

NOAA Pacific Marine Environmental Laboratory
Ocean Climate Stations Project

TECHNICAL NOTE 8

Flex Battery Depletion in PA006 Mooring

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Introduction

The OCS PA006 mooring was deployed at Ocean Station Papa in June 2012, and recovered in June 2013. The buoy well contained the Flex data acquisition system, the MApCO₂ system electronics, and the associated battery packs for each. The Flex system used three FLEX-06-01 alkaline D-cell packs connected in parallel, and the MApCO₂ had one alkaline pack. The focus of this document is the early and excessive depletion of the Flex battery packs, though the MApCO₂ also stopped working before the end of the deployment.

Background

Figure 1 shows the battery voltages of the PA006 mooring side by side with the KE010 mooring for comparison. Both moorings were deployed for one year.

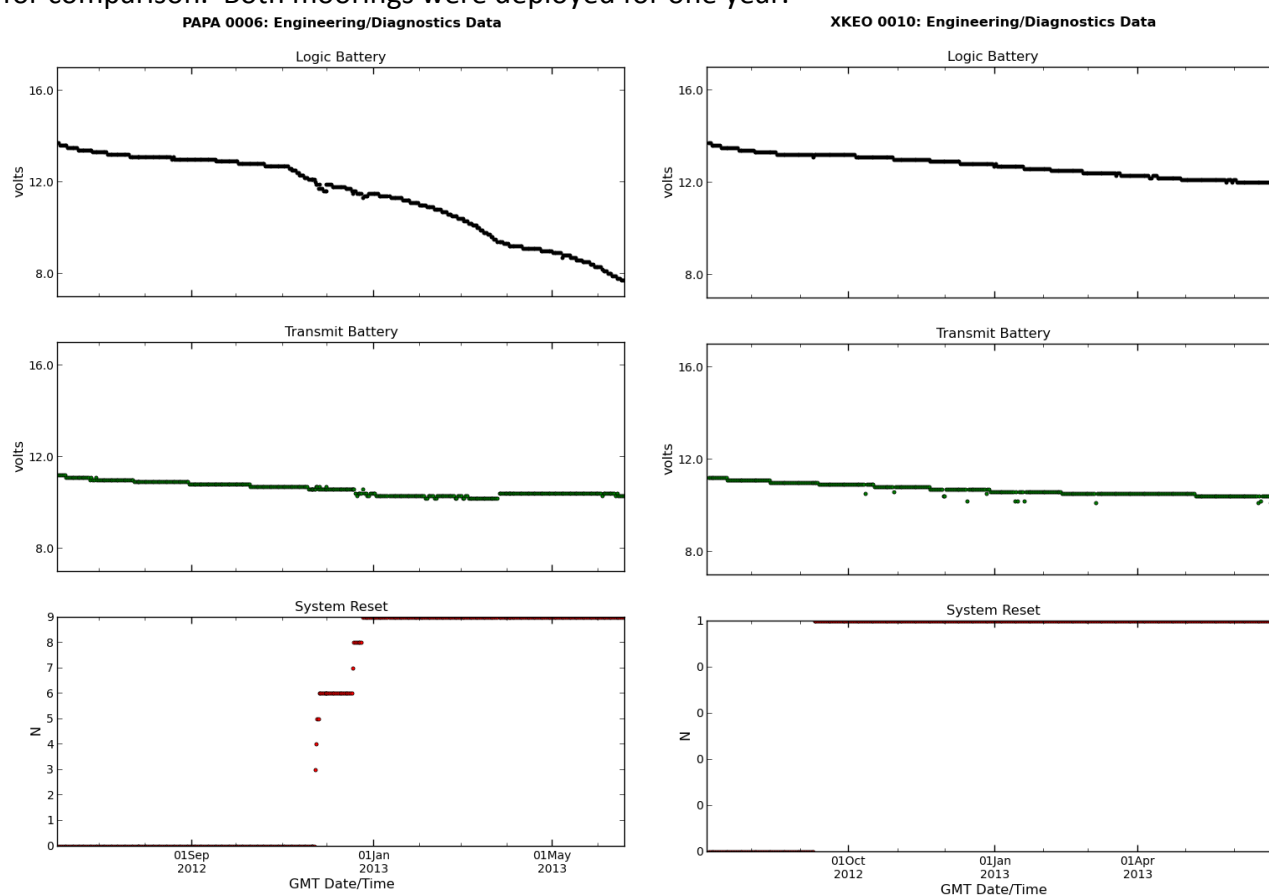


Figure 1: PA006 (left) and KE010 (right) battery voltages and system reset plots for one year deployments.

In the top panels of Figure 1, the Logic battery voltage of PA006 shows a steep decline. The Logic battery supplies power to the meteorological instruments and Flex data acquisition processes. At the beginning of the deployment, the Logic battery voltage was 13.7V. At the time of recovery, the voltage had dropped to 7.7V, compared to 12.0V for KE010.

The first sharp decline of the PA006 Logic battery voltage occurred around November 5, 2012. This was followed by a short string of system resets, which began on November 22, 2012. In previous deployments, system resets and high battery drain were found to be associated with water intrusion in the buoy well. Upon recovery, the PA006 well was dry.

Investigation of Cause

When the PA006 mooring was recovered, it was missing a sensor from the tower. The Vaisala WXT520 combination weather sensor was gone, along with its mast and mounting plate. The cable was sheared off and corroded, shown in Figure 2. Since this combination instrument includes a rain sensor, the Flex system continuously supplies power from the logic battery. The instrument stopped returning real time data on October 16, 2012, and the internal compass stopped on October 17, 2012. The instrument may have been damaged and dangled from the tower for a period before falling off.



Figure 2: Sheared cable of missing Vaisala.

When the buoy was returned to the lab, it was fully disassembled and inspected. At this time, corrosion was noted on the mating connectors for the Paros barometric pressure sensor at the Flex faceplate, shown in Figure 3. The Paros reported good data throughout the deployment.



Figure 3: Corroded mating connectors of Paros barometric pressure sensor.

The Paros sensor receives power from the Flex system for two minutes out of every ten, in order to acquire an average atmospheric pressure measurement.

All three Flex battery packs were inspected in the lab. There was no obvious external damage. The voltage of the Logic circuits of each string within the packs was measured, and no individual bad strings were found.

Conclusions

The sheared cable from the Vaisala sensor was constantly receiving power from the Logic battery through the Flex system. Exposure to water on the bare wires would cause a direct short, draining power. The corrosion of the Paros connectors may also have been caused by shorting due to moisture, which might lead to additional power drain. These sources likely caused the excessive drain of the Flex Logic batteries.

Recommendations

Instruments deployed in the field sometimes perform erratically, with data coming in and out. If an instrument stops reporting real time data entirely for a period longer than one week, it is recommended that a new system calibration file be sent to the Flex system via Iridium, with that sensor removed. This will stop the Flex system from supplying Logic battery power to that instrument.

All connectors should continue to be inspected and greased at the time of deployment to ensure that moisture does not enter the connection and cause a short.

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