

NKUST ROV TEAM 2026 MATE Non-ROV Device Design Document

The vertical profiling float, measuring 500 mm in length and 150 mm in diameter, is designed for autonomous underwater missions, fully complying with the competition's thruster-ban and size constraints. The main pressure hull utilizes a clear acrylic tube for easy visual inspection. The end caps are 3D-printed using PETG and fully coated with epoxy resin to seal microscopic pores, ensuring a high-pressure watertight seal in combination with dual O-rings. A 310 stainless steel U-bolt is securely mounted on the top cap, providing the required 5x5 cm clearance for ROV recovery. For vertical movement, the device employs a positive-displacement piston engine. A 12V DC motor drives a lead screw and syringe to draw in or expel water, altering the float's overall density to achieve stable vertical profiling.



The system operates on an independent 12V power supply utilizing eight 1.5V NiMH batteries wired in series. To prevent short circuits and overloads, a 1.5A ATO blade fuse is installed within 5 cm of the battery's positive terminal. For hardware safety, the top end cap features a 2.5 cm diameter pressure relief hole sealed with a friction-fit rubber stopper, which automatically pops out to vent internal overpressure and protect the hull. The float is governed by an ESP32 microcontroller. During the mission, it initiates a PID control loop using MS5837 pressure sensor data as feedback to ensure the float hovers precisely at 2.5 meters and 40 centimeters for 30 seconds respectively. An internal ultrasonic sensor monitors the piston stroke, acting as a hardware failsafe to cut power at mechanical limits. The device logs data every 5 seconds. Upon surface recovery, the ESP32 transmits the data packets via LoRa to a topside computer, where a custom GUI automatically plots a "Depth vs. Time" graph to validate the mission.



System Specifications

Full Load Amps (FLA) & Fuse: The measured FLA is 0.1A during waiting mode (motors off) and 0.7A during buoyancy change mode (motors on). A 1A ATO blade fuse was selected based on these measurements to provide a safe and compliant margin.

Communications: Long-range wireless transmission via LoRa; custom GUI automatically generates the "Depth vs. Time" validation plot.

