

NON-ROV DEVICE DESIGN DOCUMENT

Buoyancy Engine

To comply with the 2026 dimension constraints, the float is housed in a cylindrical enclosure measuring less than 1 meter in height and under 18 cm in diameter. A 5 cm wide U-bolt is securely mounted to the top cap to serve as the mandatory recovery mechanism for the ROV.

The vertical movement of the untethered float is powered entirely by a custom buoyancy engine. By changing the piston's position, the volume of the closed compartment of the float decreases or increases. In terms of physics, the buoyancy force is dictated by the equation:

*The buoyant force = The acceleration due to gravity * The density of the fluid * The volume of the fluid displaced by the object*



Figure 1: Non-ROV Device

Autonomous Control and Communication

An onboard STM32F103CBT6 microcontroller governs the float's autonomous vertical profiling. The MCU utilises an MS5837 pressure sensor and a JY901B IMU via the UART protocol to continuously monitor depth and adjust positioning, allowing the float to accurately descend to and ascend from the required 2.5 m and 40 cm target depths for 30 seconds each. Two limit switches are installed to prevent the motor from over-actuating the piston, and a DS3231 RTC module via I2C is used for accurate time measurement. An ultrasonic sensor is also utilised as an additional measure to prevent the float from hitting the ice sheet.

Since the float must operate without a tether, it relies on a LoRa module communicating over UART for wireless data transmission. This module broadcasts the initial pre-dive ping and the post-recovery data dump to a custom GUI on the surface laptop. During the submerged profile, where RF transmission is impossible, time and pressure data are logged continuously to an onboard SD Card via the SPI protocol, ensuring zero data loss before the final transmission.

Battery and Power Safety

The float is powered by two onboard parallel 12V battery packs, each composed of ten NiMH AA battery cells connected in series, fully complying with the 2026 battery restrictions. Two voltage regulators provide 5V and 3.3V rails, respectively, for the electronics.

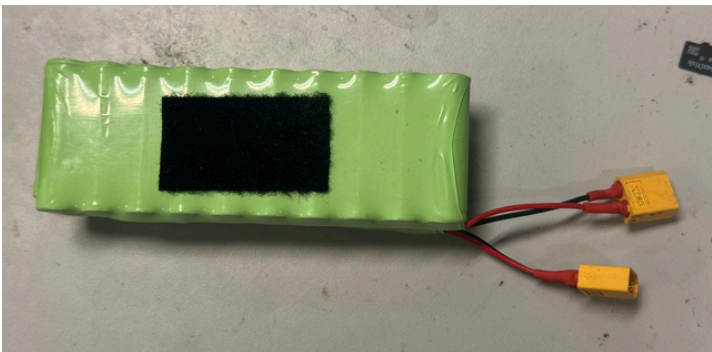


Figure 2: Battery pack

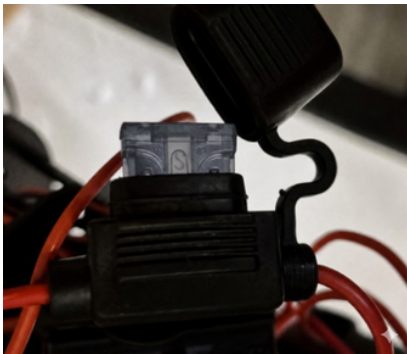


Figure 3: Fuse(s) used on the non-ROV device

System Interconnection Diagram (SID) of Non-ROV Device

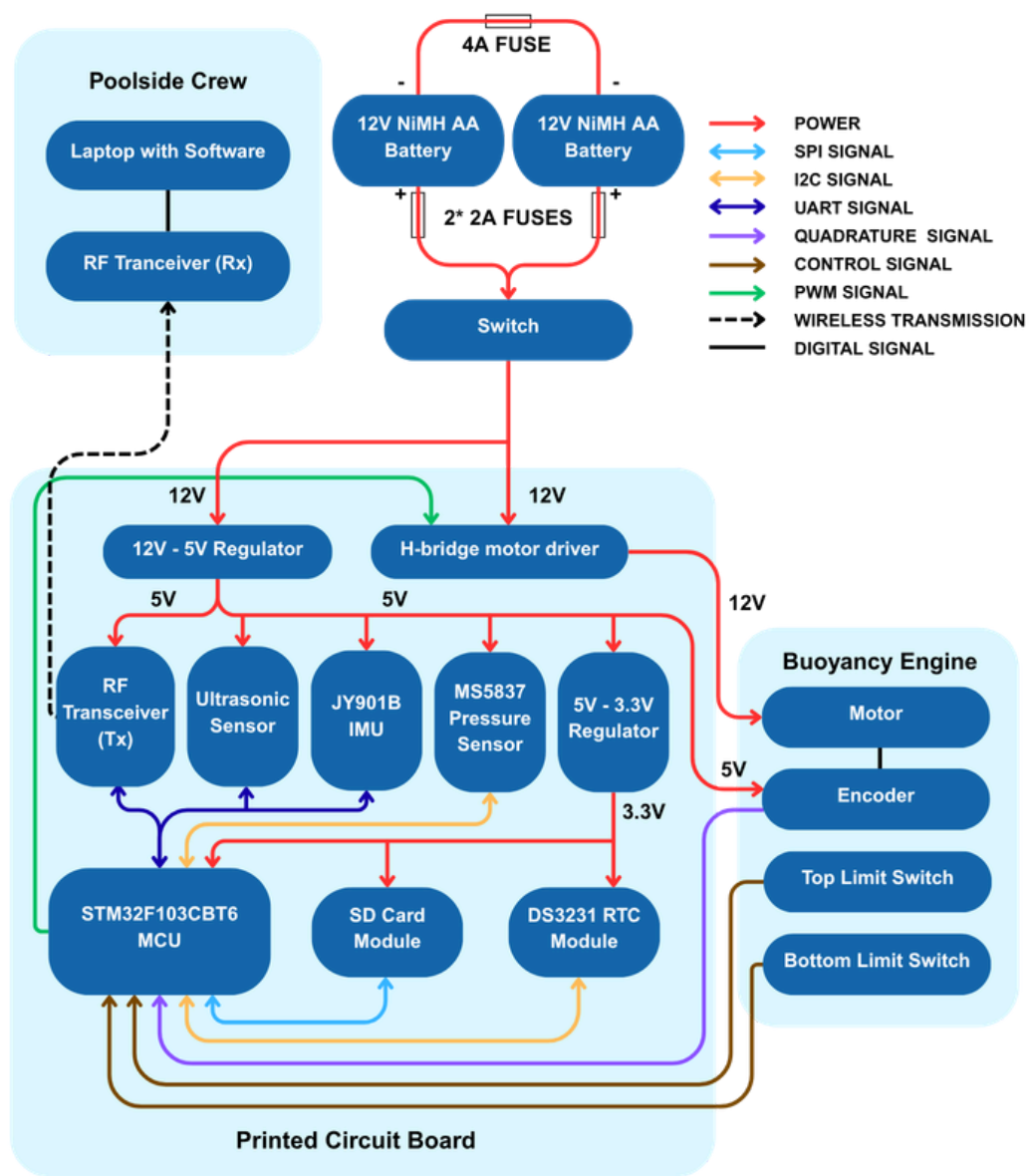


Table of the measurements showing full load current

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Full load amps for waiting mode (mA)	462.38
Full load amps for buoyancy change mode (A)	1.96
Power consumption for buoyancy change mode (W)	5548.56
Per 12V NiMH Battery Pack mAh rating (mAh)	2000
Fuse size per battery pack (A)	2
Fuse size at the common ground (A)	4