

NON-ROV DEVICE: VERTICAL PROFILING FLOAT

The Float is a vertical profiler designed to execute multiple profiles descending to a depth of 2.5m. While completing these profiles, it records and transmits data to the surface side station. The propulsion for the float is a buoyancy engine controlled by depressing or repressing the plunger inside a syringe. Changing the amount of water inside the syringe changes the weight of the float relative to the weight of the water it displaces. The discrepancy between the buoyancy force and the craft's weight permits it to translate up and down and hover in the water.

The float was constructed primarily by a mix of 100% and 75% infill ABS plastic with a rectilinear pattern for the housing, internal supports, and battery packs. Other components include a 500 mL plastic syringe, a Creality 42-34 stepper motor, a PTFE O-ring, a PTFE gasket, stainless steel bolts and washers, brass heat inserts, and lead fishing weights (Figure 1). These items were chosen for their cost, accessibility, manufacturability, and MATE safety standards. Waterproofing was accomplished by using O-ring seals and silicone grease. The pressure sensor was potted with epoxy. The float is 27.84 cm tall with a 15.00 cm diameter.

An ESP32 microcontroller controls the float operation. The complete circuit combines an MS5837-02BA pressure sensor, an RYLR896 LoRa module, and a buoyancy engine consisting of a stepper motor and TMC2209 motor driver (Figure 2).

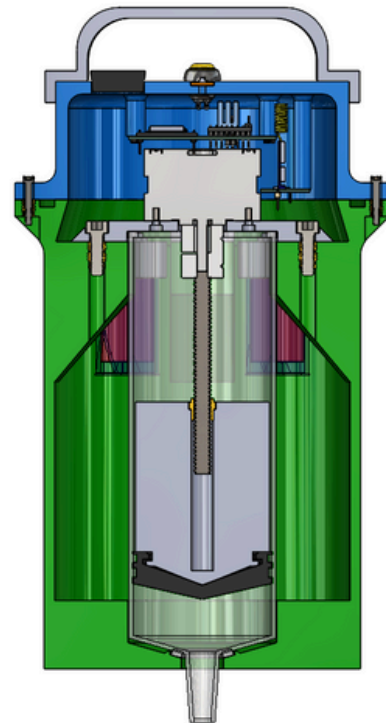
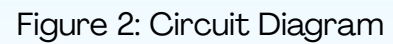


Figure 1: Vertical Profiler CAD Model

Crush Depth used UART serial communication through the HardwareSerial interface for the ESP32 and the REYAX LoRa RYRL896. The LoRa module operates on a bandwidth of 915 MHz, a United States ISM license-free radio band to communicate between the float and the base station. The LoRa utilizes AT commands to set parameters such as address, network ID, bandwidth, and range, respectively. The radio is capable of low bit rate transmission while simultaneously being able to transmit up to 15 km, making it highly suitable for the task.



Figures courtesy in order as listed: Luke Salazar, Jack J. Jackson, and Jake Dudley