

Cooling System: User Manual

Top Level Diagram:

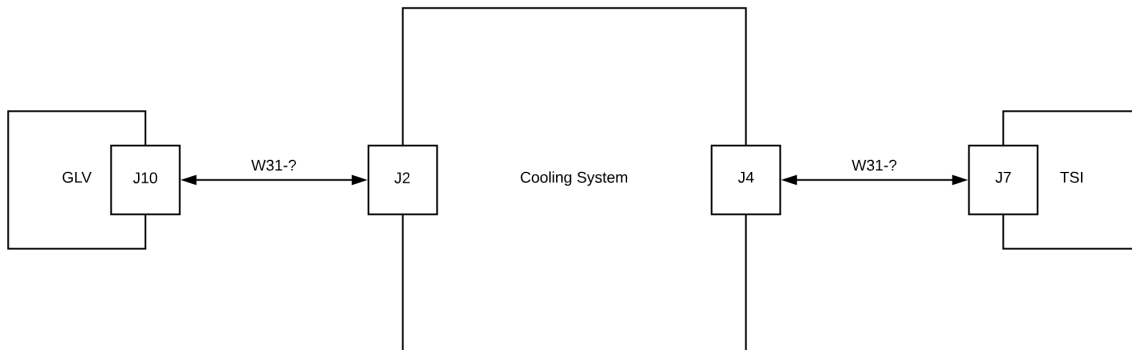


Figure 1 Top level diagram

Connecting the cooling system:

From this top diagram, we can see that the cooling system is connected to the rest of the car with two CAN/GLV cables. Since the CAN network has no particular order the cooling system can have CAN/GLV input and output from any system as long as the packs are the last ones in the network.

Connecting tubing together:

The tubing is connected in a self-explanatory way. The diagram is shown below. There is no specific direction the flow needs to go in. The two ports on the motor controller can be both inputs and outputs.

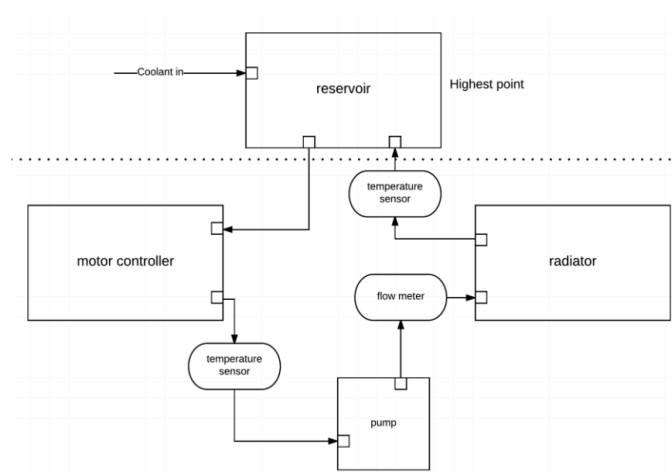


Figure 2 Tubing Connectivity

Wiring the sensors and pump/fan:

The wires from the sensors and pumps/fans go to their respective places on the controller. The controller has 3 spots for temperature sensors and 2 spots to power fans. There is an input labeled pump and another for the flow meter (INS-FM17). The back of the cooling controller is shown below. The manual for the controller is also included on the website.



Figure 3 Cooling Controller Connections

Powering the system:

The motor controller runs off of 12v DC. The car is energized with 24v DC. The cooling system includes a DC/DC step down converter. Wire one side of the converter with 24v from the glv and the other powers the cooling system. The red and black (two leftmost wires) represent positive and negative 24v DC. The white and black (two rightmost wires) represent positive and negative 12v DC. See image below.



Figure 4 24v DC/DC converter

Adding water to the tubes:

Disconnect all of the quick connect fittings and unscrew the tops. Add water to each segment of tubing. Finally add water to the main reservoir.

Removing water from the system:

You can remove the water from the system the opposite way that you added it. Remove the quick disconnects from the motors controller and unscrew the fittings. Dump the water out and repeat for all tubes. The motor controller will have residual water in it. Unscrew the hose fittings from the motor controller and dump all of the water out.

Turning the system on:

When the 12v is supplied to the controller and all the wires are connected, the system should automatically turn on and start pumping. You should start seeing some temperature readings and the typical flow rate value is 6.7 Lpm. If you are not receiving a value around 6.7 then something is wrong with the system. The issue might be the sensor might be broken or not plugged in correctly, there is too much air in the tubing system, or the system is not receiving enough current.

Troubleshooting:

If the water is not flowing then either the pump is not receiving power or there is too much air in the tubing. For the former make sure the pump is plugged into the controller and for the latter keep adding water to the reservoir until it is completely full. Run the system for a short period of time and then turn it off. Open the reservoir and see if it is still full. If not then add water and repeat this process until it remains full.

Rule Compliance:

The cooling system must only use water or the approved opticool coolant fluid described in the rules manual. During competition, this year (Spring 2018) the judges were giving us a hard time for not having a catch-can. They finally deemed it unnecessary because this is a closed cooling system. Therefore there is no need for a catch-can.

System Necessity:

No one has ever done an analysis on whether or not the cooling system is truly needed. It is most certainly not needed to drive the car for a couple of minutes. But we have speculated it may likely be needed for 44 laps in the endurance event.