

Interconnect Team

Nick Steele '20 and Monserrat Mendez '20

Interconnect Team:

The electrical components, connections, cables, boards, plugs, fuses, screens, buttons, and relays on the car are dictated by the electrical sub-teams and the competition rules. The mechanical team decides how to package and organize all the electrical systems within the frame of the car. The interconnect team is generally responsible for packaging and mounting all electronic systems onto the car except for the batteries, the motor and braking system electronics. These are the responsibility of the tractive system voltage (TSV), drivetrain, and pedals subteams. In addition, 'odd job' projects seem to get umbrellaed under the Interconnect label. Working on this team requires significant collaboration with almost every electrical subteam. It is important to remember that even though the system is in a good spot, do not fall into the trap of doing something because the year before did.

Resources:

[CarMan and Relay Board User Manual](#)

[Motor Controller User Manual](#)

[CoolMan User Manual](#)

[DashMan User Manual](#)

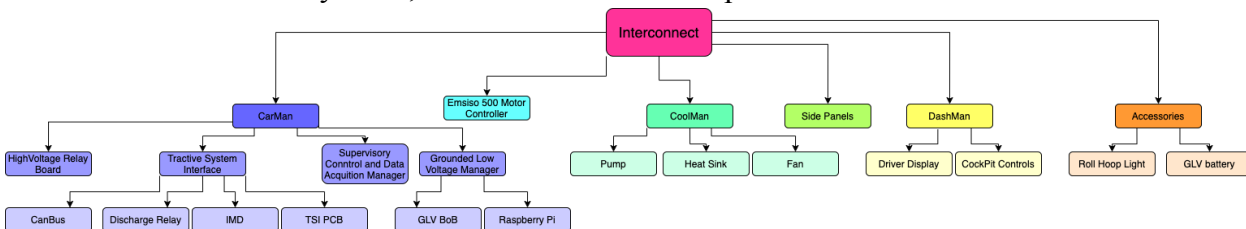
[Motor Sports Website](#)

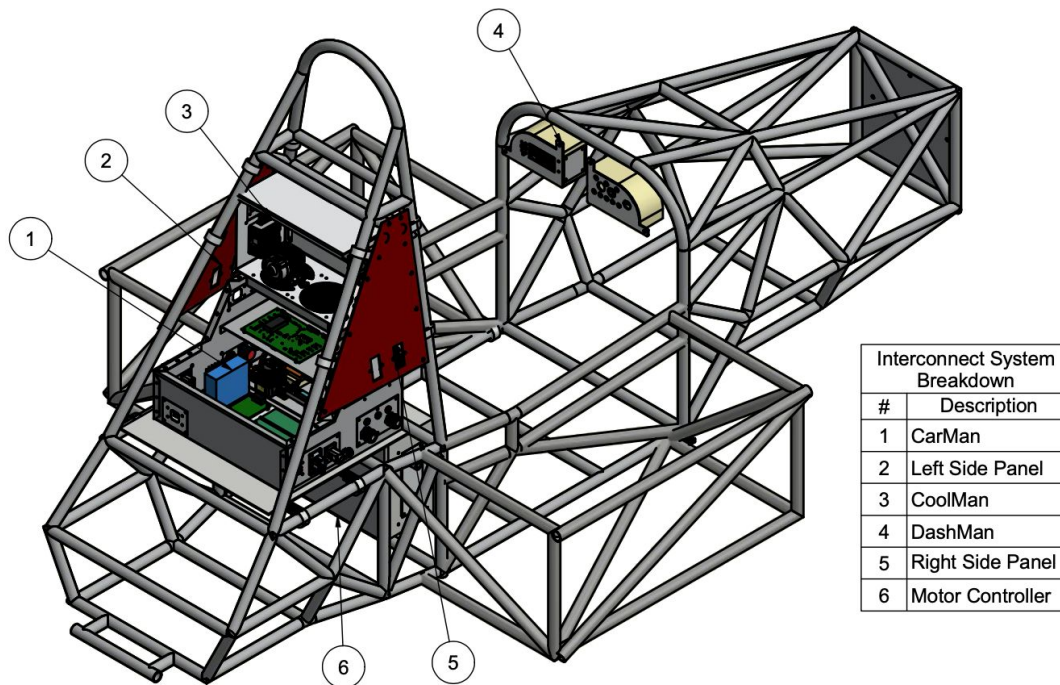
Google Drive File Paths:

- **CarMan** : CompleteAssembly > 2019-2020-Complete > Enclosure > CarMan
- **MotorController**: CompleteAssembly > 2019-2020-Complete > Enclosure > CarMan > Motor Controller > MotorContoller_Asembly.iam
- **CoolMan**: CompleteAssembly > 2019-2020-Complete > Enclosure > CoolingShelf > GLVBatteryAndCoolingShelf.iam
- **DashMan**: CompleteAssembly > 2019-2020-Complete > Dashboard > DashAssembly.iam

Interconnect Systems Break Down and Organizational Structure

It's up to the interconnect team to decide exactly what goes where, how it's mounted and enclosed, and the general organizational structure of the interconnect systems. Some criteria that might impact design decisions are accessibility, rules compliance, water resistance, size limitations, and cable management to name a few. The following is a breakdown of all interconnect subsystems, subassemblies and components:



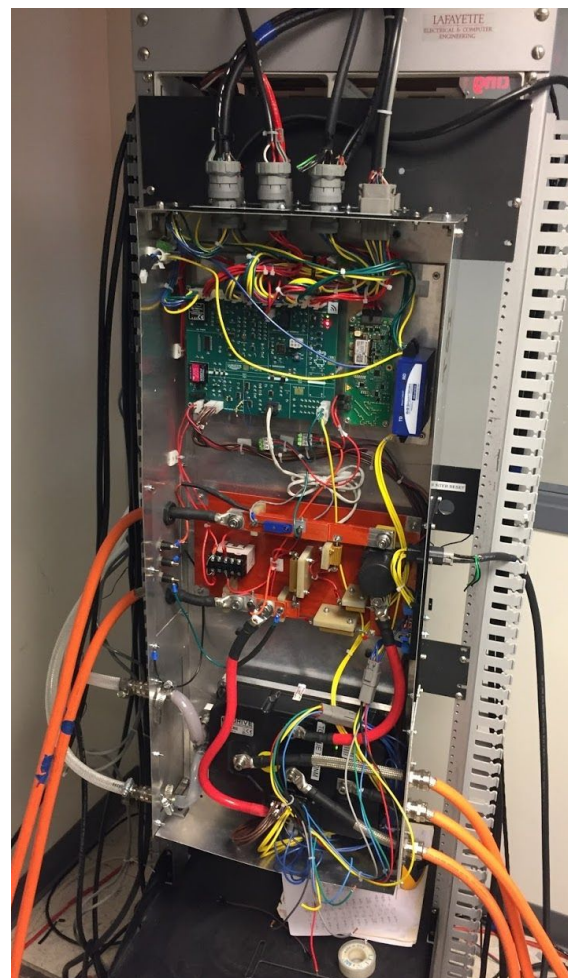


History of CarMan and the Interconnect Systems

CarMan is the result of significant iteration on previous designs. The evolution of the current system began with the earliest electric car teams. The 2018-2019 team built a 2-dimensional test enclosure for the Acopian dynamometer. This 4-foot tall sheet metal shell housed the TSI, motor controller, and the first iteration of the high voltage relay board. The test enclosure was successful and proved to be highly useful until it was disassembled in late 2019.

The objective of the 2019-2020 team was to fold the 2D fixture into a compact package that would fit into the car frame's size restrictions. Three design reviews and three redesigns were needed until the CarMan's final design was approved. The motor controller would be removed and the GLV systems added. The motor controller would be mounted underneath the car behind the driver in order to make room for the rest of the interconnect systems.

CarMan fabrication began in December 2019 and was nearing the final stages of assembly before the coronavirus shutdown began.



Current State of The Design and Errata

Interconnect subassemblies are at varying degrees of completion. CarMan was the main focus of this year's team as it represents a large portion of the entire interconnect system. In addition, its completion was required to be able to test and troubleshoot all the electrical systems it encloses. Once it reached a stage of significant completion, work on the other subassemblies began. The following is a list of interconnect projects from most completed to least completed:

1. Side Panels (Mounted in Dyno Room)
2. CarMan (Electrical Systems Installed)
3. CoolMan (Prototype in Dyno Room)
4. Motor Controller (Some Parts Manufactured)
5. Dashman (Preliminary Inventor Design)

In order to avoid an excessively long report, please see each of the interconnect system user manuals for specific details and recommendations. These user manuals are not an exhaustive list of interconnect tasks. You will find that as you get closer to competition more and more projects and more and more problems will seem to appear. Some of these may be cabling and conduit, adding a 'subfloor' to protect wiring by the driver's feet and a waterproof hood to protect CarMan.

General Advice and Takeaways for the 2020-2021 Team

Being part of the car team is an amazing opportunity. You will have the chance to design and build a freaking race car! This project is both extremely rewarding and extremely difficult. This project is ME 210 on steroids. You will learn more about the design/build process than any other senior project. You will find that working on a team of 20 some odd people is as challenging as any other part of the project. That being said, one of the most difficult parts of this project is picking up someone else's work in an area that you have no experience in. The interconnect team has put together a list of general advice to, hopefully, make this transition easier.

1. **Jump in head first!** You may feel overwhelmed with the work required to finish this project, how many unknowns there are, or how little you feel you know. Stick with it and push it. We have all been there. There is so much information on FSAE cars on the web. Researching what other teams do is a great place to start.
2. **Read the rules!** The rules dictate almost everything on the car. They dictate what materials you can use, spacing requirements, location of components, and many other things. The rule book is hundreds of pages long. **You do not need to read everything**, but skim them and make a list of rules that are relevant to your systems. Make a list of what lights, buttons, and keys need to be on the car and where they need to be.
3. **Use your resources!** Professor Helm, Professor Nadovich, and Rob in the shop are great resources. They have years of experience and can find a solution to almost any problem. Also, use us. Everyone wants to see this car built and finished and would be glad to help get it there. Feel free to reach out to us at any time if you want to ask questions or just need general guidance.
4. **Stay organized!** Keep your shared drive organized and your machine shop organized. This is extremely important towards the end of the semester when you have hundreds of .ipt files, dozens of assemblies and subassemblies. It will make your life easier but it will

also make next year's team's life easier. Also, there is nothing worse than needing to remove two bolts and having to spend 15 minutes looking for the right Allen key. Make an inventory list to document where things are located in the shop. Have a designated spot in the shop where subsystems will keep their certain parts so things don't get lost. For example, one corner or box specifically labeled for the interconnect pieces that one made can be placed there instead of just on the tables. (That table get cluttered very quickly and it's easy to lose things on that table)

5. **Design tips!** You will most likely design half a dozen mounting systems and enclosures. It is important to master the shop skills required to fabricate these assemblies. When working with sheet metal, **you will never be able to manufacture and bend parts to the tolerance required to build precise assemblies.** Account for this slop somehow. This becomes an issue when aligning water jet cut rivet holes. The middle section of CarMan had to be cut into 3 pieces for this reason. We highly recommend practicing with sheet metal bending and rivets if you decide to go that route. Make sure to **triple check measurements** of things before they are fabricated. It's also a good idea to be **consistent with the type of hardware you use.** For example, using #8 button head cap screws for an entire assembly will mean you only need 1 tool to assemble or disassemble a system. This will make your life and the life of the ECEs using the things you build easier. When designing anything, **think about how each fabrication and assembly process will look.** When creating pieces to put together into one final product, think about what steps you need to take to get there. For example, don't create a complicated shape that might be hard to put together and/ or construct. **Check the machine shop and Rob for any raw materials you might need before ordering.** This will save you time and money
6. **Help out next year's team!** Each team stands on the shoulders of the previous team. It is important for the success of the program to actively help next year's team. One advantage of the virus shutdown is that we have been able to spend excessive amounts of time on documentation to help with this. Hopefully, you will be focused on the competition instead of making user manuals. That being said, keep next year's team in mind when writing reports. Keep your team drive organized and your assemblies healthy and complete. It is also **highly recommended that you involve juniors** on this project. They will have less on their plates in the 1st semester and will help push the project further in the future. They will receive independent study elective credit.