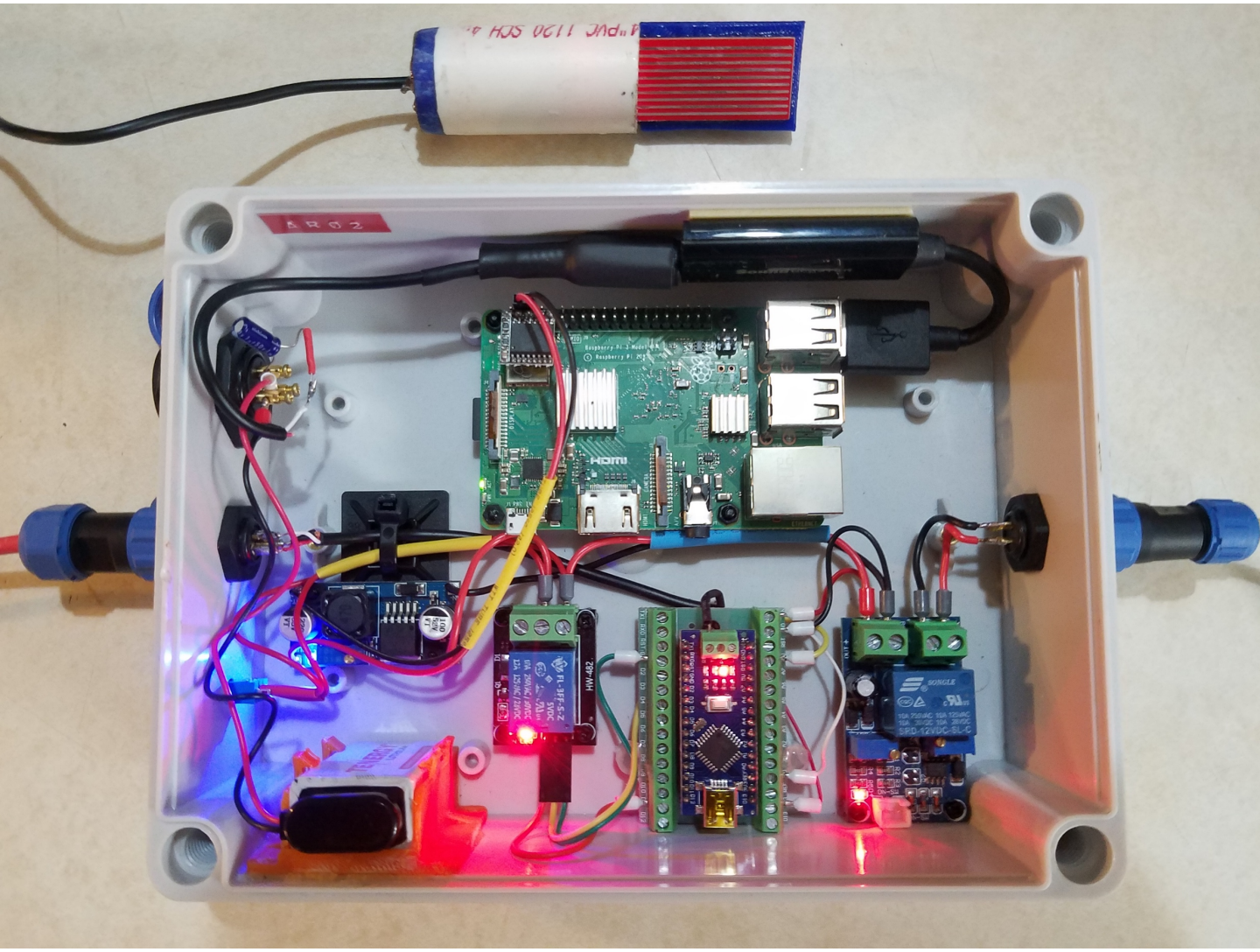
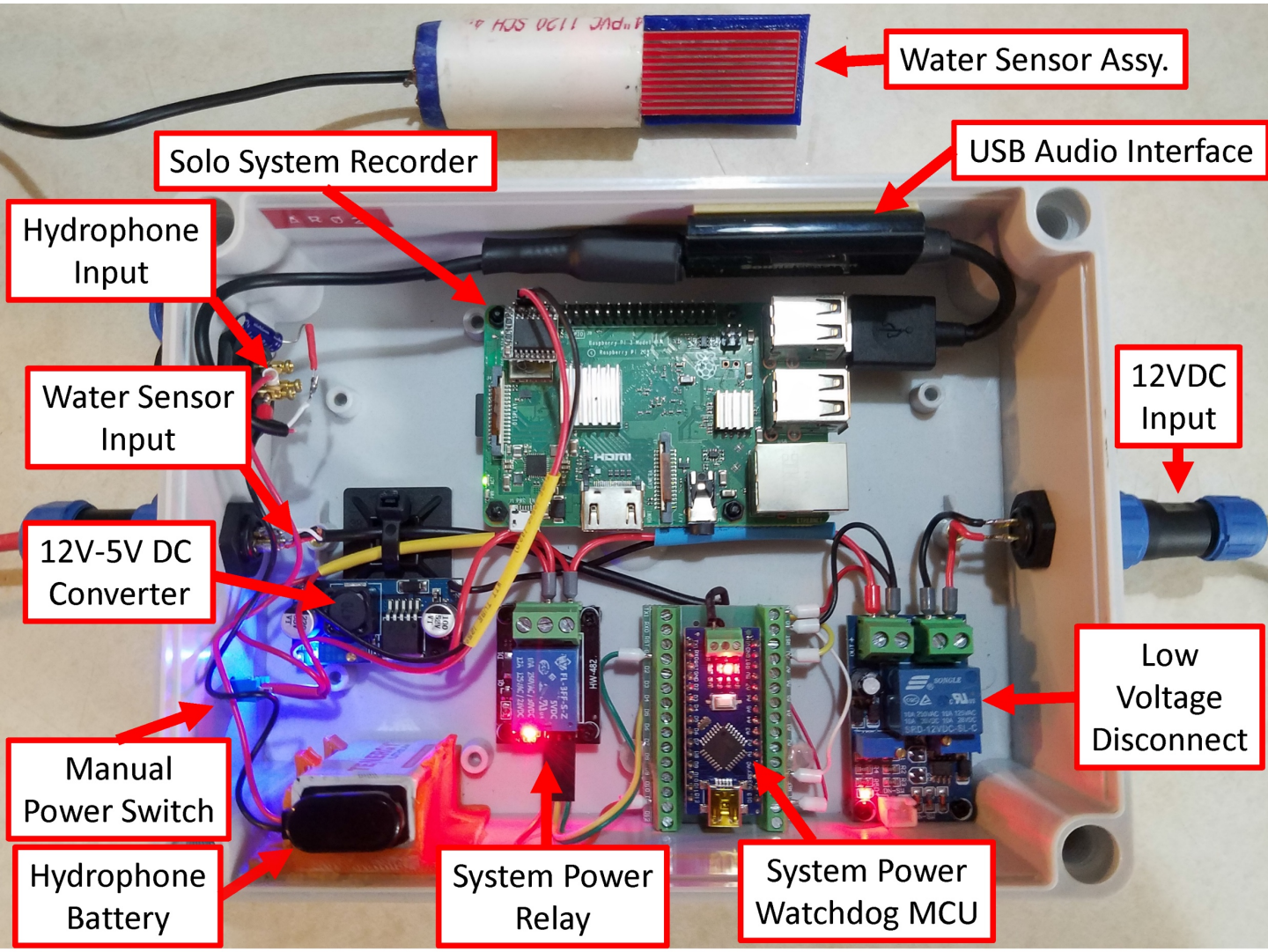
Arroyo Hydroacoustic Datalogger User Guide v0



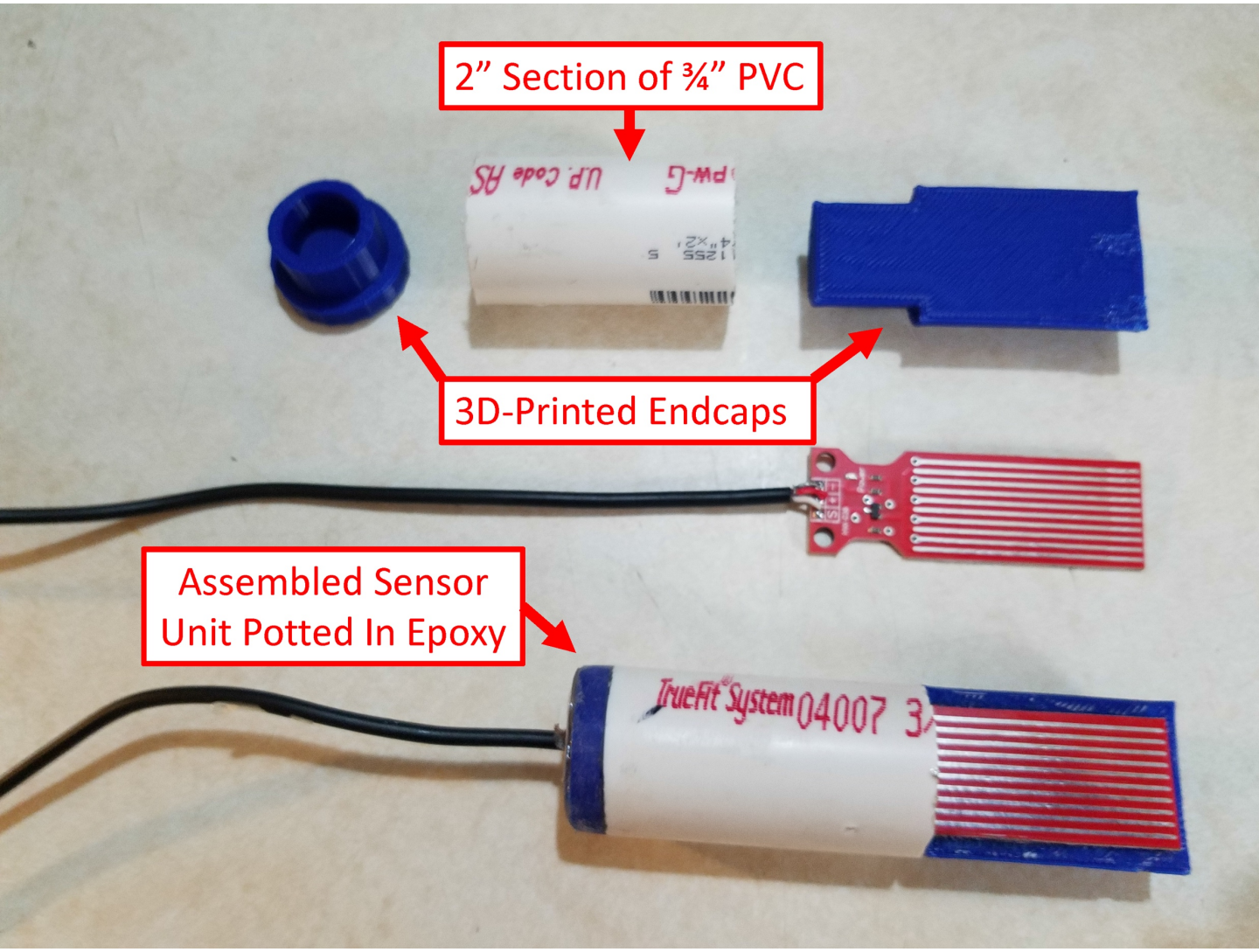
Justin S. Ball
Bureau of Reclamation TSC, 8330
7/13/2021

Module Layout:



The Arroyo logger is an adaptation of the Solo field recording system (https://solo-system.github.io) for acquiring hydrophone data in arroyo environments, where flood events may only happen a few times a year. The system is designed to only power up and record data whenever the water sensor triggers, and to conserve power in standby mode otherwise.

Water Sensor:

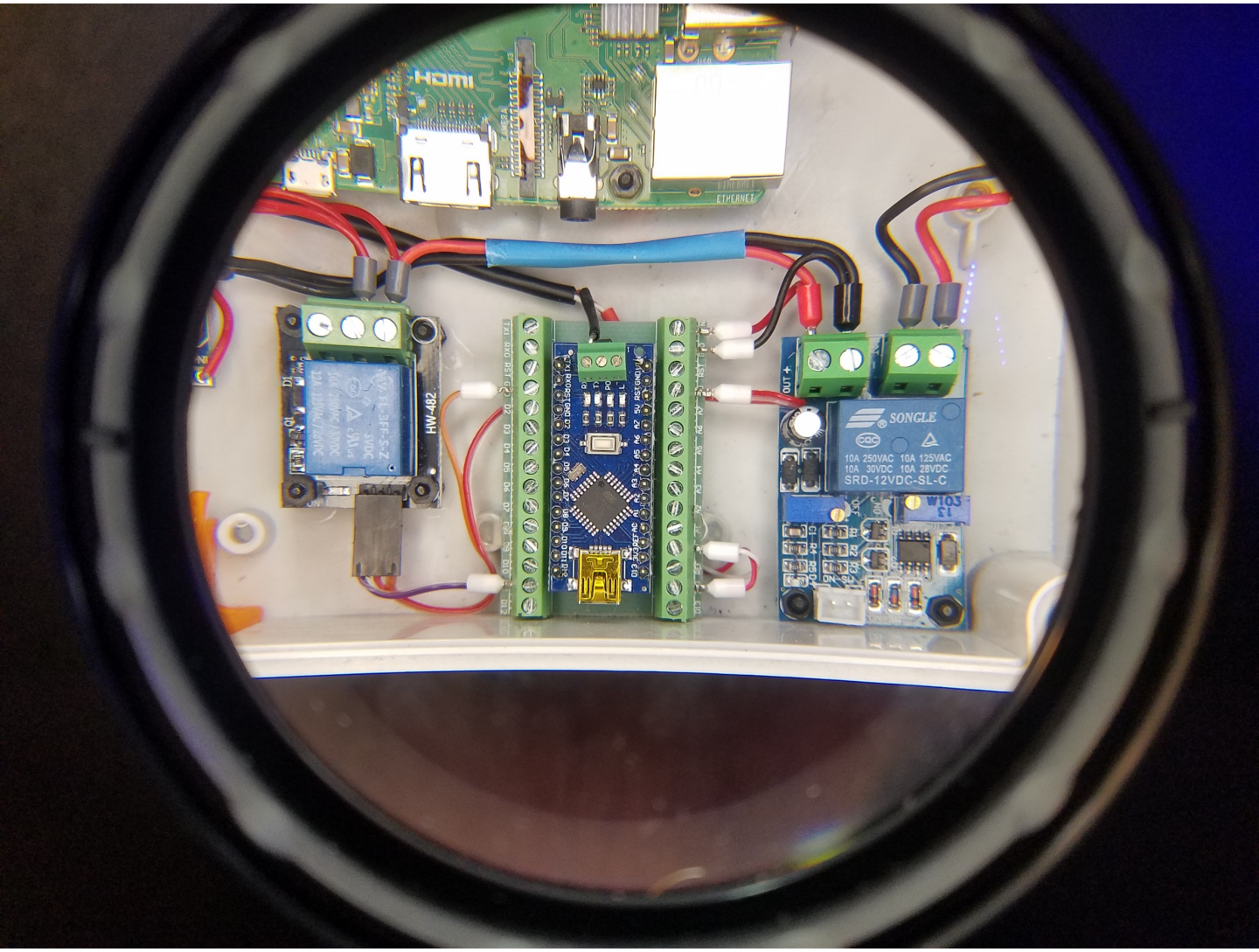


The water sensor is a simple resistive device which outputs an analog voltage in proportion to the amount of water bridging the exposed traces.

As packaged, the units are fully submersible and designed to be compatible with ¾” PVC fittings.

Note that these sensors are susceptible to galvanic corrosion when fully submerged for long time periods, and may require periodic replacement.

Arduino Watchdog Controller:

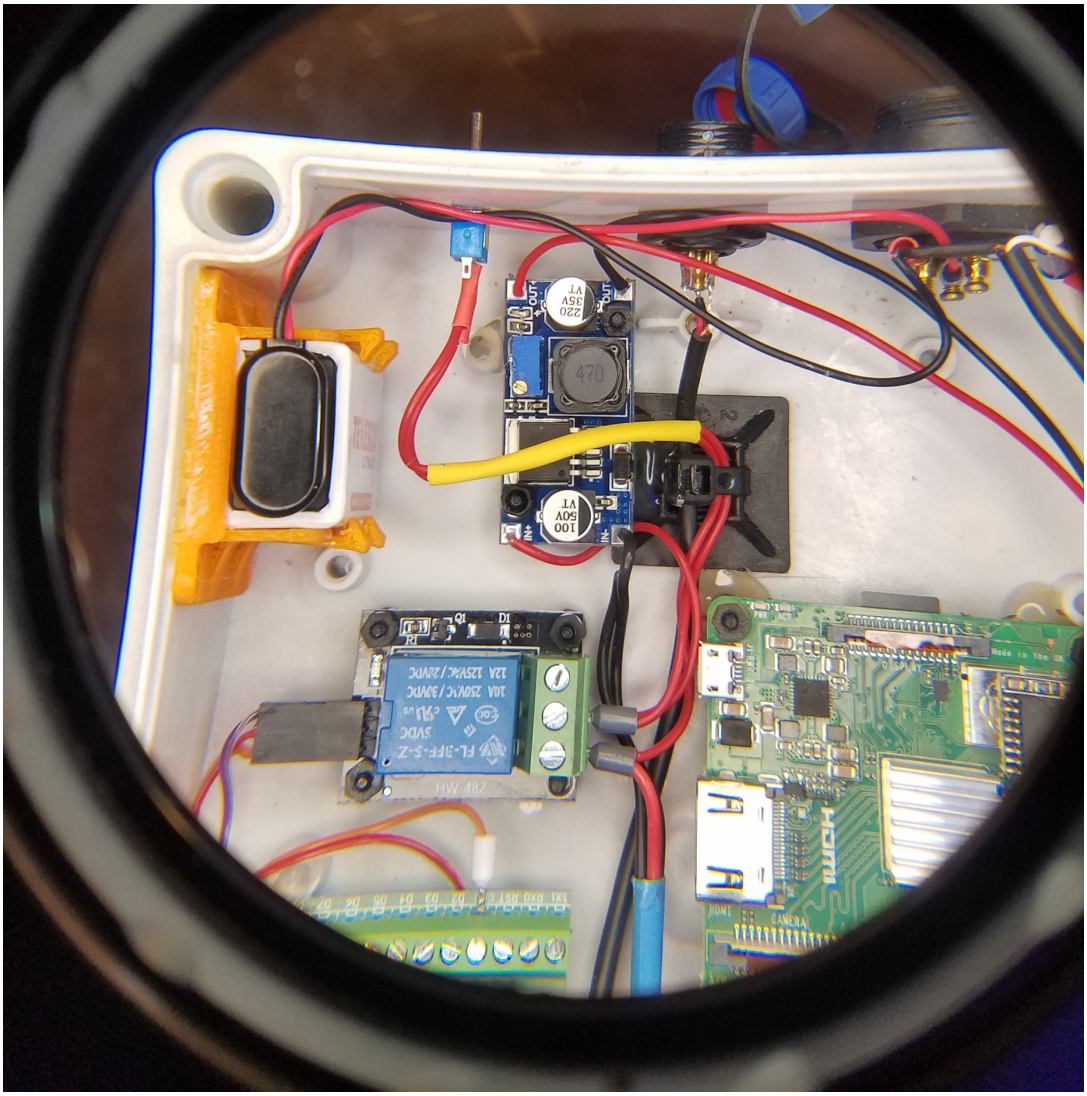


When in standby mode, the Arduino Nano MCU (above center) monitors the water level sensor and draws very little battery power (~40mA).

When water is detected, the MCU triggers the system power relay (above left) and boots up the main datalogging system.

Data acquisition then continues until either the water sensor dries out completely, or the main battery voltage decreases to 11.2VDC and the LVD (above right) powers off the entire system.

Power Subsystems:

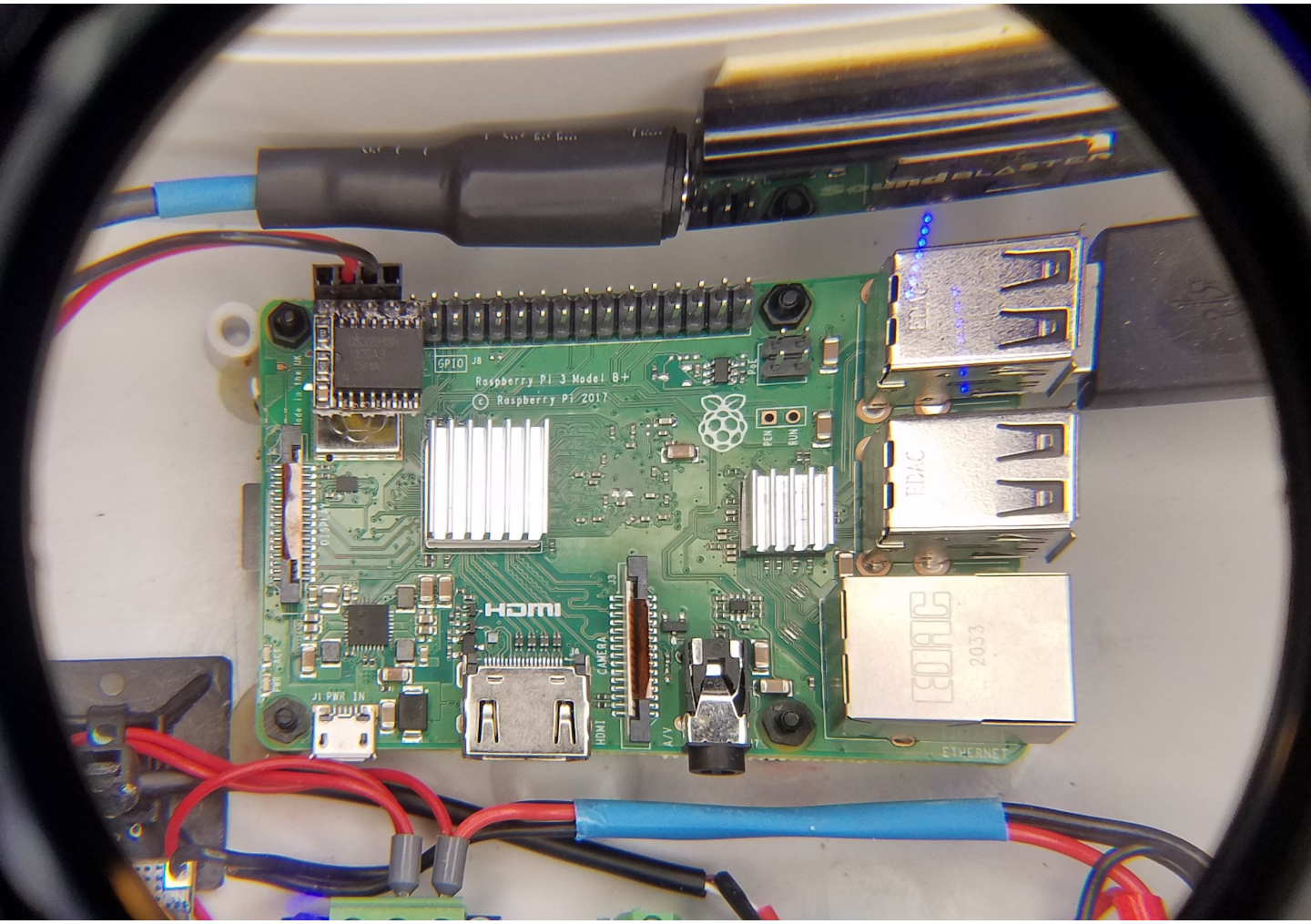


The Raspberry Pi datalogging computer is powered by a 12VDC-5VDC buck converter (above center), while hydrophone bias voltage is provided by an isolated 9V battery (above left) to prevent switching noise from contaminating the recorded data.

This battery continuously supplies power to the hydrophone and is not controlled by the watchdog circuitry, therefore it must be replaced approximately every 90 days of deployment.

(assuming a 1200mAH lithium battery is used)

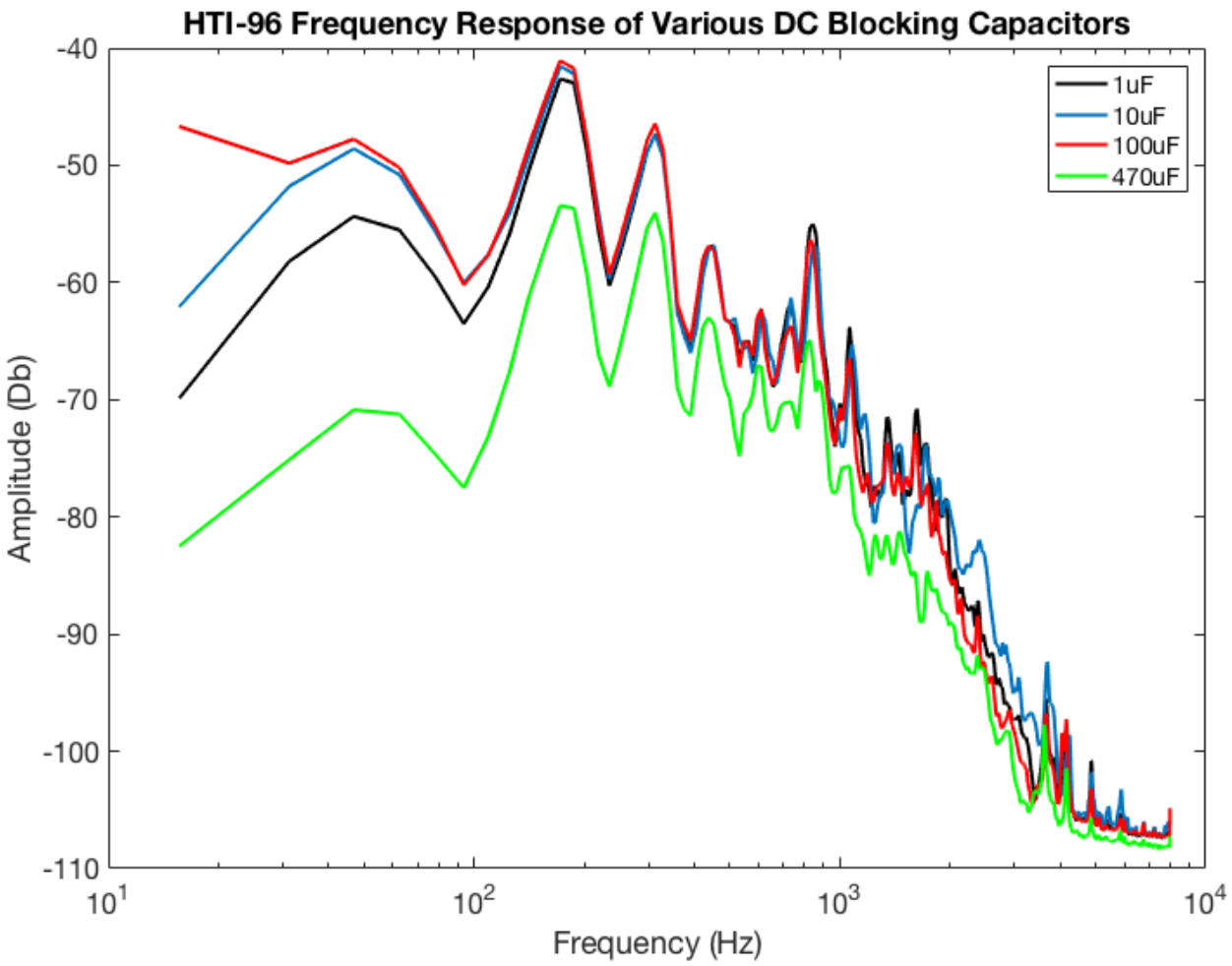
Raspberry Pi Datalogger:



The Raspberry Pi datalogging computer is configured exactly as described in the Solo System documentation, with a battery-backed realtime clock module (mounted at upper left on the Pi board) to enable accurate time-stamping of the recorded data after prolonged system power outages.

The ADC used is a Soundblaster Play 3 USB interface (top right), with a 1uF DC blocking capacitor included to isolate the Soundblaster's 2.5VDC bias voltage from the hydrophone's 9VDC bias voltage (see next page).

DC Blocking Capacitor:



Different values of the blocking capacitor will affect the system's frequency response by forming an RC filter along with the input impedance of the ADC, and 1uF was found to be optimal for preserving signal in the frequency band of interest to bedload researchers.

You may want to experiment with different values of this capacitor or replace it with a 1:1 isolation transformer if you find problems with the frequency content of your recorded data.

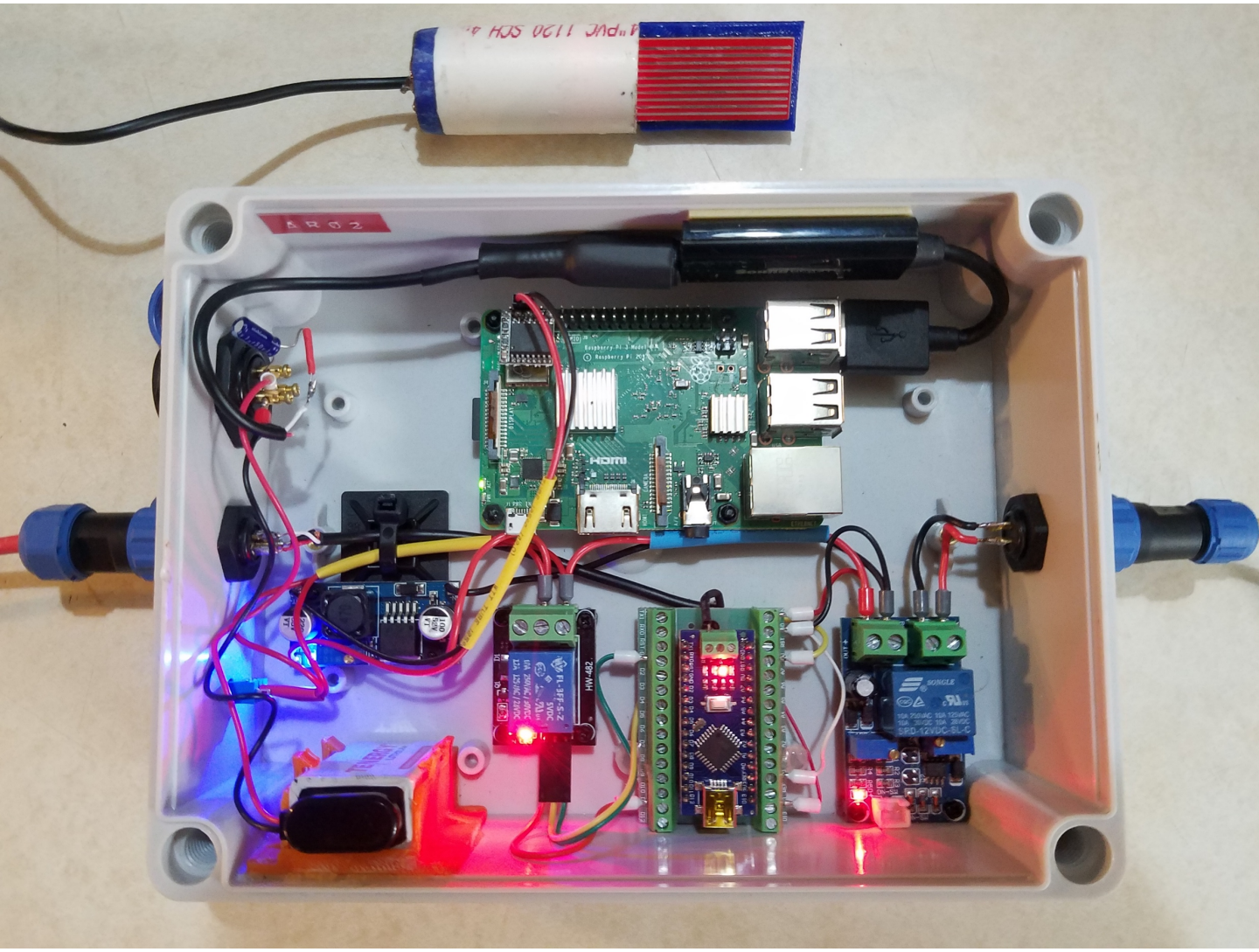
Installation:

The unit is designed so that each external component has a unique connector. On the left side of the enclosure, plug in the hydrophone and water sensor cables to the 3-pin connectors shown above.

Take care to ensure that the manual power override switch (above right) is left in the “off” position, or else the watchdog system can not prevent the main batteries from quickly draining.

Insert a 9V hydrophone battery into the orange holder inside the unit, and plug the main battery cable into the 2-pin connector on the right side of the enclosure.

Installation:



Whenever the unit is fully powered (either because the water sensor has triggered the system power relay or the manual override switch was tripped to the “On” position), you will see the blue LED on the DC-DC converter (above left) and the red LED on the system power relay (above center) illuminate.
Test the system upon deployment by wetting the water sensor and ensuring those LEDs and those on the RPi board illuminate.
When in standby mode (i.e. the state the system should be in upon leaving the site), **only the red LEDs on the watchdog MCU and the LVD (rightmost two modules above) should be illuminated.**

Servicing and Data Offloading:

The station should be serviced at least once every 90 days.

Mainly you want to ensure the hydrophone battery voltage remains above 7VDC (or else replace the battery), inspect the water sensor for significant galvanic corrosion on the exposed traces (and replace the sensor if needed), and replace or recharge the main battery if it tests below 12VDC.

Lastly, test the system before leaving the site by wetting the water sensor and ensuring the main power relay trips and illuminates the LEDs on the DC converter and Raspberry Pi board.

To offload data and reflash the SD card for redeployment, follow the instructions found here:

https://solo-system.github.io/basic_build.html