

Sensor Reliability Testing Rig for Desalination Plant

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Background

Our sponsor, Solar Power and Water, is building a desalination plant in Arizona that takes in highly corrosive brine solution and converts it into drinking water. Within the system, there is a critical tank that must maintain a specific water-level to resist plant shut down. Thus, our sponsor is looking for a reliable and easily hot-swappable sensor that will function in the conditions of the tank. At Salty Solutions, we built a testing rig that emulates the conditions of the tank to make a data-driven selection of a sensor that is compatible with the system and is reliable for over 10 years in the field.

Design Specifications

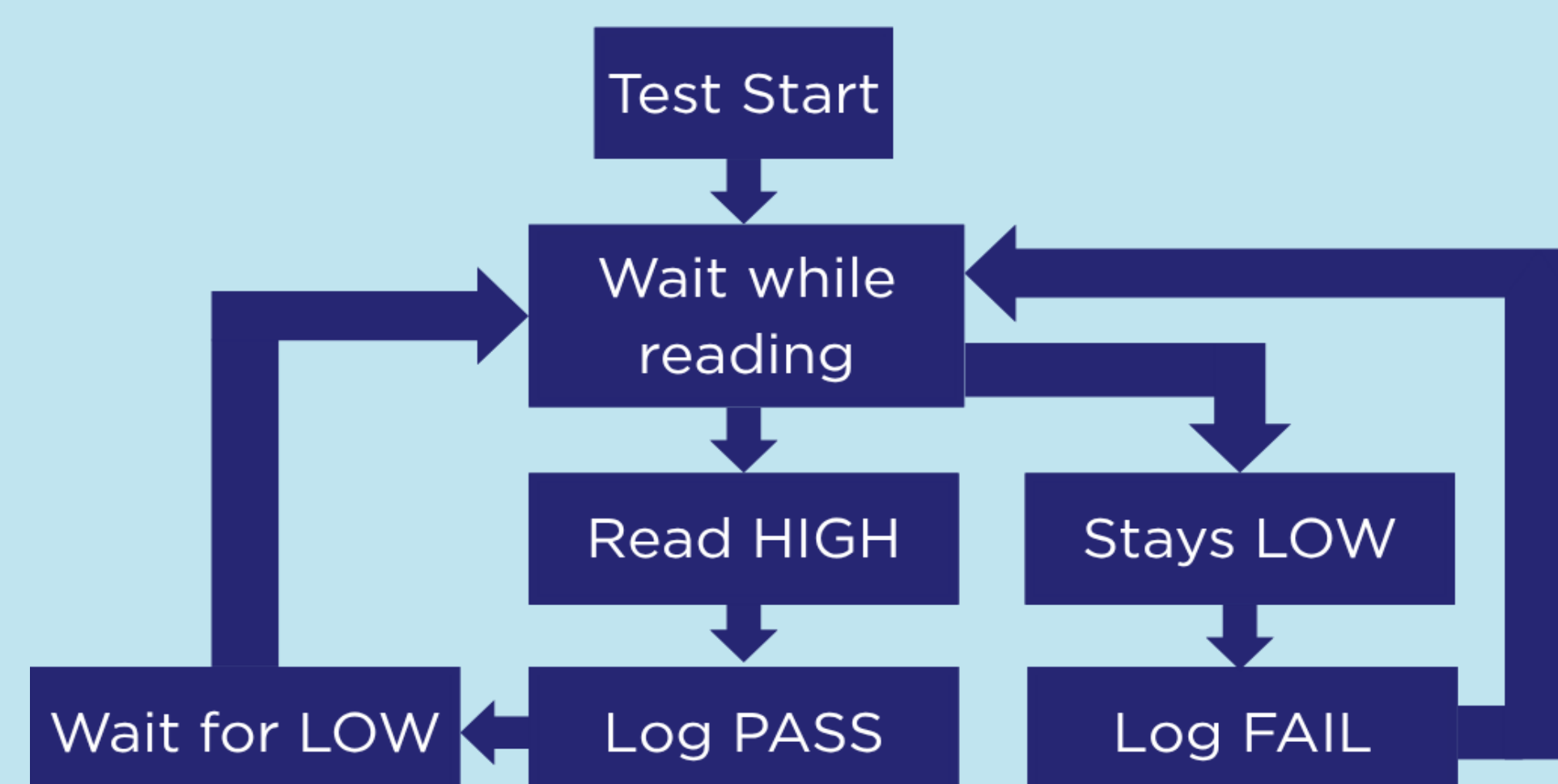
Testing Rig Specifications

- Run for 100,000 cycles
- Absolute Pressure of 4.75 kPa
- Sensors spaced ½ in. apart
- Self-standing

Sensor Specifications

- Non-Contact
- Hot-swappable
- Compatible with current electrical system in field
- Remote Data-logging
- Rated for 24V and 52 mA
- Withstand temp of up to 150° F

Data-Logging Flow Diagram



Key Hardware Components



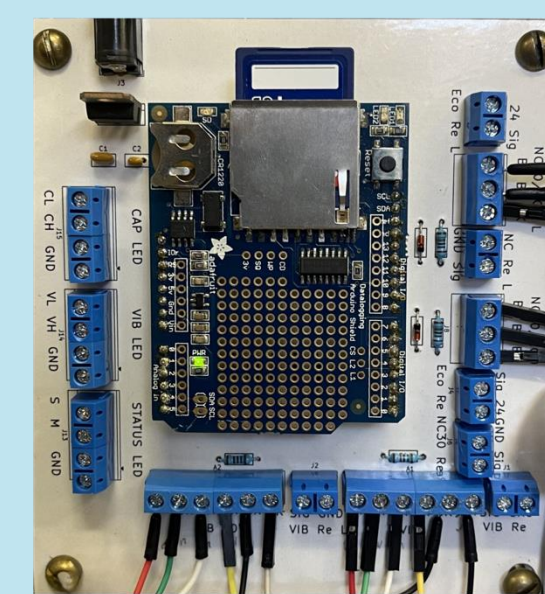
Switch-Tek LZ12 Vibration Sensor
Vibration-based liquid-level sensor with high reliability in corrosive brine environments. Its self-cleaning operation helps prevent scale buildup.



ECOLAB Capacitive Sensor
Non-contact capacitive sensor designed for external liquid-level sensing applications.



NC-30 Level Flow Switch
Capacitive flow switch capable of detecting liquid presence without direct fluid contact.



PCB

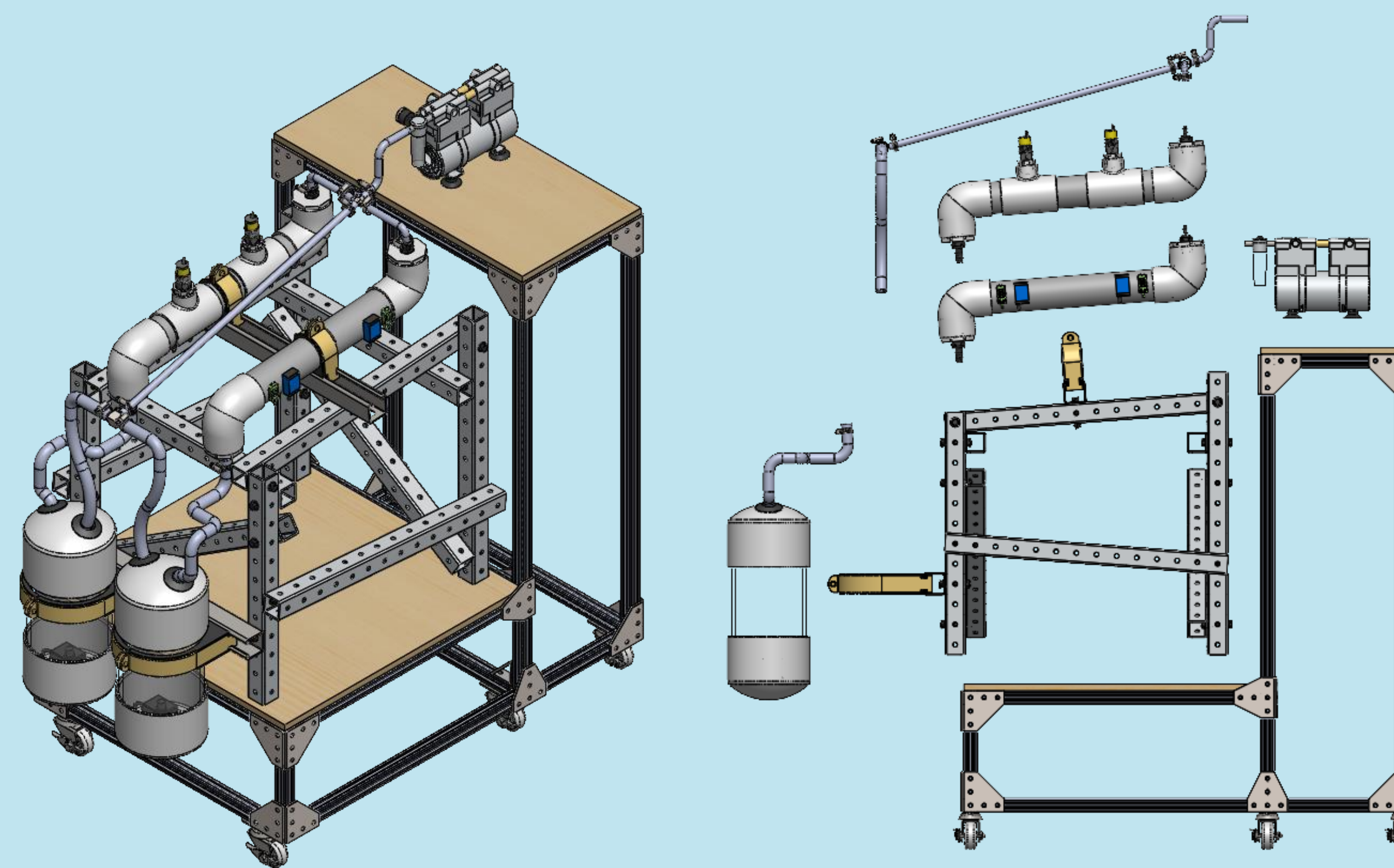
Custom electronics system used for sensor integration and data logging. Allows up to four sensors to be tested simultaneously within the test rig.

Vacuum Testing Rig

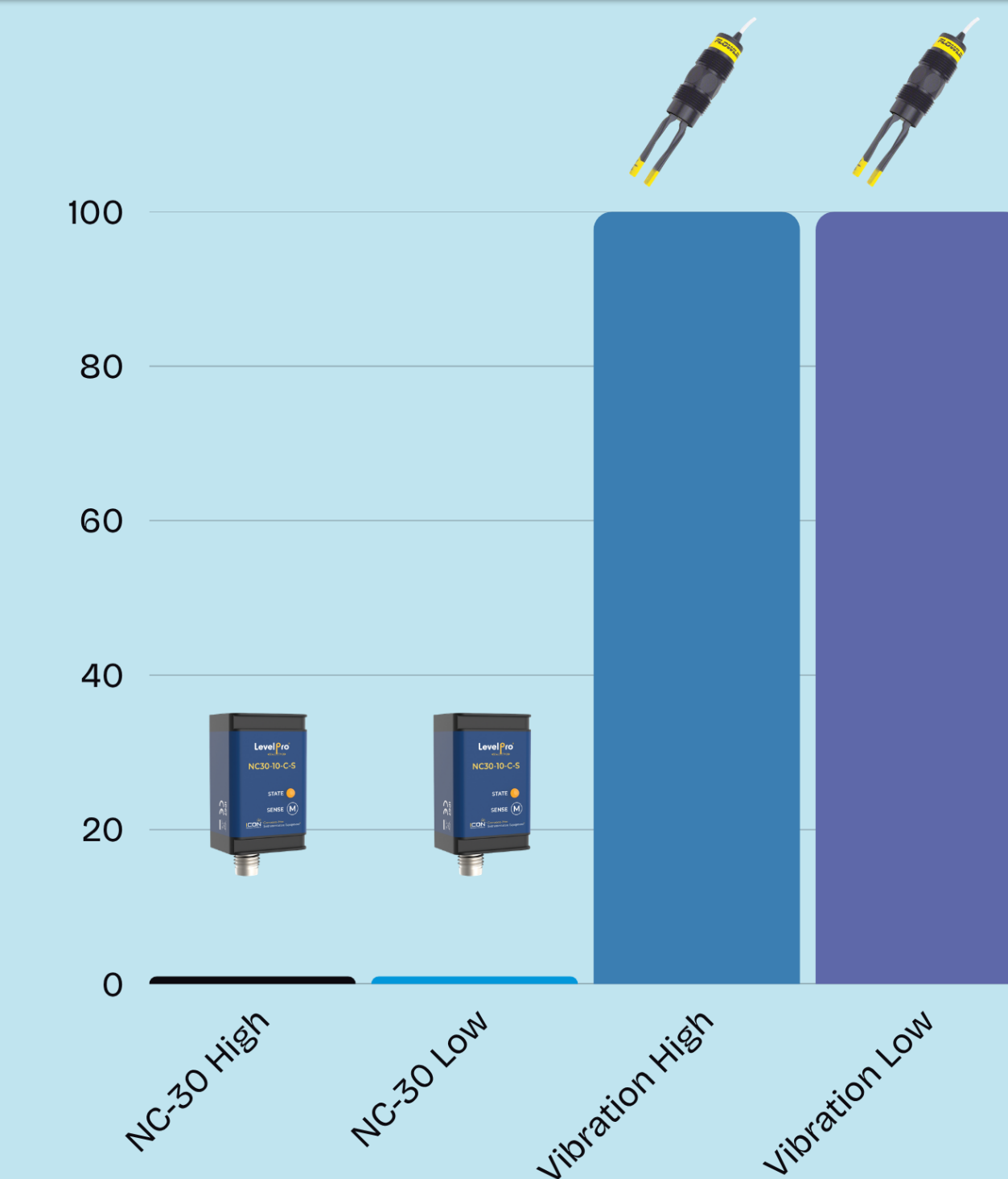


Our final system is a modular test rig designed to evaluate three liquid-level sensors. With vacuum-rated components, an air vent system, and integrated data logging, the rig successfully met project requirements for durability, reliability testing, and realistic desalination plant simulation.

CAD Design



Sensor Results



Testing results showed the Switch-Tek LZ12 Vibration Switch achieved the highest pass rate and most reliable performance under simulated desalination tank conditions. The capacitive sensors experienced inconsistent readings due to scale buildup and water residuals.

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