Flash "
Downloading to address = 0x08004000, size = 17120
Download [=====] 100% 17120 bytes
Download done.
File downloaded successfully
"dfu-util" -d 0483:df11 -a 0 -s 0x08000000:leave -D obj/bootstub.bin
dfu-util 0.8
```

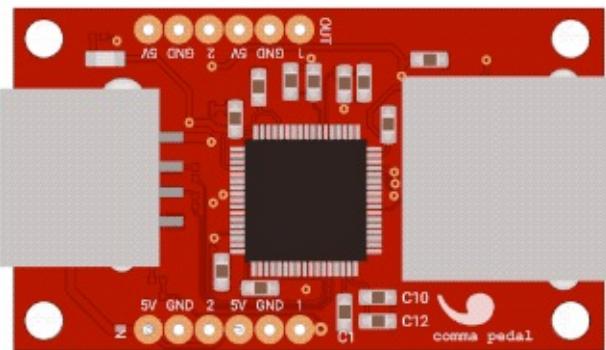
```
Copyright 2005-2009 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2014 Tormod Volden and Stefan Schmidt
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Please report bugs to dfu-util@lists.gnumonks.org
```

```
dfu-util: Invalid DFU suffix signature
dfu-util: A valid DFU suffix will be required in a future dfu-util release!!!
Opening DFU capable USB device...
ID 0483:df11
Run-time device DFU version 011a
Claiming USB DFU Interface...
Setting Alternate Setting #0 ...
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
```

```
DFU mode device DFU version 011a
Device returned transfer size 2048
DfuSe interface name: "Internal Flash "
Downloading to address = 0x08000000, size = 12332
Download [=====] 100%          12332 bytes
Download done.
File downloaded successfully
Transitioning to dfuMANIFEST state
```

I believe you can ignore the error in this as well as the Invalid DFU suffix signature warnings.

When you're finished you should be seeing a flashing green LED if your board has this.



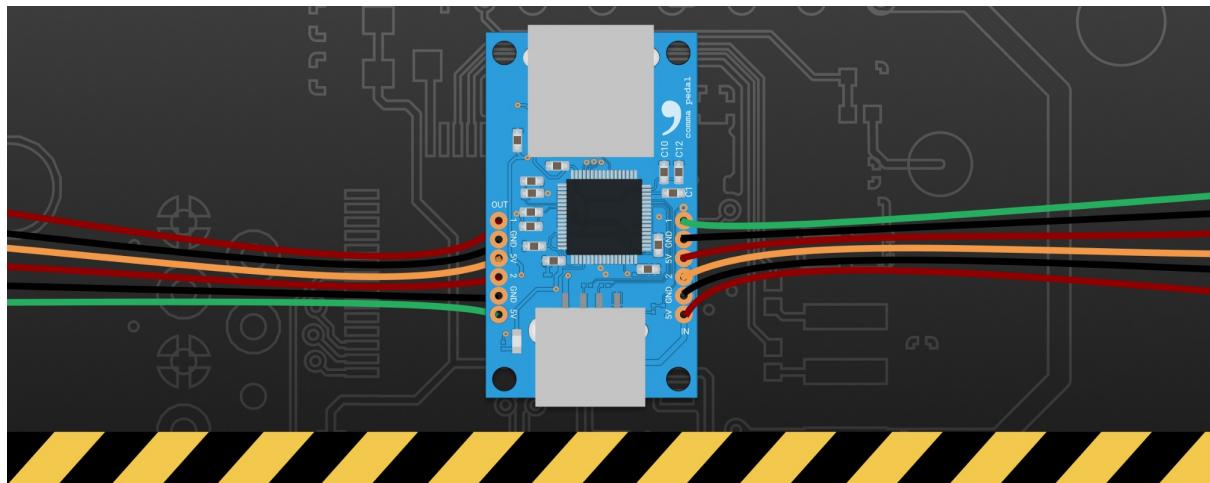
---

If Successful, the [Pedal](#) LED should be flashing Green.

You may now unplug the [pedal](#) from USB.

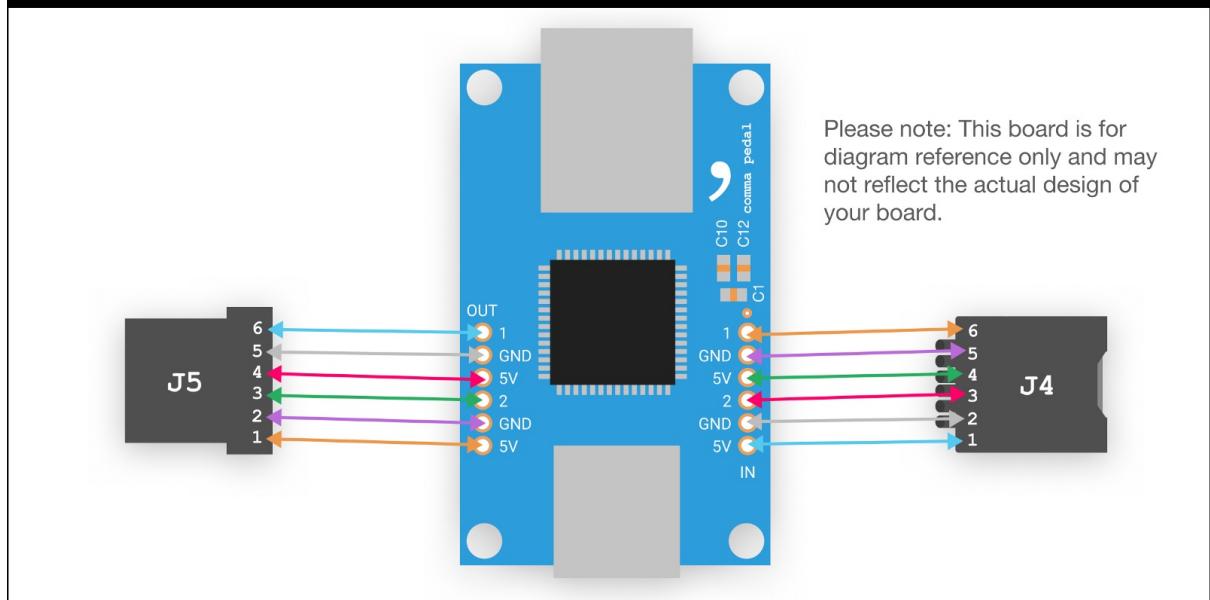
Enjoy!

## Comma Pedal: Wiring the Connectors

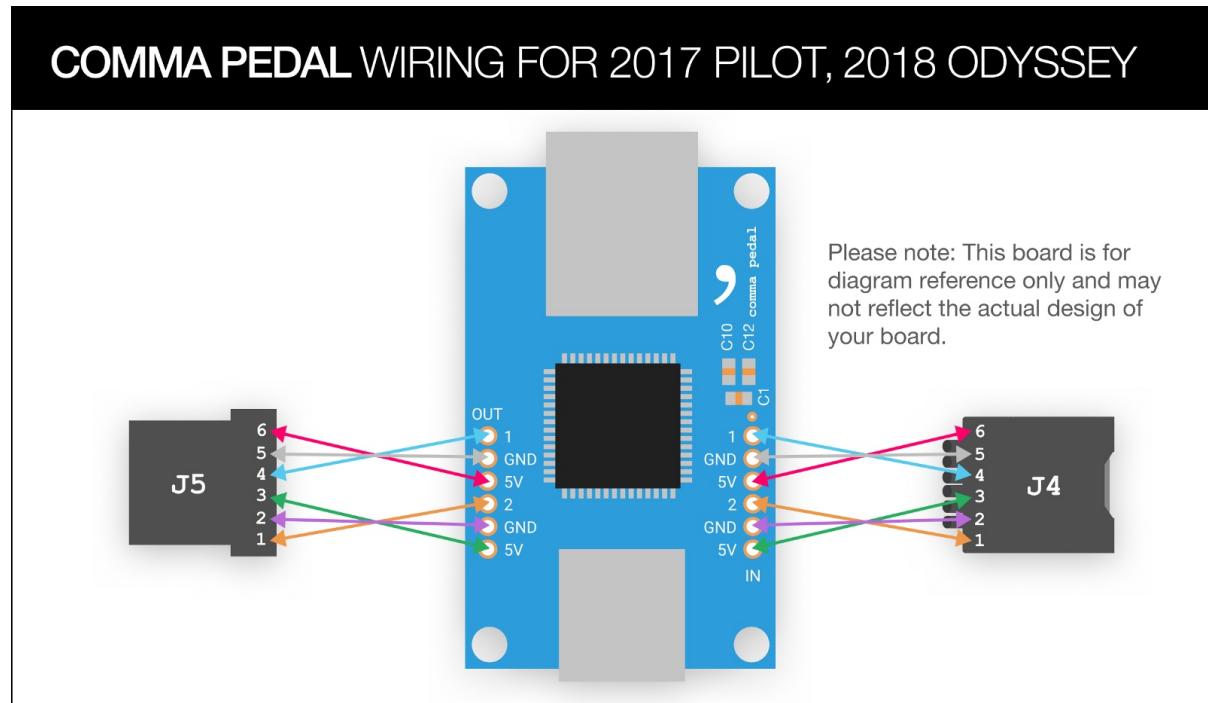


Document is a work in progress. Check back soon for more details.

### COMMA PEDAL WIRING FOR 2016 ILX

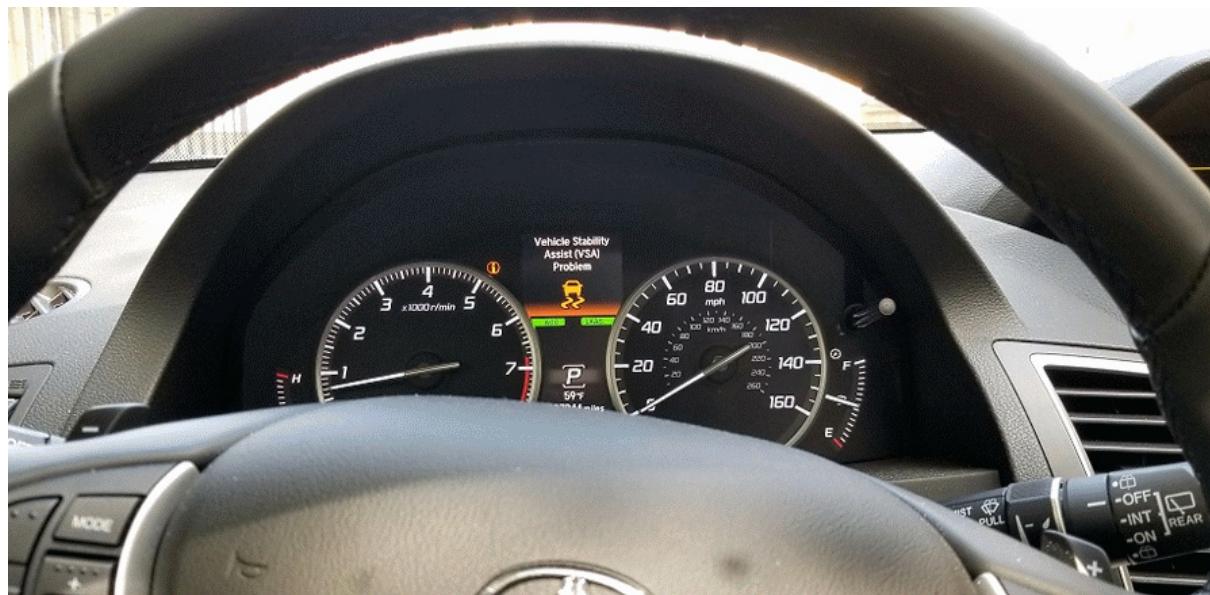


Wiring Diagram of 2016 Acura ILX Connectors for Comma Pedal

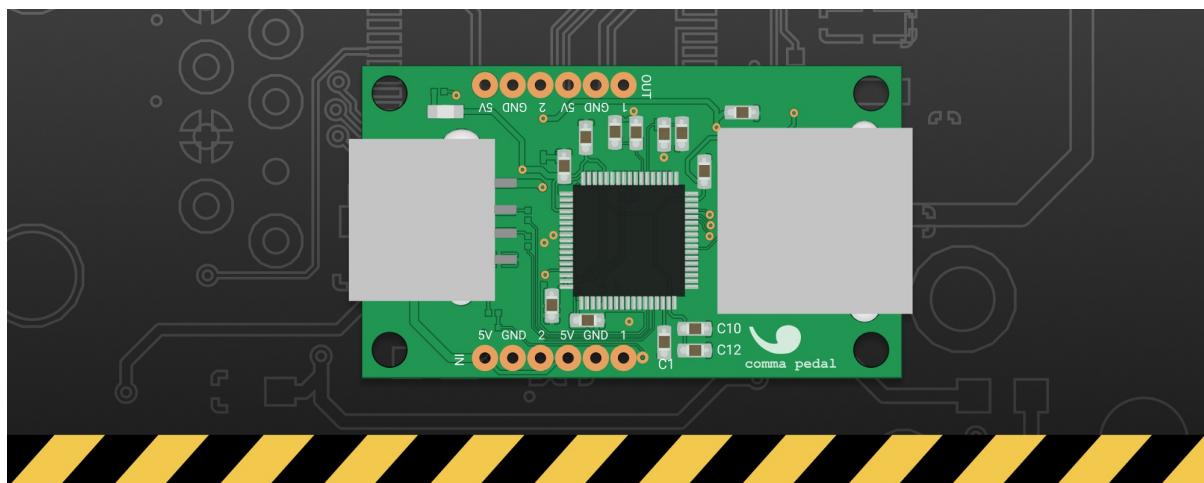


Wiring Diagram of 2017 Honda Pilot & 2018 Honda Odyssey Connectors for Comma Pedal

## Troubleshooting



# Comma Pedal: Installing in Your Vehicle



This guide will take you through my experiences installing the Comma Pedal in my 2017 Honda Pilot and some of the article is vehicle specific so please feel free to adapt it to your vehicle.

**THIS DOCUMENT IS A WORK IN PROGRESS AND IS NOT COMPLETE.**

**DISCLAIMER:** Before we get started, I'm going to warn you that I'm not an expert on any of this. Sadly I also feel the need to tell you that by doing these types of things, you have the potential to void your vehicle manufacturers warranty and are risking breaking something. I'm not warranting this guide to any level so proceed at your own risk. Much of the information I'm writing about I've gathered from other community members and from my experiences with installing this in my own vehicle.

Now we can proceed.

## Prerequisites

- This guide assumes you have properly [Flashed your Comma Pedal](#).
- This guide assumes you have properly [Wired and Tested Your Comma Pedal](#) for your specific vehicle.
- This guide also assumes you are brave and are willing to do (what some might consider) unacceptable things to your perfectly nice and already operating motor vehicle.

## Removing the accelerator pedal

This is optional but I highly recommend it for your sanity and safety of you and your Comma Pedal.

**Locate the wire harness connecting to your accelerator pedal.**



**Disconnect the wire harness from your accelerator pedal.**

Start by locating the connector on your accelerator.



Now we need to get both hands involved.

Pinch the connector at the top of the tab with 1 finger on the tab-side, and one finger on the back-side. This should cause the bottom of the tab to pop out a bit. See below.

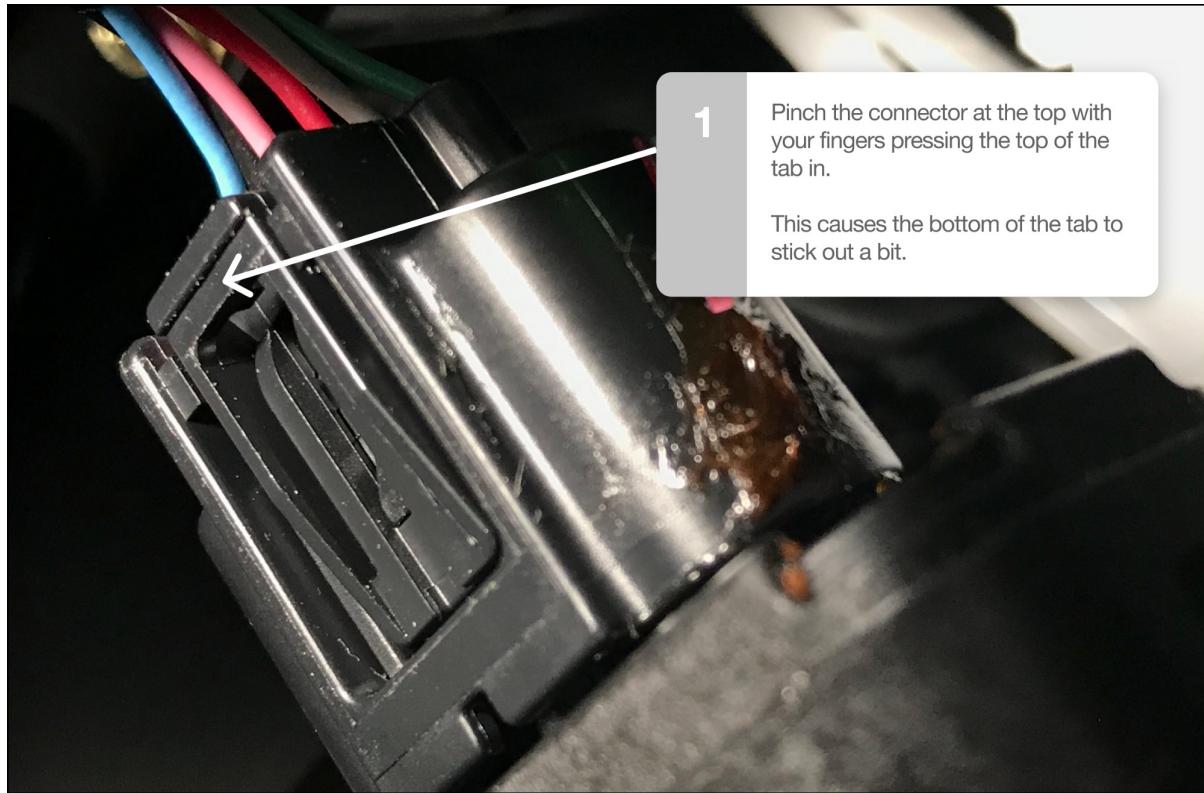


Diagram of Pinching the Connector

While pinching the tab in, the bottom of the tab will pop out a bit. Now place a long-thin flat head screwdriver in under the tab.

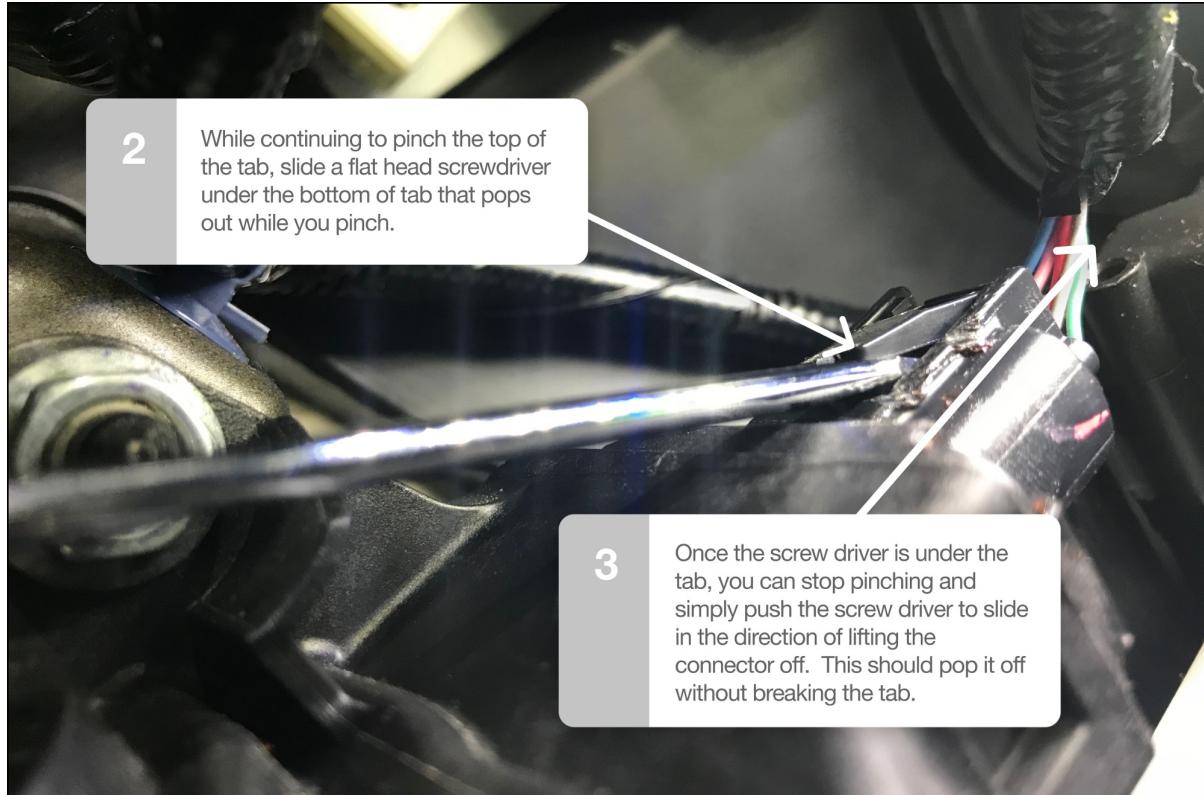


Diagram of Removing the Connector with Screwdriver

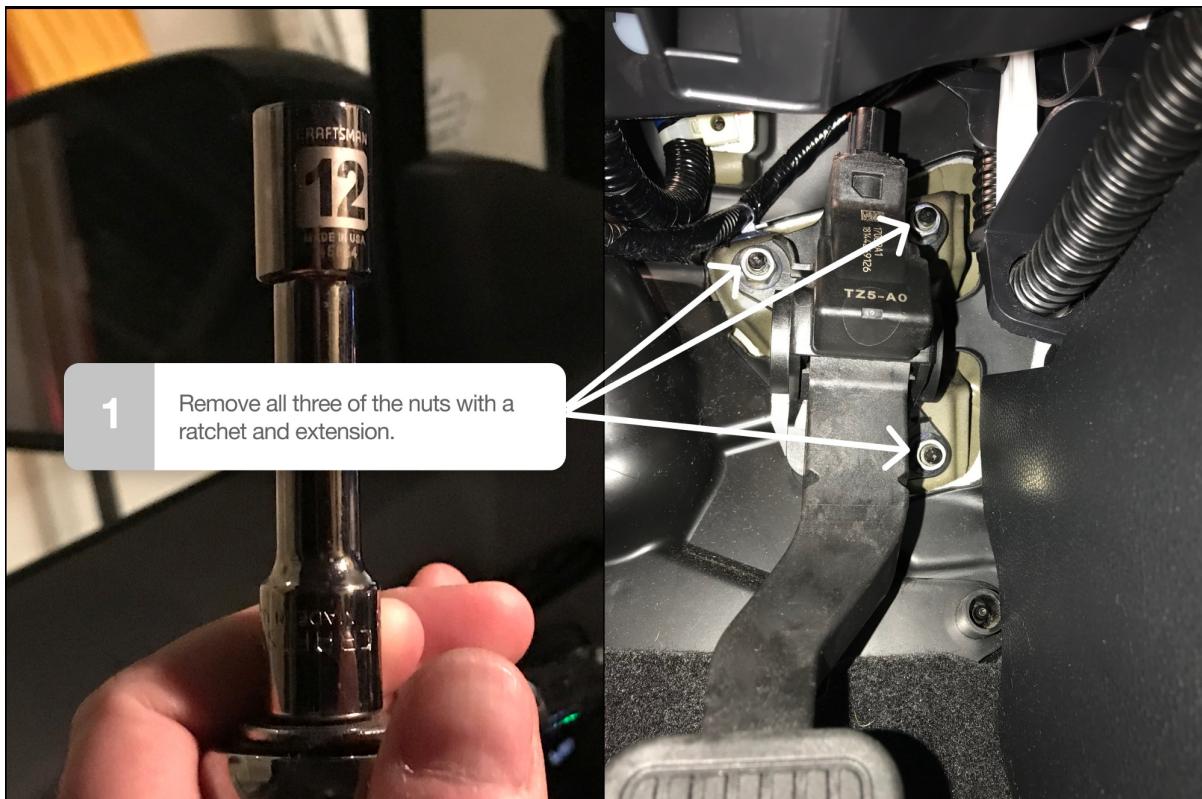
While the screwdriver is under the tab, you can remove your pinching hand and apply force to the bottom of the screwdriver to lift the connector out of your accelerator [pedal](#) as shown above.

## Remove the Pedal

The [pedal](#) in my 2017 Honda Pilot has 3 nuts to remove it. See below.

Most modern vehicles (I'm assuming) are similar to mine in that the [pedal](#) is self-contained and only hooked up by a wire harness and nothing else so it's relatively straight forward to take it in and out.

I used a 12mm socket with extension to remove these.



## Attaching the Interceptor Device (Comma Pedal)

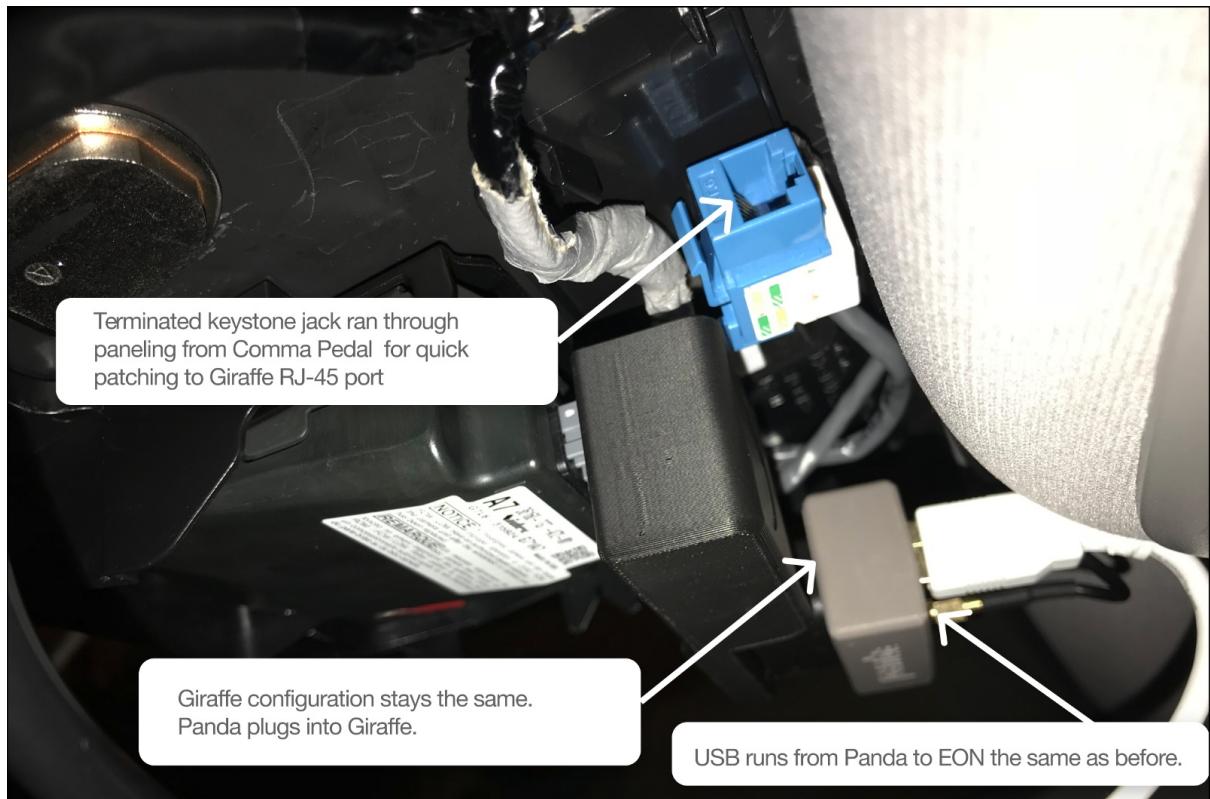
It's fairly self explanatory at this point. Obviously the [pedal](#) sticks on top of your physical [pedal](#), then you need to connect the wiring to your stock harness that you disconnected from the physical [pedal](#).

Attach a network cable (RJ-45) from the [pedal](#) network port, up to your [Giraffe](#) near your mirror.

I recommend running a custom cable length up to [giraffe](#) to make it nice and cleaner so you don't snag or have any wires dangling down. Terminate the cable ends after running your custom cable length through the paneling of your vehicle.

I ran mine up over your feet in the feet well then up the pillar of the door opening and up over the ceiling of the car behind the paneling and stick it out where the [Giraffe](#) is.

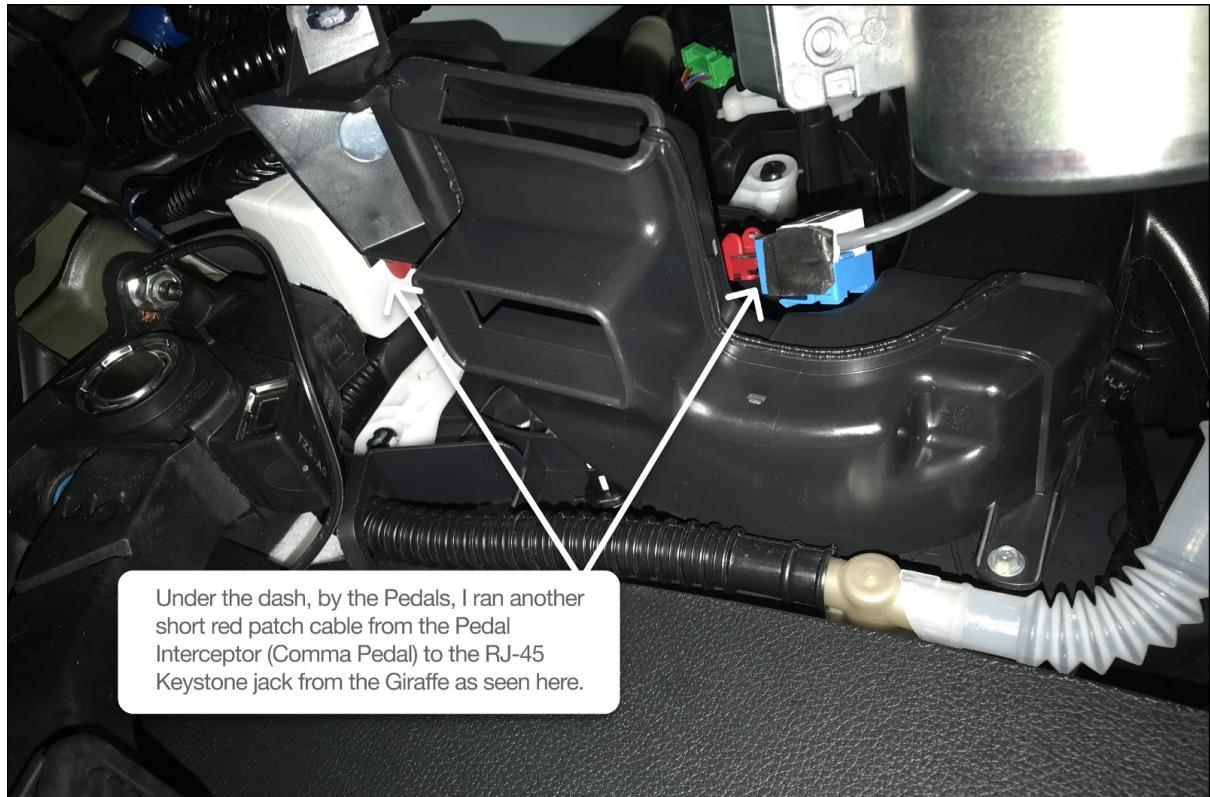
I terminated the cable ends with Keystone Jacks and used 6" patch cables to wire it up.



My terminated keystone jack up by the [giraffe](#).



A short patch cable is connecting the [giraffe](#) to the keystone connector.



Under the dash, by the Pedals, I ran another short red patch cable from the Pedal Interceptor (Comma Pedal) to the RJ-45 Keystone jack from the Giraffe as seen here.

A red patch cable connects the interceptor to the [Giraffe](#)

## Next Steps

Now that you have it all wired up, you need to install a version of [OpenPilot](#) with support for the [Pedal](#) in your vehicle.

As of today, [OpenPilot](#) doesn't support Comma [Pedal](#) in all vehicles that it supports so you may have to use a fork.

I currently have a PR in for the Acura RDX, Honda Pilot, Honda Odyssey which should resolve for those vehicles once it's accepted but that may or may not be soon.

I believe the Acura ILX might already have support for the [Pedal](#) so feel free to use the master branch as is.

Currently Toyotas do not support Comma [Pedal](#).

Enjoy!

# Customizations

Recently a lot of folks are interested in customizing [Openpilot](#) in one way or another. We would like to begin organizing these ideas so people can easily find them and make use of them if they desire.

Although some things will never be supported by Comma.ai, Inc. They're kind enough to opensource their libraries to us so we can make them work for us and possibly even contribute new features and inspiration back to them.

That being said, starting it off here.

## Driving UI

The first and seemingly most popular request is showing more statistics / information on the screen as you're driving. This code is not available in the core codebase and has been added by various community members.



## Code for this customization

Find this customization at [ErichMoraga/openpilot](#)

# Future Releases

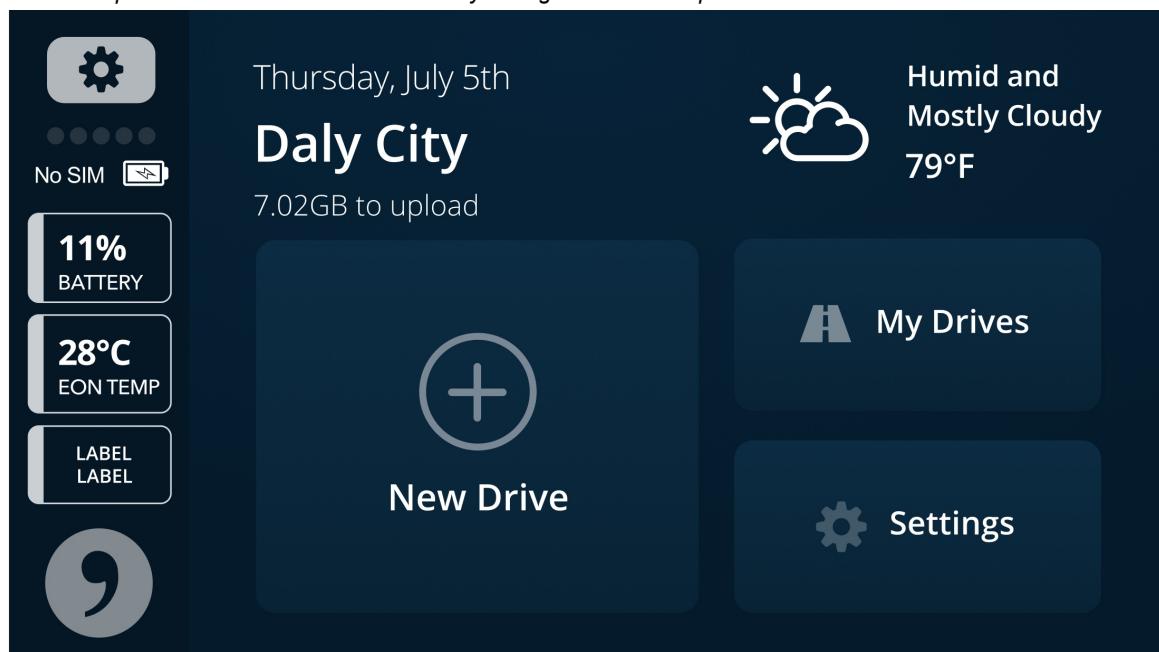
**PLEASE NOTE:** These are purely based on things released by Comma.ai, Inc.'s CEO publicly on Slack and Periscopes and may or may not change in the future.

## Release Cycle

Comma tries to stick to a 2 week sprint cycle and they release to dev mostly on Sunday's and to release2 on Monday's.

### Features to look for in future releases

- **v0.6.x**
  - Fix wind and further improve wobble
  - 10 second calibration over 5 mph calibration
  - White [Panda](#) will no longer be supported.
  - locationd should ship
    - a very integrated location finder daemon with < 1m accuracy
    - includes SLAM and dead reckons down to cm
- **v0.5.x**
  - Removes Waze and Spotify
  - Driver Monitoring
  - Updated UI for the "Home" screen *NOTE: The below image may not represent the actual UI but is merely a concept based on information released by George over Periscope.*





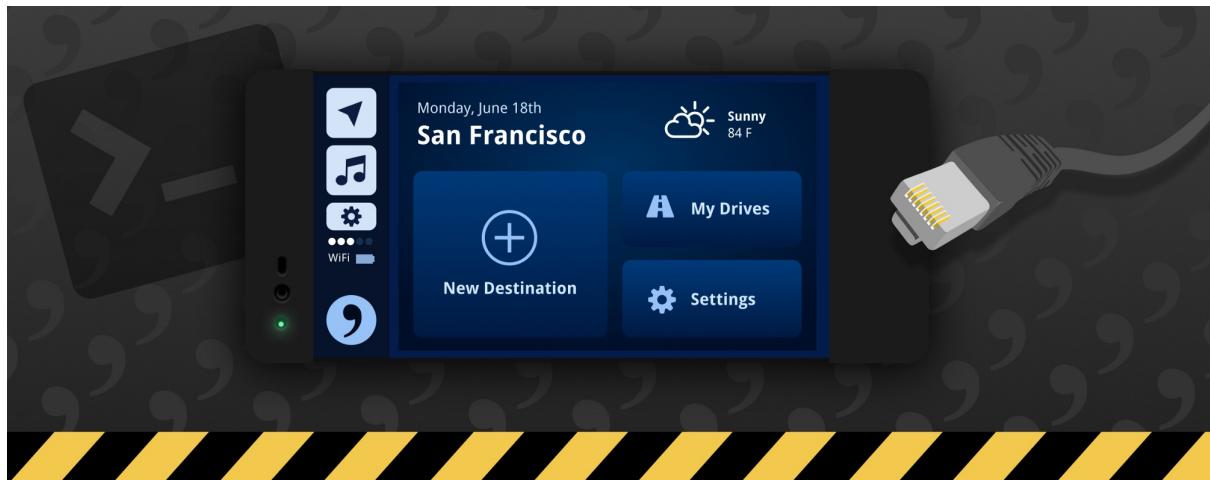
# Development Guides

We're always striving to create great articles for helping you make contributions to [openpilot](#).

Without guides, many people might be intimidated to contribute to the code even when they are perfectly capable of doing so.

So we're compiling a list of guides we think are the most relevant to those looking to make changes to [openpilot](#).

## Connecting to EON with SSH



Recently I've noticed loads of requests for a simpler guide to getting connected to [EON](#). The "dashcam" device that is capable of running [OpenPilot](#) giving supported vehicles the ability to drive semi-autonomously.

Let's get started.

## Required Tools on Windows

If you're on Windows, please follow my guide on installing the tools needed. I use pretty specific tools in the rest of this article that you may not have installed on your system.

Go to guide on [Installing Additional Tools for Connecting to SSH on Windows 10](#)

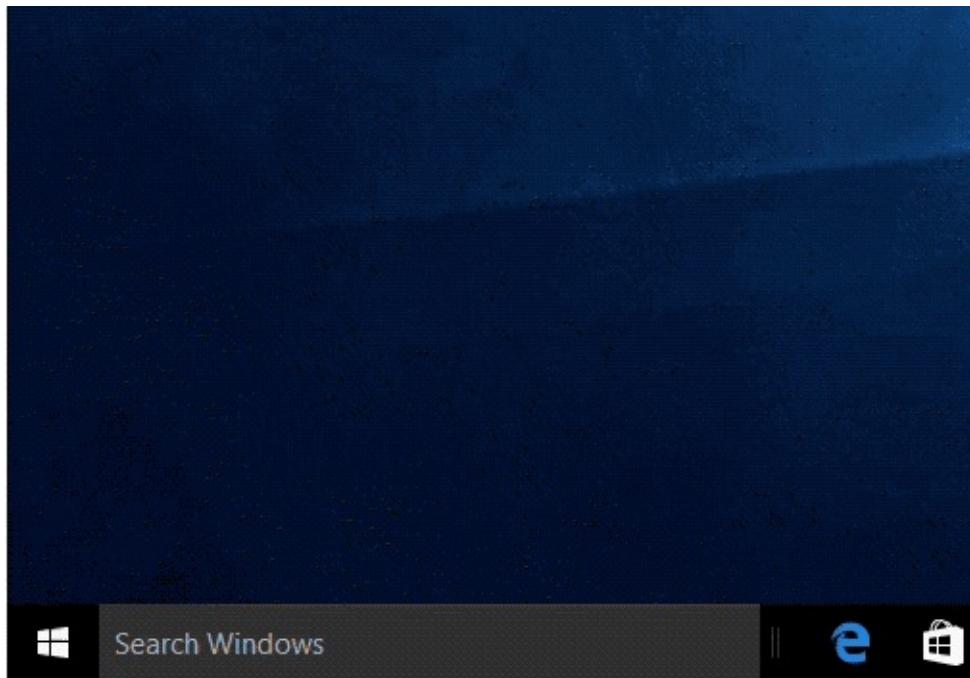
## Guide

### 01. Open Terminal / PowerShell

On **Mac**: `CMD+SPACEBAR` and type `Terminal` and press **Return**.



On **Windows**: Press the `WINDOWS KEY` on your keyboard and type `Powershell` and Right click the result and click `Run as Administrator` or right click the Start Menu icon and go to `Power Shell (Admin)`



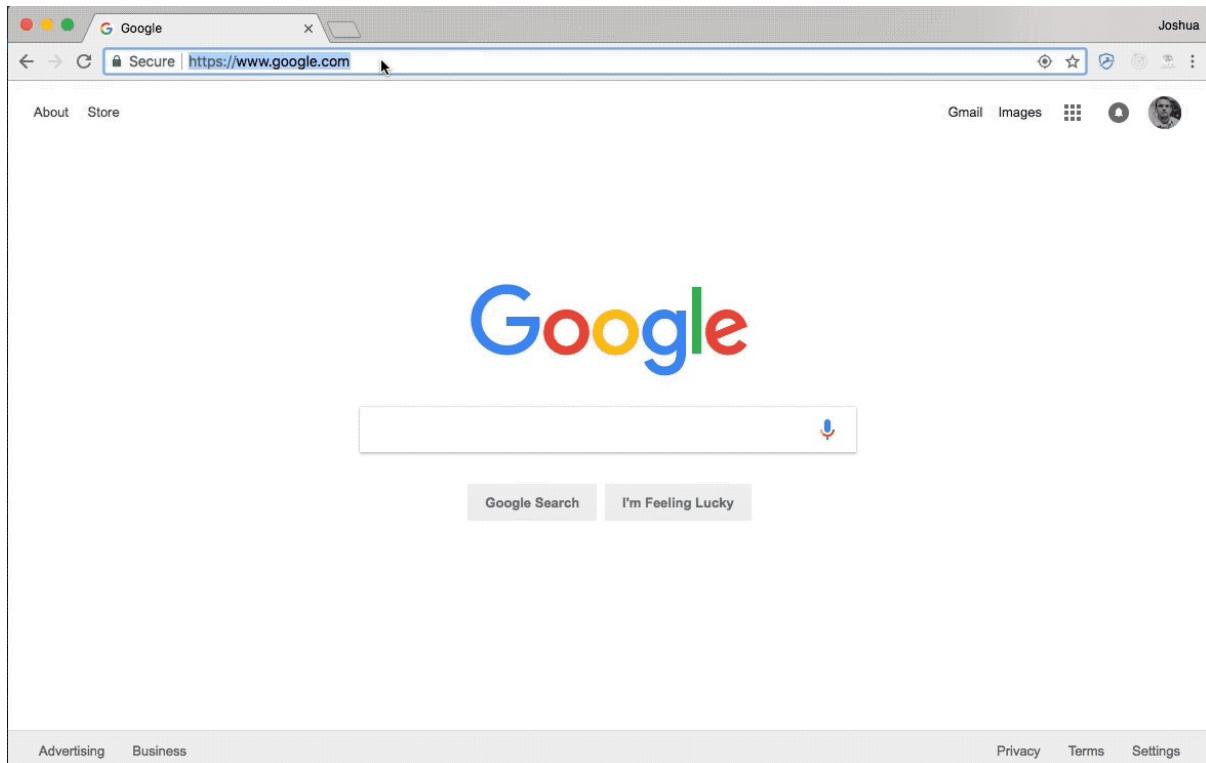
On **Ubuntu**: `CTRL+ALT+T`

You will remain in Terminal / PowerShell for the majority of this article series.

## 02. Installing the EON SSH Developer Key

Visit the [Configuring OpenPilot](#) page on the [Comma Wiki](#).

Select and Copy the entire key from the page and return back here. I'll wait.



Now that you've copied the key, let's add it to a file on your computer.

Type in the following command to create the `.ssh` directory if it isn't already created.

```
# Mac / Linux  
mkdir -p ~/.ssh/
```

```
# Windows  
md ~/.ssh/
```

#### By the way...

`~/` is just a shortcut for your user directory. On Windows: `C:\Users\<username>\` On Mac: `/Users/<Username>`  
On Linux: `/home/<Username>`

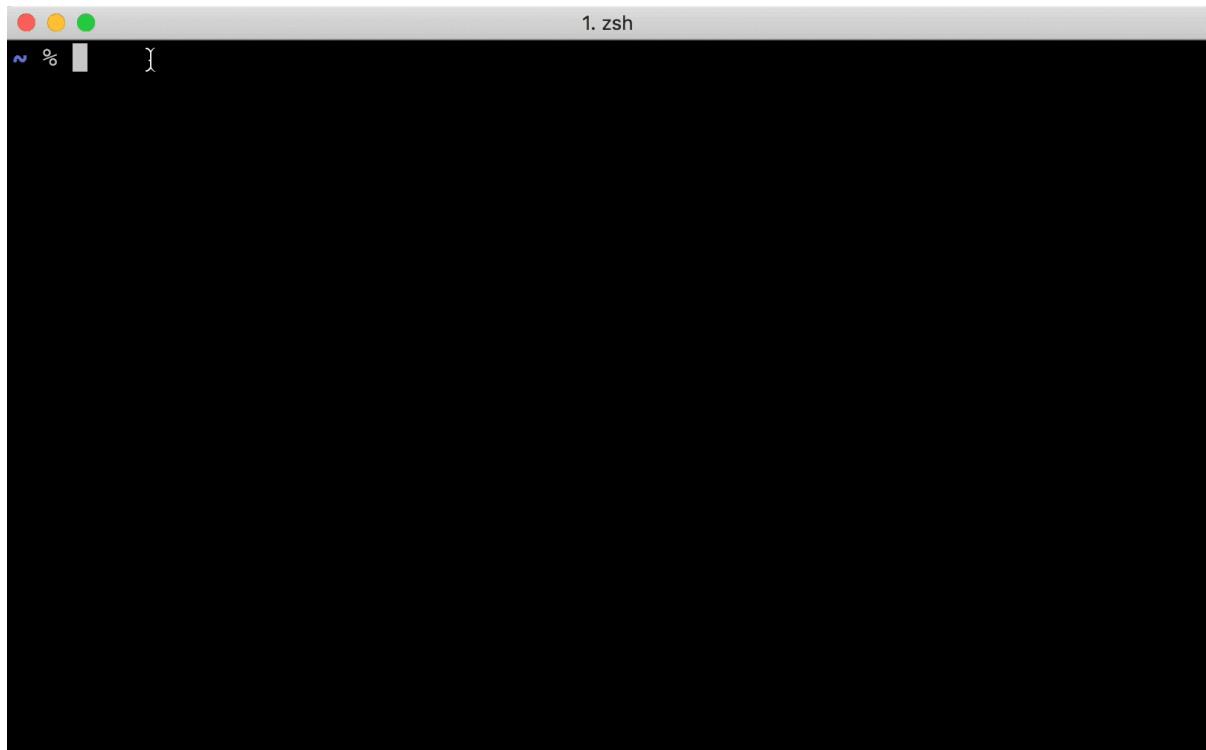
Now we need to put the key we copied from the Wiki into a new file.

We can use the following command to open a new blank file for us to paste our key into:

```
vim ~/.ssh/openpilot_rsa
```

Paste (CMD+V / CTRL+V) the entire contents of the PRIVATE KEY just like the animation below.

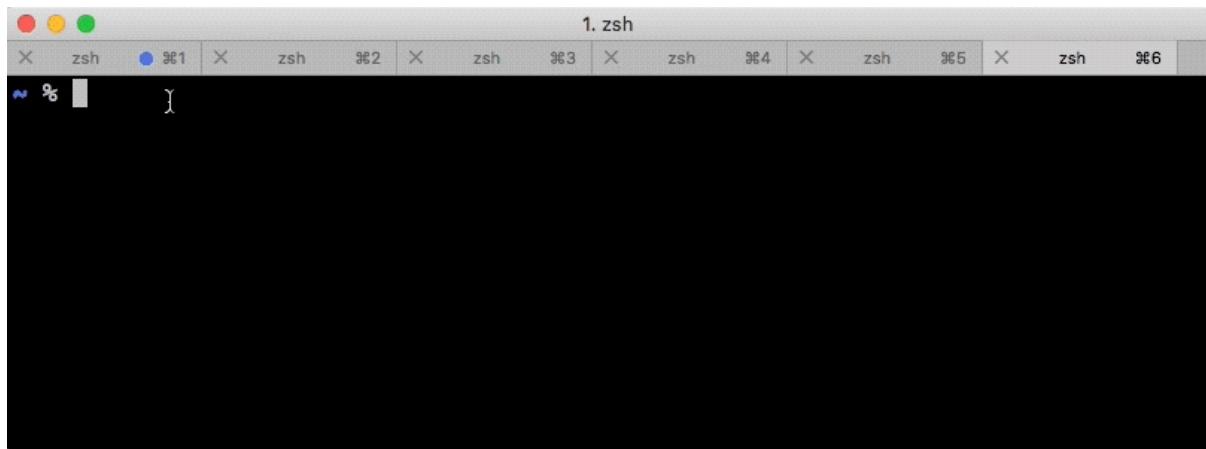
After pasting it, press `Esc` on your keyboard, then type `:wq!` to save.



The file should be saved and closed and you should now see the prompt again.

**Special note:**

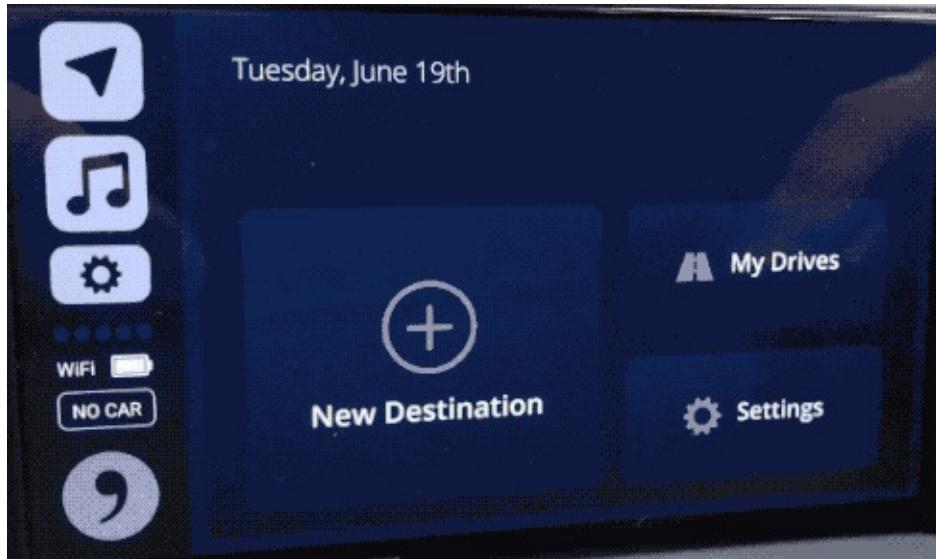
Mac & Linux: you may have to run the following command so the machine knows the key is safe. `chmod 600 ~/.ssh/openpilot_rsa`



### 03. Connecting EON to WiFi

To continue on, we must ensure your [EON](#) is connected to the same wifi network as your computer. We also need to obtain the [EON](#)'s IP address so let's do this.

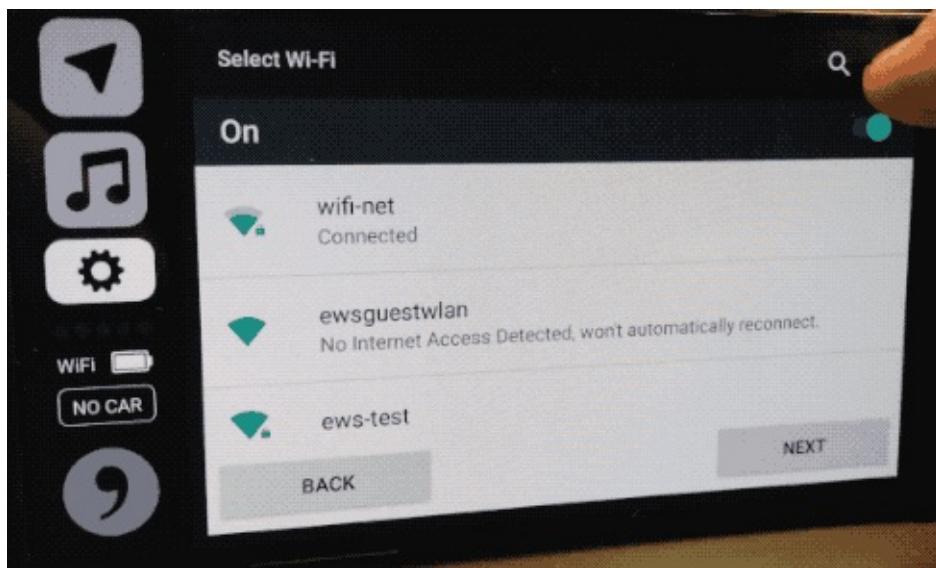
With your [EON](#) in hand, (*and hopefully within the comfort of your own home or office... no need to be in the car for this one...*) tap the Settings button and scroll down to WiFi Settings.



If you **aren't connected** to the same WiFi, now is the time to go through the standard WiFi process. You know the drill... RIGHT?

If you find you **are connected** to the same network, click the ellipsis dots in the top right corner and click Advanced.

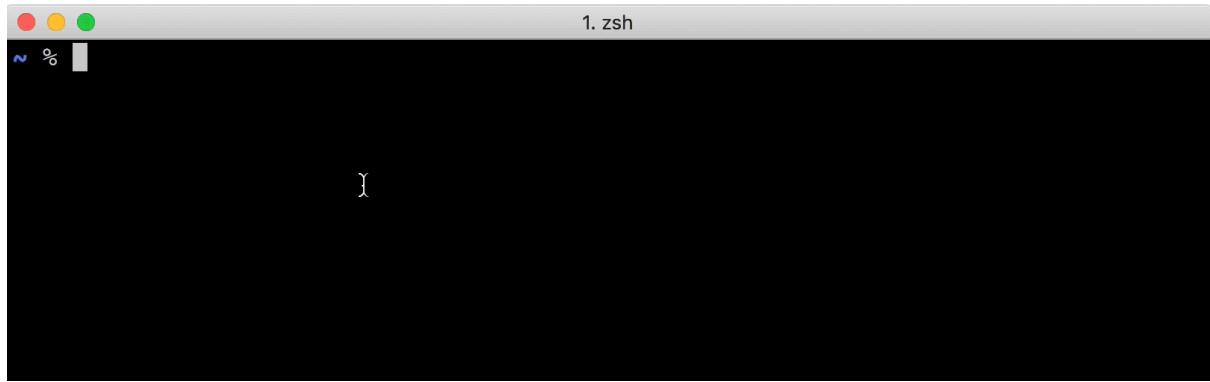
Scroll to the bottom of that screen to find the **EON**'s IP address.



Now, back in the shell window on your computer. (PowerShell on Windows, Terminal on Mac / Linux).

Type the following command to test that you are able to connect to your **EON**:

```
ping <IP_ADDRESS_OF_EON>
```



If your ping appears successful, hit `CTRL+C` after about 4 pings (if on Mac). I believe Windows only pings 4 times by default.

If the pings were successful, proceed to connect to your [EON](#) by typing the following command:

```
ssh root@<IP_ADDRESS_OF_EON> -p 8022 -i ~/.ssh/openpilot_rsa
```

After entering this command for the first time, you will likely receive a prompt for adding the unknown host to the known hosts file. Simply type yes and press enter to proceed. See an example in the animation below.



If you have any troubles with any of the steps above, feel free to leave a comment below or hit me up on the Comma Slack @jfrux

## What's next?

Now that you're connected to SSH, you can do many different tasks within your [EON](#).

[Comma EON: Installing a Fork of OpenPilot](#)

## Installing Tools for Accessing EON via SSH on Windows 10



On most unix-based platforms, including MacOS and Ubuntu you will have the tools you need to connect to your Comma EON such as `openssh` and `vim` already installed and are ready to go.

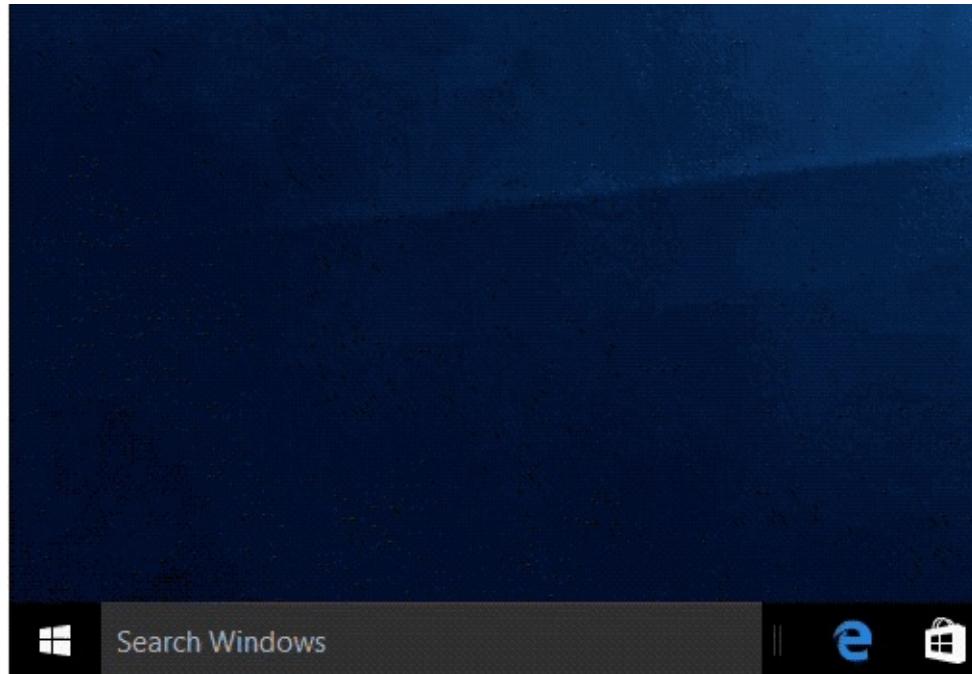
If you're on one of these platforms, you may skip to the [Getting Connected with SSH](#) article.

On Windows, it's not as straight forward. In order for my other articles to make the most sense possible, I recommend you follow my conventions below on what and how to install these things on Windows 10.

*Without further ado...*

## Guide

Open up PowerShell with Administrative Privileges by **right clicking** the Windows Logo or Start Menu generally found in the bottom left.



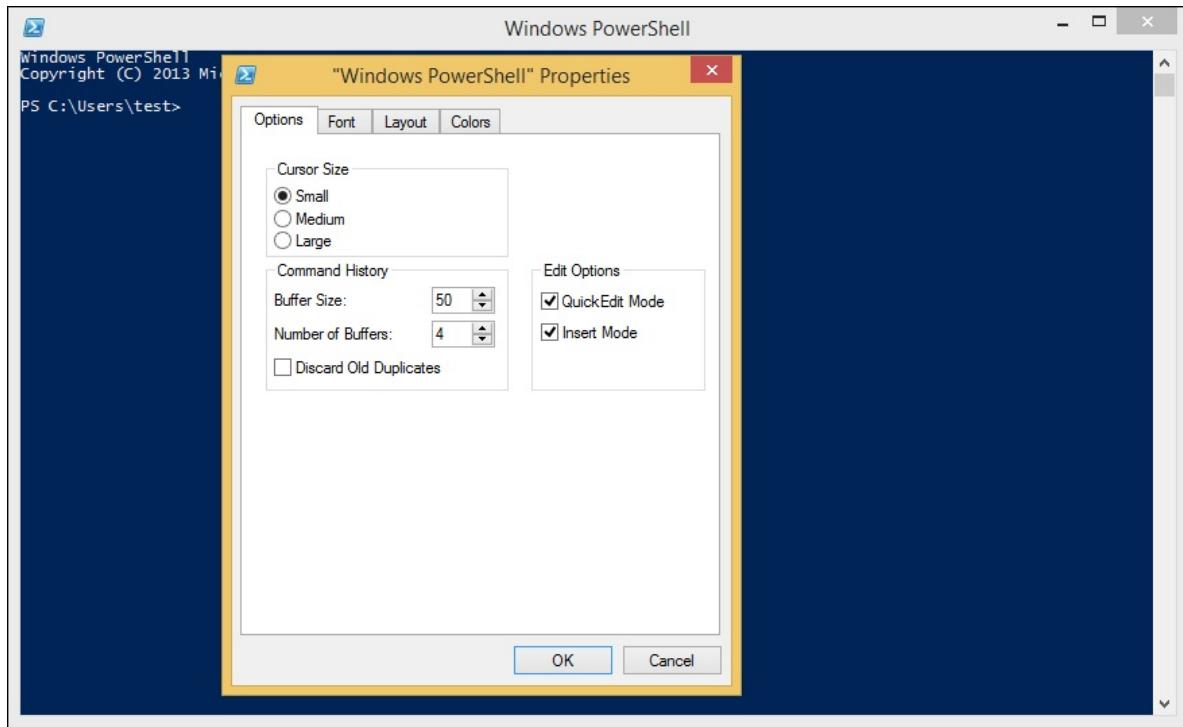
Alternatively, you can Search Windows for `PowerShell` then right click the result and click `Run as Administrator`.

## 01. Disabling Quick Edit on PowerShell

Start by disabling Quick Edit in PowerShell to prevent any confusion while running installs.

**Why do I need to disable Quick Edit:** With Quick Edit enabled, PowerShell can “pause” a running process by simply clicking the shell window. This can cause much confusion and frustration.

Disable it by Right Clicking the icon at top left of the PowerShell window and clicking Properties. Uncheck Quick Edit and press OK.



A screenshot I ripped from somewhere since I'm not running Windows at the moment.

## 02. Install Chocolatey Package Manager

Install [Chocolatey](#) Package Manager by **pasting / typing the following command** into your freshly opened PowerShell:

**Why do I need Chocolatey?** Well you don't NEED anything in life. Some things just make life a little easier. Chocolatey is "the package manager for Windows". Basically, it makes installing ANY application (especially command-line based tools) much easier.

```
Set-ExecutionPolicy Bypass -Scope Process -Force; iex ((New-Object System.Net.WebClient).DownloadString('https://chocolatey.org/install.ps1'))
```

For more information or troubleshooting this process, visit the [Chocolatey guide](#).

**NOTE: For good measure, after installing Chocolatey close PowerShell and re-open it.**

Now, most articles relating to Windows + SSH and even the [Comma Wiki](#) itself, recommend using a tool known as PuTTY which is okay in some cases but for the sake of this article and the fact that you're on a modern Windows operating system (Windows 10) AND for my own personal sanity let's stick with the open standard known as `openssh`.

## 03. Install OpenSSH with Chocolatey Package Manager

Install [OpenSSH Client with Chocolatey](#) by **pasting / typing the following command** into your newly opened PowerShell:

```
choco install openssh -y
```

This tells Chocolatey to install the `openssh` package. The `-y` parameter just tells it to answer Yes for the standard install prompts to make things smoother.

## 04. Install VIM Editor with Chocolatey Package Manager

Install [vim with Chocolatey](#) by **pasting / typing the following command** into PowerShell:

```
choco install vim -y
```

VIM is a popular text editor for your shell that is used across different operating systems and it'll help the rest of my articles go smooth for you.

Once both installs have completed successfully, I'd close and reopen PowerShell once more for good measure.

Now with a fresh PowerShell screen up in front of you, let's move on to the fun stuff.

Your next step is most likely going to be the article below...

Continue to guide on [Connecting to EON with SSH](#).

Enjoy and thank you for reading.

Add support for a vehicle

# Contributing

## Creating a New Document

If you would like to create a new document, all we ask is that you first do a search of the repository for similar pages to find the best place for it. If you're unsure, we can all help you with the location when you submit the pull request.

Documents are all in the Markdown format. If you're unfamiliar with this format, it's REALLY straight forward. That's why we chose it.

Markdown is just plain text but uses symbols to emphasize formatting instead of the styling itself.

For a simple cheatsheet, checkout the following GitHub gist...

## Pull Requests

Feel free to create the new document directly in the GitHub interface.

It will guide you to create a Pull Request. Go ahead and do that, and one of the appointed community members will approve the PR as quickly as possible.

Create a new `.md` file in the relevant directory.

Documents should always be as tiny as possible and should stick to its purpose.

If you need to add info that might be already covered by another section, please use a markdown link to that respective content.

## What can a document represent?

A document should always be as small as possible. Do not over explain. If it's a question that hasn't been submitted, submit it quickly so it gets indexed and we can reference those links later when people continually ask them.

Short and sweet.

## An example of an FAQ addition

*In slack, you notice someone asked this:*

```
I'm taking my vehicle in for service ... is there an easy way to remove the giraffe?
```

You simply create a new md file in `src/faq` with a relatively useful but not too long name such as `how-to-remove-giraffe.md`

With the following content:

```
Q: I'm taking my vehicle in for service ... is there an easy way to remove the giraffe?
```

```
A: From the back of the griaffe, go up from the bottom, there is a tab to depress, giraffe slides out
```



## Markdown

We didn't think it made much sense to write an entire document on Markdown but we found a great Gist we can embed here for your viewing pleasures...

Think of this like a cheat sheet for how to format your [openpilot](#) documents.

[Markdown Cheatsheet](#)