

SCAR

SCAR is a pump-driven vertical profiling float that controls depth via ballast modulation for ocean data collection and transmission at specified depths.

Mechanical Design

The main body consists of an acrylic tube sealed at both ends using 100 mm diameter end caps with **dual NBR O-rings** to ensure reliable **watertight pressure sealing**. The enclosure is designed to relieve internal pressure when it exceeds ambient conditions, providing inherent overpressure safety. Rear longitudinal fins are incorporated to provide **passive stability** through a restoring drag-induced moment, maintaining vertical alignment during profiling.

[ELEC-NRD-006]

Buoyancy Engine Mechanism

SCAR's buoyancy system uses two unidirectional **diaphragm pumps**, one for intake and one for expulsion, connected to a sealed ballast tank. A motor driver controls pump actuation to vary ballast volume: increased water intake raises density for descent (negative buoyancy), while water removal reduces density for ascent (positive buoyancy).

[ELEC-NRD-002]

A **float switch** is integrated within the ballast tank as an **overflow safeguard**, providing a hardware-level cutoff for the intake pump when the maximum water level is reached.



Fig. 1. Float Switch



Fig. 2. Weighted End Cap Assembly

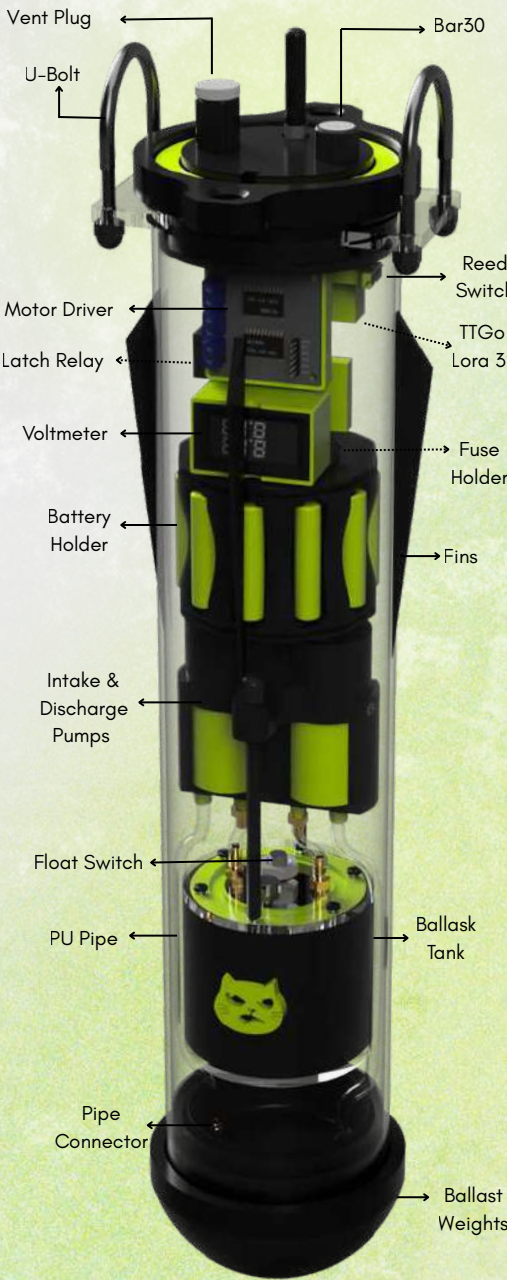


Fig. 3. S.C.A.R. Rendered Isometric View

Dimensions : 15 x 10 x 53 (cm)

Float Communication

FLOAT-SCAR uses a LoRa-based wireless system for command and data transfer. A **LILYGO TTGo LoRa 32 controller** manages depth control, sensor reading, and telemetry logging. During operation, depth and pressure data are stored onboard. After resurfacing, data is transmitted to a ground receiver via **LoRa communication**. The receiver forwards validated packets to a GUI for **graph visualization and logging**. This enables low-power, long-range communication suitable for underwater missions.

Real-Time LED Feedback

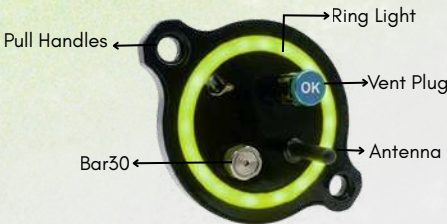


Fig. 4. Top Lid Assembly and Sensor

A visual **LED indicator** provides real-time system status, showing pump activity, cycle completion, and readiness for retrieval.

Electrical System

SCAR is powered entirely by **10 AA NiMH batteries**, protected by a **1A cartridge fuse** and securely housed within a 3D-printed electronics carriage. The system provides a 12VDC supply, ensuring sufficient and **stable power delivery** to the two diaphragm pumps of the buoyancy engine.

[ELEC-NRD-001 & 005]



Fig. 5. Battery Pack of SCAR

Fig. 6. 1A Cartridge Protective Fuse Assembly

A 12-5V voltage regulator powers the Lora32 microcontroller and the motor driver that control the pumps. To maintain depth at 2.5m and 40cm, the **BAR30 pressure sensor** provides real-time depth feedback and a **PID control loop** on the microcontroller regulates pump actuation to maintain target depth. This approach provides **stable vertical control** with lower mechanical complexity compared to actuator-based systems.

SCAR has the **main fuse 3cm away** from the battery pack, connected by a 4cm wire to the positive terminal which is less than the 5cm requirement. SCAR also contains a **Voltmeter** that shows the voltage and amps pull and the fuse holder is easily accesible.

[ELEC-NRD-004]



Fig. 7. Voltmeter - Battery Voltage & Current Draw

The full load amps value was measured & summarized in Table 1 below.

[ELEC-NRD-005]

Full Load Amps Condition	Amperage (mA)
Waiting (Pumps Off)	290
Buoyancy Change Mode (Pumps On)	660

Table 1. Full Load Amps Measurements

Fuse value selected from measurements: **1A**

[ELEC-NRD-007]

