# Isolation of Drift Factors in MEMS Pressure Sensors

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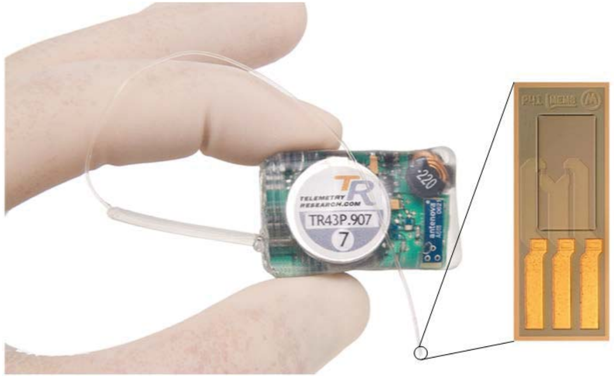
## Introduction

Hydrocephalus is a medical condition caused by a build up of cerebrospinal fluid (CSF) and results in an increased intracranial pressure. CSF accumulation is normally treated with a shunt, but the shunting device is easily blocked. Real time pressure data is a key indicator of a congested shunt; however, long term error accumulation (drift) in sensors limit the accuracy of lifetime monitoring.

Specific goals to achieving life time pressure monitoring include identification and mitigation of factors which contribute to long term drift.

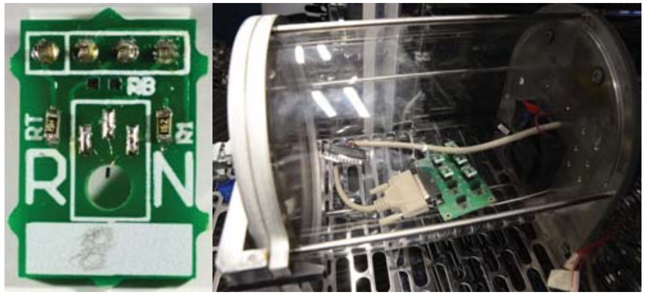


| Drift Factor | Indicator |
|---|---|
| Inelastic deformation of membrane | Drift not observed in vented sensors |
| Oxidation growth on the membrane | Change in gauge factor without change in photosensitivity |
| Deterioration of photo-resistive layer | Change in gauge factor and photosensitivity |
| Reference cavity effusion | Drift not observed in vented sensors |
| Thermal bonding damage | Drift difference in thermal and non-thermally bonded dies |
| Thermal damage in operation | Drift after thermal cycling |
| Drift from DC excitation | No drift using AC excitation |

## Method

Drift can be partitioned into two categories: sensitivity drift (which changes the gauge factor) and offset drift (which biases the pressure reading).

Preliminary testing, performed by measuring sensor error over three months, was conducted to provide insight into the nature of drift, sensitivity or offset. Due to their size, dies were mounted in small PCBs (stub holders). Testing was performed in a pressure chamber which was placed inside a temperature controlled oven.



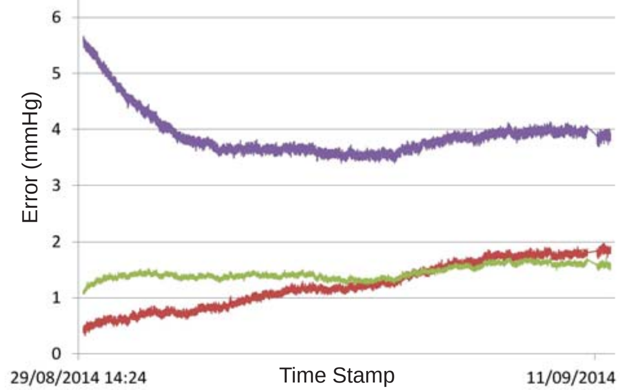
Current testing is isolating the drift contribution from the following candidates:

- inelastic deformation and oxidation of the membrane
- Deterioration of the photo-resistive layer
- Reference cavity effusion (leakage)
- Thermal bonding damage (prime candidate)
- Drift from DC excitation.

## Conclusion

Error is determined by comparing the die pressure measurements with a baseline reading, obtained from a low drift commercial Mensor pressure sensor. Measured drift is bilateral and unpredictable, making compensation very difficult. It can be inferred from long term testing that drift is indeed present in dies.

Two week drift data of three sensors




Measurements are underway to quantify drift from different sensor technologies, with the aim of understanding the cause and possible compensation mechanisms for drift.

Error over pressure after drift period