

Strain Gages In Rowing

smartOar



Author: Bob Martin, Owner, smartOar

Strain gages are applied to the carbon fiber shaft of an oar. The force on the oar through the stroke is then measured and transmitted to a Coach in a launch. The force curves of up to eight rowers can be viewed simultaneously.

Company smartOar

Industry/Application Area: Remote Monitoring of Strain Gages

Product Used:

- [C2A-06-250LW-350 Strain Gages](#)
- [M-BOND AE-10 Adhesive](#)
- [GAGEKOTE #8](#)
- [GAGEKOTE #5](#)

The Challenge

Coaches can't always see the timing relationships as rowers in a crew boat pull through their strokes. Matching catch and release timing is important if boats are to go fast. The shape of the force curve shows how the muscles of a rower engage through the stroke. As a practical matter oars can have considerable bend when a rower is exerting maximum effort, so reliability of the installation is important along with durability. The strain gage on the oar is subject to temperature



changes when splashed. The installation must also be waterproof, although long-term immersion is not an issue.

The Solution

A strain gage is applied to the oar shaft approximately midway between the collar and the blade. Wires run along the shaft to a box (Oarpod) containing elements of a Wheatstone bridge and an analog to digital converter. A microcontroller interfaces between the converter and an RF transceiver. The transmission protocol is modified Zigbee. A “Coaches Tablet” contains a sunlight readable display, a single board computer and another transceiver in a water-resistant box. The Coaches Tablet can connect with the Oars and display up to eight force curves in real-time. (The largest boats in competitive rowing have eight oars).



The User Explains

Use of a proper adhesive and good surface prep is critical to the long term reliability of the strain gage. Lead dress away from the gage is also important. Multiple layers of protective coating keep water out and provide physical protection. The rubbery nature of GAGEKOTE #5 is valuable as is a



final layer of butyl rubber. Because a rowing stroke is repetitive, the sensor can be zeroed between strokes. Therefore, matching for temperature is not especially important and a single strain gage can be used in the Wheatstone bridge.

“Micro-Measurements® has been very helpful in providing guidance in strain gage selection as well as recommending effective measures for protecting the strain gages”

Contact Information

Bob Martin
Owner/Engineer
smartOar
bob@smartOar.com
www.smartoar.com

Vishay Precision Group, Inc. (VPG)
Micro-Measurements
mm@vpgsensors.com

