

Hephaestus Robotics Non-ROV Doc

Glaucus II



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Photo Credit: Amber Williams

Hephaestus Robotics' autonomous profiling float, Glaucus II, was built around the mission to autonomously collect data at different depths. The float is designed to consistently submerge itself to 2.5 m, then back up to 40 cm, and hold its depth while collecting data.

Since the float is constrained to a max height of 1 meter and a max diameter of 18cm, the design of Glaucus II involved creating a CAD model to plan and optimize the space available to optimize the internal space and serviceability. The team put substantial thought and consideration into all engineering decisions, including selecting parts. Firstly, to house all of our components without choosing too large of an enclosure, we decided on a 4" Blue Robotics watertight enclosure, which provides sufficient size, reliability, and had a depth rating of up to 10 meters.

Name of Pump	15 ft check	Time(to 15 ft)	Power Draw(15ft)	Additional Notes
Goso GB37-530	☒	13.93s	14.11W	1st choice: works well, reversible, small
Kamoer KHPP260-HB-B22	☐			dysfunctional
Kamoer KPHM600-SW3B17	☒	12.12s	14.1W	2nd choice: works well, reversible, big
Seafo SFSP1-L016-01	☒	2.36s		pumps too fast; would need solenoid
CrocSee CRS-A016	☒	7.14s	14.14W	nonreversible

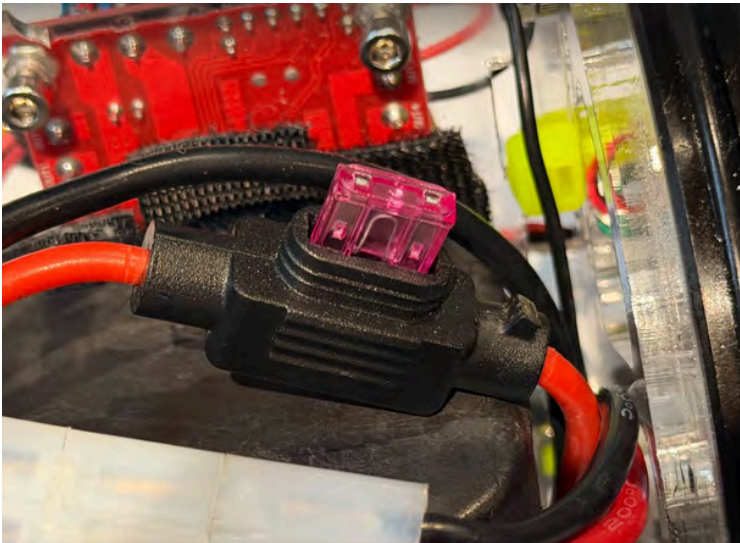
The system is controlled by a Raspberry Pi 4B, which controls the buoyancy engine, sensors, and LEDs, and directly interfaces with an L298N H-Bridge motor driver over GPIO, providing easy control over the pump via Python. The pump adjusts buoyancy by moving water in and out of a bladder in the system. The float measures depth with a Blue Robotics Bar02 pressure sensor, which converts pressure to depth. This data is graphed using Matplotlib. The float is powered with a 12V NiMH Battery, selected due to its higher current capacity than C-size alkaline batteries. The battery provides 12V to the pump, and is stepped down to 5V with a step-down converter for the Pi. The float includes

a 5V RGB LED strip mounted inside the float along the perimeter, which produces different colors to signal what action the float is performing: descending, ascending or depth holding. Glaucus II uses a PID controller to maintain a desired depth underwater. This control system constantly adjusts the motor output based on pressure sensor feedback, allowing the float to hold a specific depth with precision. Thousands of simulations were conducted to tune the PID controller, testing various parameter combinations to achieve the most ideal responsive behavior. The float communicates with the topside via Wi-Fi provided from a router and amplified by a yagi antenna. To determine the required ballast and ensure neutral buoyancy for Glaucus II, we first calculated its total mass and volume. Using Archimedes' Principle, we calculated how much water Glaucus II needed to displace to equal its weight. Since water has a known density, we used the mass of the float to figure out how much mass and volume it needed to displace. This process ensured that the buoyant force matched the weight of Glaucus II, allowing it to maintain stable underwater positioning.

The power system was designed with a 12V 3000mAh NiMH battery pack to provide a high-current source capable of supporting the dual-voltage requirements of the propulsion and logic systems. To safely fulfill the 4.35A Full Load Amperage (FLA), the architecture utilizes a high-efficiency DC-DC buck converter to step down voltage for the Raspberry Pi 4B, LED strip, and Bar02 sensor, while providing direct 12V power to the L298N motor driver. This ensures a regulated, stable voltage prevents logic resets during motor-induced voltage sags. By calculating the "worst-case" simultaneous draw of all components, the system ensures the battery's discharge rate is not exceeded. Overcurrent protection is managed via a fused main line, currently utilizing a 5A fuse.

Component	Max Current Draw (Amps)
Pump	2.00 A
Raspberry Pi 4B	1.47 A
LED Strip (30 leds)	0.86 A
Bar02 pressure sensor	0.0004 A
L298N Motor Controller	0.018 A
Total	4.3484

Total FLA: 4.35 Amps
Fuse size selected: 5A



5A Fuse



12V 3000mAh NiMH Battery Pack