



# TPPE 000 Technical Presentation Proficiency Examination

## Subwoofer Installation Project

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# Subwoofer Installation Project

## Outline

- Brief Introduction to Car Audio
- Why Would I Want a Car Audio System?
- Subwoofers
- Wiring & Interference
- Circuit Diagrams
- Problems Faced
- Cost
- Pictures
- Summary

# Subwoofer Installation Project

## Introduction

- A car audio “system” has many components
- Power Related components
  - Battery, alternator, capacitors, amplifiers, etc.
- Audio/Video components
  - Deck, head unit, speakers, TVs, etc.
- Accessories
  - Wires, fuses, splitters, connectors, etc.

# Why Would I Want a Car Audio System?

- You may want to...
  - Make long car rides less boring
  - Make you system support devices
- For me that answer was simple: I wanted to...
  - Enhance my vehicle's multimedia experience
  - Increase the overall volume and fidelity of my vehicles audio system
  - Boost "Bass" reproduction
- In order to fulfill my requirements, I would need to install an amplified subwoofer.

## Subwoofer Installation Project

# What is a Subwoofer?

- A subwoofer (sub) is essentially a type of speaker
- They are designed to deliver “bass” notes – low frequency sounds, typically around 10-200 Hz
- Subs are often employed in cinemas and home theatre setups
- They come in a variety of shapes and sizes
- Circular cone subs can be anywhere from 8” to 20” in diameter



# What is a Subwoofer?

- Some important sub specifications:
  - Number of voice coils
  - Electrical Impedance; ( $\Omega$ )
  - Recommended enclosure volume; ( $\text{ft}^3$ )
  - Response Frequency Range; (Hz)
  - Speaker Sensitivity; dB
    - The “intensity” of the subwoofer measured from 1 meter away using 1 watt of input power.
  - Nominal Power Range; Watts (RMS)
    - The recommended input power range for subwoofer operation.

## Subwoofer Installation Project

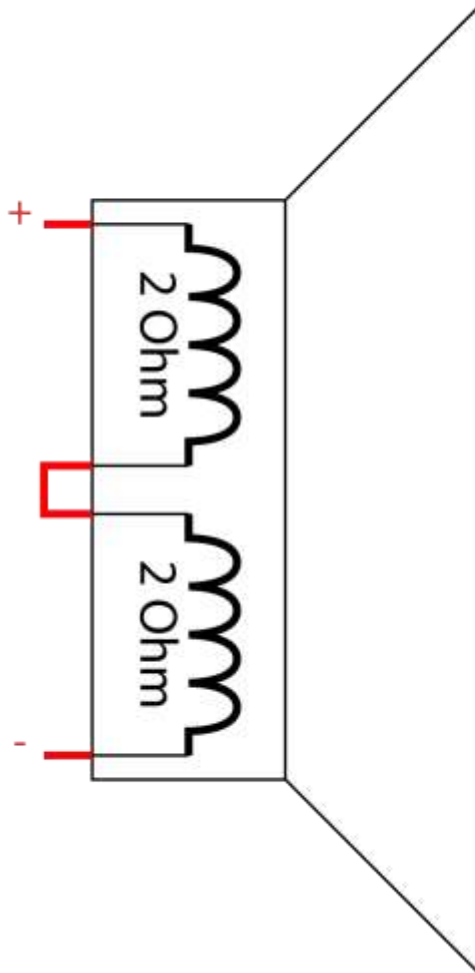
### My Subwoofer Pick

- I choose a Pioneer 12" TS-W308D2
  - Dual voice coils (DVC) ( $2\Omega$  each)
  - Impedance; either  $1\Omega$  (DVC in parallel) or  $4\Omega$  (DVC in series)
  - Recommend enclosure volume;  $0.85 - 1.75 \text{ ft}^3$
  - Response frequency range; 20-180 Hz
  - Speaker Sensitivity; 90 dB
  - Nominal Power Range; 400 Watts RMS (Max 1400 Watts)
  - Purchase price; \$65 (USD)
- This sub offered great value, while still being reasonably powerful and loud.

# Subwoofer Installation Project

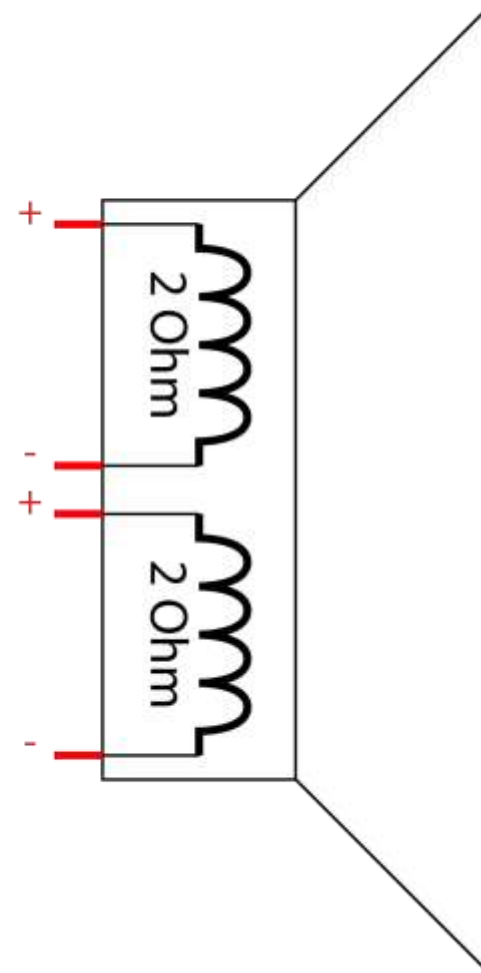
## Dual Voice Coil Configurations

Series (4 Ohm)



VS.

Parallel (1 Ohm)





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### How to Power the Sub?

- An amplifier (amp) must be used in order to increase the power of the source audio signal
- I choose a Pioneer GM-5300T
  - Nominal Power Output; 380Watts RMS (Max 760 Watts)
  - Purchase price; \$100 (USD)
- This amp was fairly inexpensive while still meeting the power requirements of the load (the subwoofer)



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### Wiring

- The amp drew a max 30 Amps with a 4Ω load
- 4 AWG copper wire was chosen for the battery to amp run (~18 ft)
- 8 AWG speaker wire for the amp to subwoofer run (~2 ft)
- I purchased a wiring kit for \$100 (USD) that came with the necessary wires as well as some helpful connectors and accessories

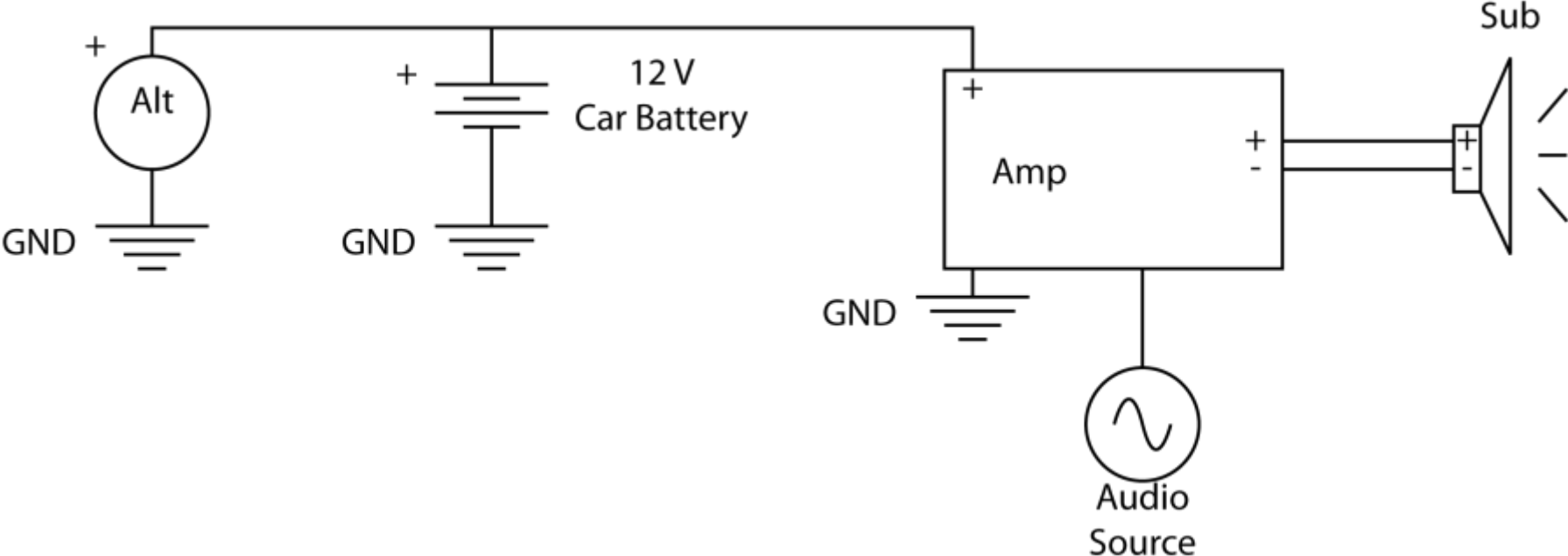


# Interference

- Wire carrying large amounts of current produce an Electromagnetic Field (EMF)
- This EMF can induce a current in a proximal speaker wire creating Electromagnetic Interference (EMI)
- This leads to artifacts and unwanted noise in the subwoofer's audio output.
  
- To help avoid this interference, I ran all the power cable and speaker cable on separate sides of the vehicle
- Furthermore the amplifier has filters that helps normalize noise from the alternator/battery

# Subwoofer Installation Project

## Simplified Circuit Schematic



## Subwoofer Installation Project

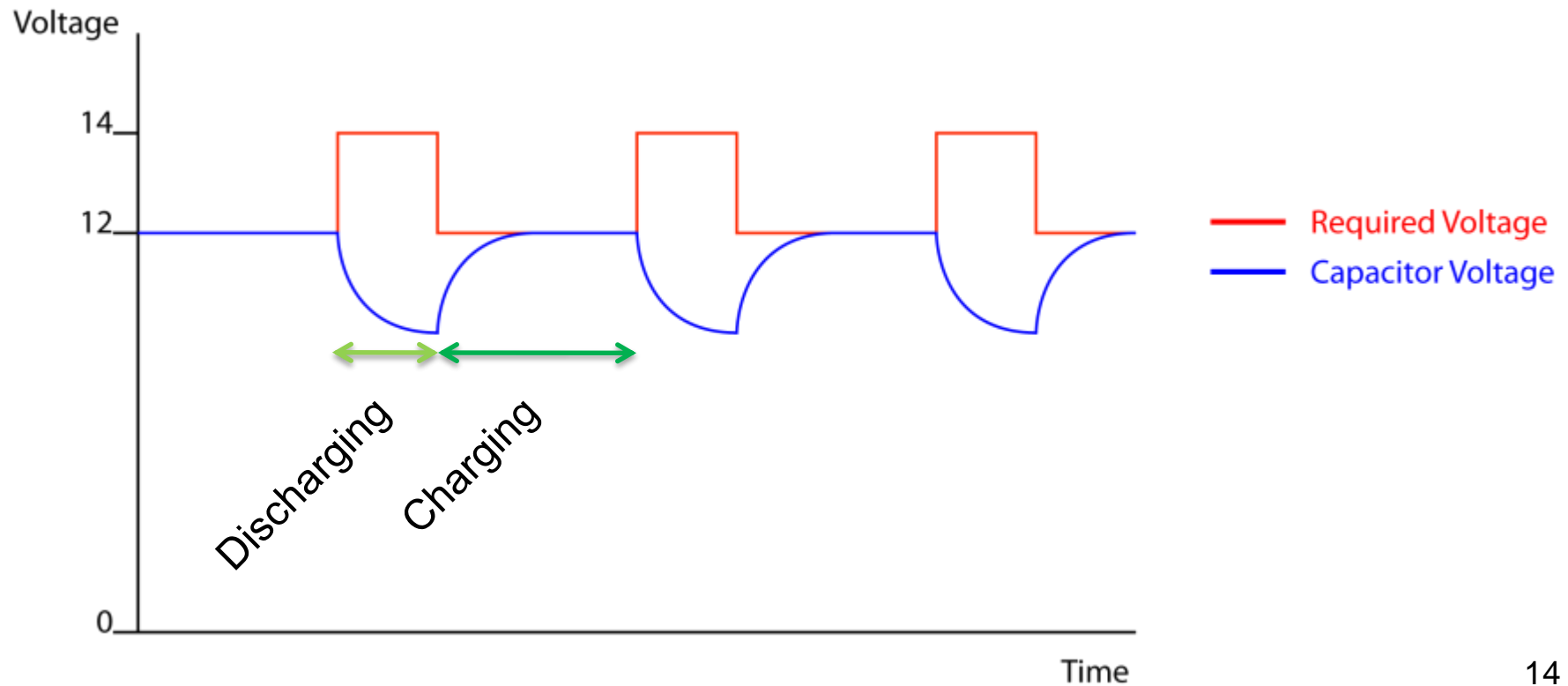
# Capacitor

- Headlights were dimming on heavy bass hits
- Inadequate voltage in the system
- Installed a 1 Farad electrolytic capacitor to provide extra voltage during peak voltage use
  - Capacitor could quickly supply voltage to the sub when needed
  - Capacitor charged during periods in between bass hits



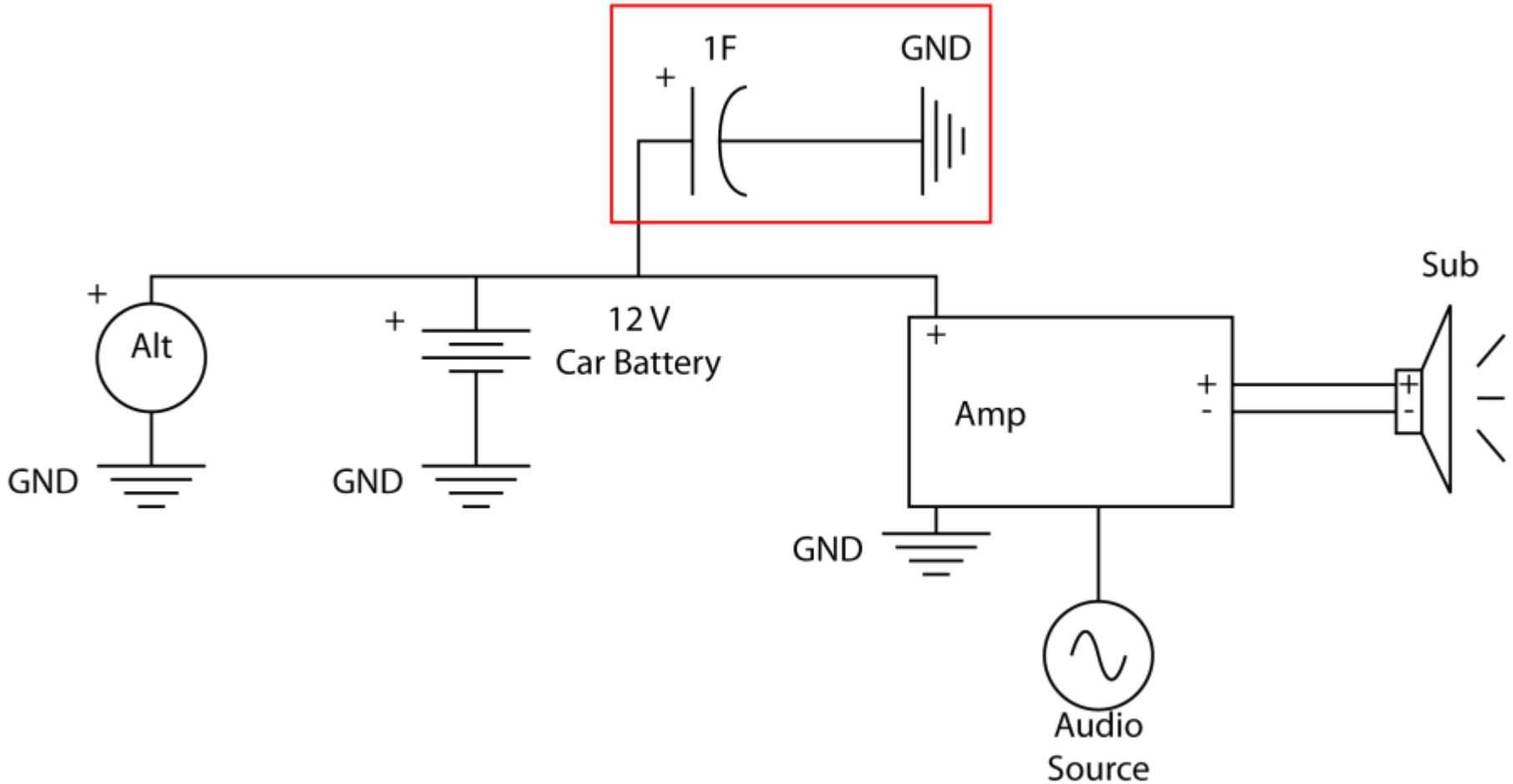
## Capacitor

- The capacitor essentially helped “fill in” voltage fluctuations



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## Final Simplified Circuit Schematic



## Subwoofer Installation Project

# Total Cost

- By doing the install myself, I was able to save on installation costs:

Part	Cost (USD)
Subwoofer	\$65
Enclosure	\$35
Amplifier	\$100
Wiring Kit	\$100
<u>Capacitor</u>	<u>\$80</u>
<b>Total</b>	<b>\$380</b>



# Subwoofer Installation Project

## Pictures



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# Subwoofer Installation Project

## Pictures



# Conclusion

- Vehicle is much louder
- Audio system has better bass reproduction; much more immersive listening experience
- Gained knowledge of the electrical systems in automobiles
- Gained knowledge of various electrical components (capacitors, amplifiers, wiring, etc)
- I would recommend installing a car audio system with subwoofer to anyone with a “stock” system

# Subwoofer Installation Project

## References

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## Subwoofer Installation Project

# Questions?

The pleasure we obtain from music comes from *counting*, but counting unconsciously. Music is nothing but unconscious arithmetic.

- Gottfried Wilhelm Leibniz