

Rüdiger

NON-ROV Device Documentation

A. Mechanical Design

Our float *Rüdiger* (Figure 1) is constructed from a 100 mm acrylic tube, a lead screw and a 550 mL syringe, forming a buoyancy engine.

The internal volume of the syringe is changed by extending or retracting the plunger, controlling the intake of water. This directly modifies the buoyancy of the system, enabling control of the vertical descent and stable depth holding during profiling.

The endcaps serve a dual purpose, sealing the enclosure and providing pressure relief, as they will pop out in the case of positive pressure. Externally, there are hooks build into the bottom endcap (figure 3) to attach extra ballast, enabling buoyancy adjustments as needed. Internally, the stepper motor driver and other connectors are soldered onto a perfboard mounted to the Arduino. The Arduino and the battery pack are secured to the top endcap. The pressure sensor is mounted externally to the bottom endcap to ensure direct contact with the surrounding water.

B. Electrical Design

The float is controlled by an Arduino Uno R4 with a built-in WiFi module. The Arduino controls the stepper motor to drive the buoyancy engine based on the depth data collected by the pressure sensor. A limit switch integrated into the buoyancy mechanism is used to detect when the plunger reaches the end position.

The power system consists of battery pack made of 8 AA NiMH batteries connected in series to supply the system with 9.6 V. The series configuration increases the voltage to meet the voltage requirements of both the Arduino and the stepper motor. The positive line of the battery pack includes a 2A fuse for overcurrent and stall protection. The fuse is sized to safely handle current spikes while preventing damage in case of a short circuit or failure of the limit switch.



Figure 1: Rüdiger



Figure 2: NiMH Battery Pack and Fuse

C. Mission Operation

Before starting its mission, Rüdiger hosts a local WiFi network, the laptop control interface connects to that network. When a button on the interface is pressed the float receives a command to initiate the dive and begin depth data recording. To approach and hold the target depth reliably a PID algorithm is used of the depth data to regulate the position of the plunger.

During the mission Rüdiger's status is continuously displayed by an LED Matrix internally. After completing the two dive cycles the float holds its position underwater. A bright blinking LED is then activated to signal the ROV for retrieval and to increase surface visibility. Back on the surface the control interface connects back to the float and sends a command to transmit the recorded data. The depth is then graphed on the control interface.

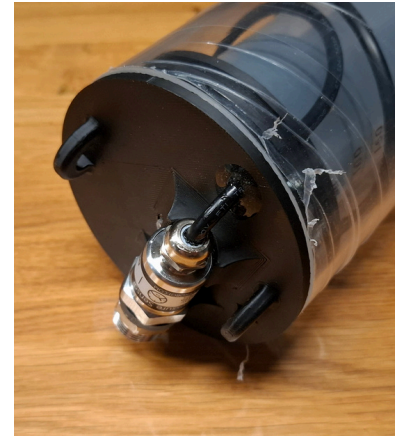


**Figure 3: Bottom Endcap
with hooks**

Electrical SID for Profiling Float and Reciever

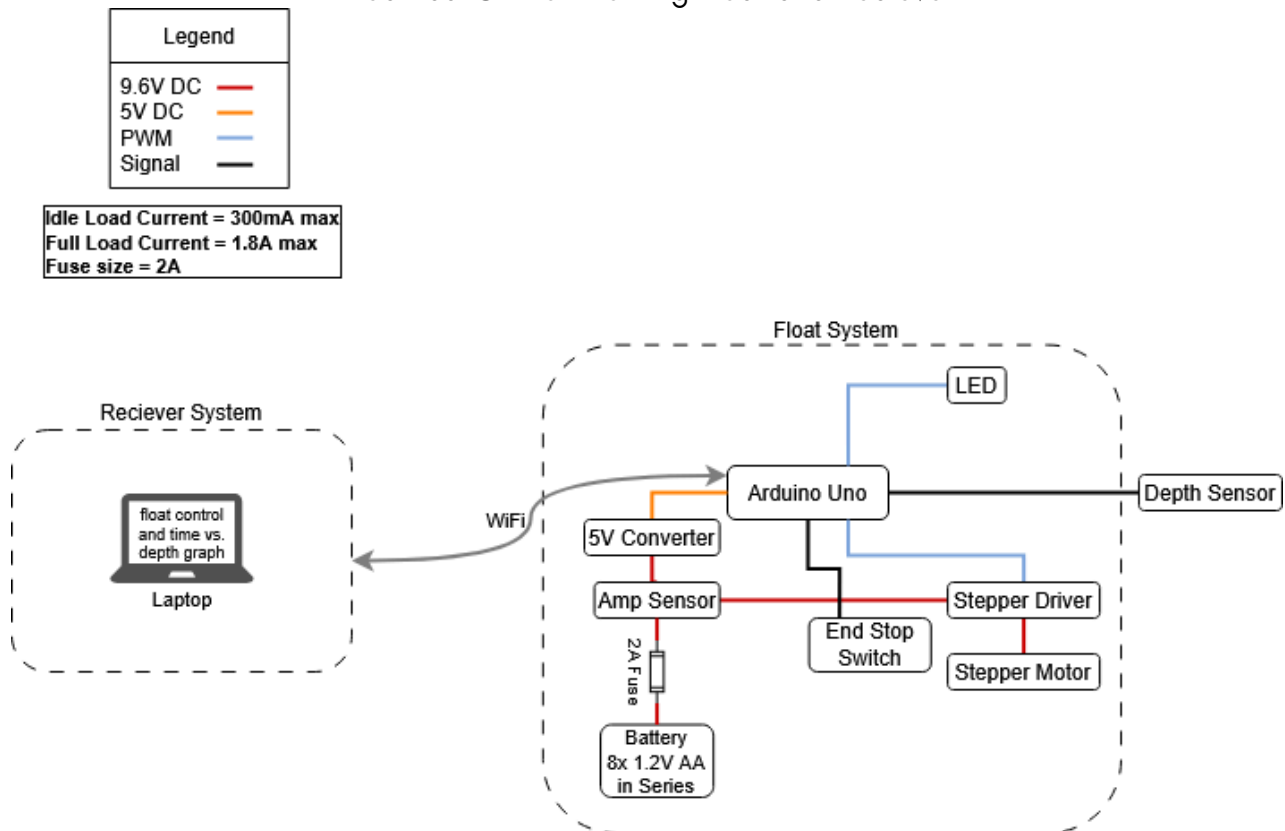


Figure 4: Electronics Systems Integration Diagram (SID)