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# GENERAL CARE AND MAINTENANCE OF THE RADIATION ANALOG-DIGITAL INTERFACE (RAD)

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# 1 Summary

The RAD system is aimed at simplifying the extremely difficult task of making measurements of shortwave & longwave radiation fluxes from a remote measurement site. The system was designed for ship deployments and is designed to withstand corrosive atmospheres, severe wind and precipitation, and extreme heat.

A general manual of the RAD is provided online at [http://rmrco.com/prod/rad/rad\\_manual\\_v9.pdf](http://rmrco.com/prod/rad/rad_manual_v9.pdf).

This document is a brief overview of the maintenance required to properly maintain the RAD system in good working order so the radiation measurements will be as accurate as possible and the system will suffer minimal degradation from environmental stresses. This document will be updated as we gain more experience with the system as it is used in the marine environment.



Figure 1: The RAD system installed on the NOAA R/V Pisces in Jan 2010. This installation used a plastic radiometer mount, pipe fitting, and box backplate. Stainless hose clamps held the box to the vertical pipe under the radiometers.

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## 2 Isolating dissimilar metals.

The output of the radiometers is often only a few tenths of a millivolt and the RAD input preamplifiers are typically 120 and 820 for the PSP and PIR respectively. Thus they are particularly sensitive to electromagnetic interference (EMI) which can be extreme in typical shipboard, mast top installations. Thus the RAD is made to reside as close as possible to the radiometers and uses shielded cables for all connections. The RAD enclosure is an aluminum diecast box and the electronic circuit connects to case ground by a single point ground.

**Dissimilar metal corrosion.** The RAD box is a powder-coated diecast 6061-T6 aluminum. Unfortunately, the box & backplate hardware are 316 stainless steel which is very well suited for marine use, but great care must be taken to avoid corrosion. *It is not unusual for the lid screws to become so corroded the they cannon be removed and the lid has to be cut off.*

Non-metallic (UHMW plastic) plate is used for the box backplate and the radiometer plate. The backplate has tabs and holes for convenient mounting using hose clamps.

### RULES

- Use nylon washers and insulators to insulate all hardware from the RAD box.
- Use nylon washers and insulators to separate the stainless bolts from the brass radiometer cases.
- Use antiseize compound on all fasteners. Be sure to use lock washers or locking nuts.
- In the box, use sealing compound in the backplate mounting screw holes (Fig. 2).
- Use silicone grease for the lid o-ring.

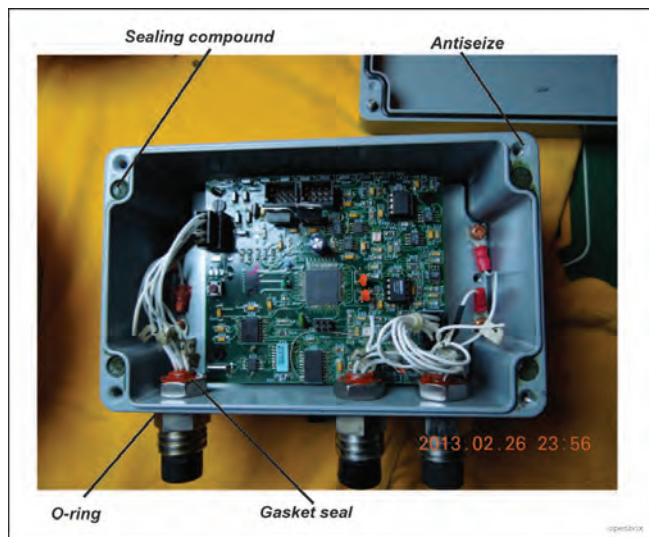


Figure 2: A new RAD enclosure ready for shipping. The backplate hardware are dipped in antiseize and the holes for backplate hardware are sealed with sealing compound (a.k.a. monkeysh\*t). In the picture here the “o-ring” reference points to the o-ring under the three Impulse connectors. The lid has a soft o-ring that sits in a groove and seals against the raised ridge around the top. The lid o-ring should be greased with silicone grease before the lid is finally installed.

### 3 Installation & Grounding

Installation is covered in the manual. The only note here is to be sure the ground strap has a good contact with the ship. It may be necessary to scrape a bit of paint off of a railing or stanchion in order to get good contact.

The ground connection is prone to corrosion. Once it is made, the connection can be painted to help reduce the rate of corrosion. The grounding joint should be checked, visually and with an ohmmeter, on a regular basis (typ. six months).

### 4 Radiometer inspection and cleaning.

The radiometers need to be inspected on a regular basis.

#### RULES

- Corrosion. Watch for excessive corrosion. The Amphenol connectors used for the radiometers are not particularly suited for marine use (Fig 4).
- Rinse with fresh water. Use a small flask of fresh water to rinse off the radiometers and clean the domes. A regular rinse does wonders to reduce corrosion.
- Clean the domes. Dirt can be removed first by rinsing as above then by using a combination of wet then dry lintless optical wipes. Ordinary Kleenex such as Bounty has been recommended by some opticians as suitable. But avoid paper towels which usually have an abrasive mixed in with the paper. Fig 3.
- The time between inspections depends on the environment. Tropical conditions with regular rainfall might not need cleaning more than once each few weeks. In situations where the ship exhaust sometimes covers the installation, or dry dusty conditions prevail will dictate more regular cleaning.



Figure 3: An accumulation of dust on a PSP from the Saharan desert. The radiometer was on a ship operating in the Carribean Sea and the deposit came across the Atlantic Ocean.



Figure 4: The PIR in this image was left unattended for several months on a tropical island in the Indian Ocean.



Figure 5: This enclosure has suffered severe water damage from a small nick in the connector o-ring. When the connector holes are drilled, the powder coat is broken. Normally, the receptacle o-ring prevents water getting into the break. After two years on a NOAA ship salt water penetrated under the damaged o-ring and under the powder coat finish. Extra care is taken to assure the o-rings are perfect and a sealant is used to further protect the box.