2021 Award Nomination

Title of Innovation:
REL2310 & REL2310B

Nominee(s)
American Innovations Team

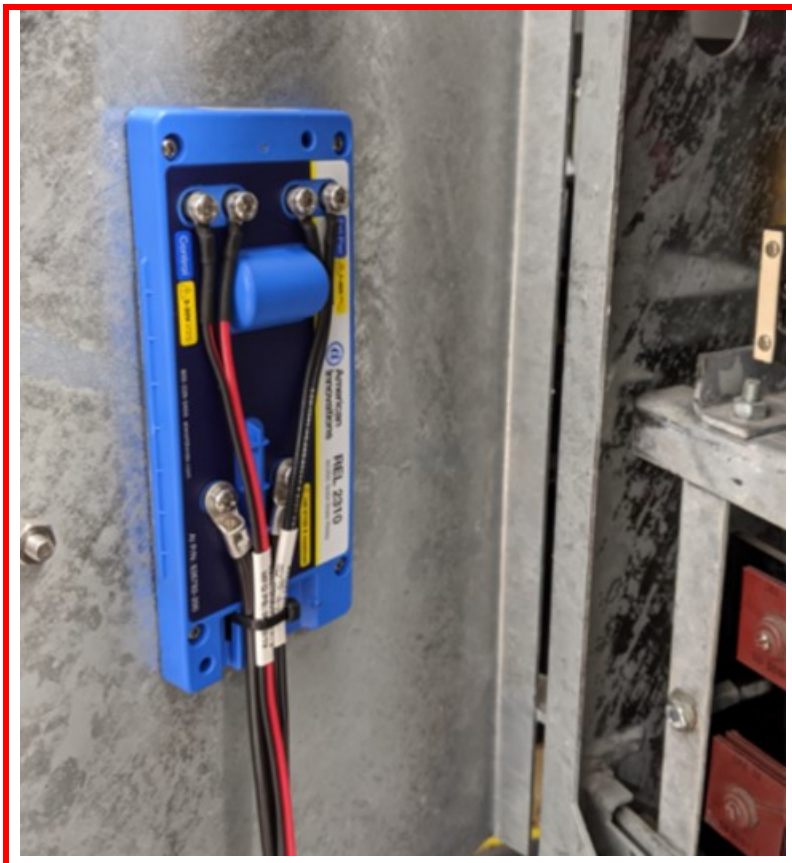
Category:
(select one below)

Coatings and Linings	Instrumentation
Cathodic Protection	Testing
Materials Design	Modeling/Risk Assessment
Chemical Treatment	Other—fill in

Dates of Innovation Development:
(February 2018 to February 2020)

Web site: aiworldwide.com

Summary Description:
REL2310 & REL2310B are normally closed solid state relays suitable to interrupt low voltage rectifier AC secondary signals. The same relay is also suitable for interrupting bond connections using a battery powered RMU. The relay supports short interruption cycles, reduces installation time, and can be installed in smaller areas due to its small footprint. It can interrupt up to 100Vpeak/100A. REL2310 is intended to be line powered while REL2310B is battery powered. By installing this device on the AC secondary side, it benefits from the surge protection built into rectifiers.



REL2310 Mounted on Rectifier

Full Description:

(Please provide complete answers to the questions below. Graphs, charts, and photos can be inserted to support the answers.)

1. What is the innovation?

REL2310 & REL2310B are normally closed solid-state relays suitable to interrupt low voltage rectifier AC secondary signals. The same relay is also suitable for interrupting bond connections using a battery powered RMU. The relay supports short interruption cycles, reduces installation time, and can be installed in smaller areas due to its small footprint. It can interrupt up to 100Vpeak/100A. REL2310 is intended to be line powered while REL2310B is battery powered. By installing this device on the AC secondary side, it benefits from the surge protection built into rectifiers.

2. How does the innovation work?

Innovation in the REL2310 & REL2310Bcenters on incorporating solid-state FET devices to support both AC and DC signals. External power or battery power is used to create normally closed state when control signal is removed. Multiple FET devices are incorporated to reduce on state impedance, reduce power loss, and smaller heatsink. Control input is optimized to reduce power requirements.

3. Describe the corrosion problem or technological gap that sparked the development of the innovation. How does the innovation improve upon existing methods/technologies to address this corrosion problem or provide a new solution to bridge the technology gap?

Interrupting rectifier current is a standard process to facilitate IR free cathodic protection measurements. To interrupt rectifier current, a mercury relay or solid-state relay is typically installed in rectifier AC primary, AC secondary, or DC output connection. Mercury relays are suitable for AC or DC current interruption but are not suitable for short interruption cycles. Solid-state relays are suitable for short interruption cycles but typically only available in AC or DC variants, and not both. AC solid-state relays typically require high AC levels to operate and thus not usable in AC secondary installations for rectifiers configured with low output voltage. In this case, interruption switch must be installed in rectifier AC primary input or DC solid-state relay used at rectifier DC output. DC solid-state relays installed at rectifier DC output are not recommended as they are subject to inductive load conditions and exposed to higher surge events. DC solid-state relays are also typically normally open. Normally closed relays are typically used for rectifier interruption applications. REL2310 is a normally closed solid-state relay and can switch both AC or DC currents. REL2310 can be installed in AC secondary with low signal level and thus eliminates need to install DC solid-state relay at rectifier DC output.

To interrupt bond connections, a relay suitable for both AC and DC signals is required. Monitoring equipment typically installed at bond sites are battery powered. Thus, an

interruption relay is needed that required minimal power from RMU. REL2310B solves these issues.

4. Has the innovation been tested in the laboratory or in the field? If so, please describe any tests or field demonstrations and the results that support the capability and feasibility of the innovation.

Yes, both lab and field tests were conducted on this device. High-power lab rectifier was used to conduct switching test and evaluate thermal performance. Test were conducted with various AC and DC connections, interruption cycles, inductive loads, and mounting conditions.

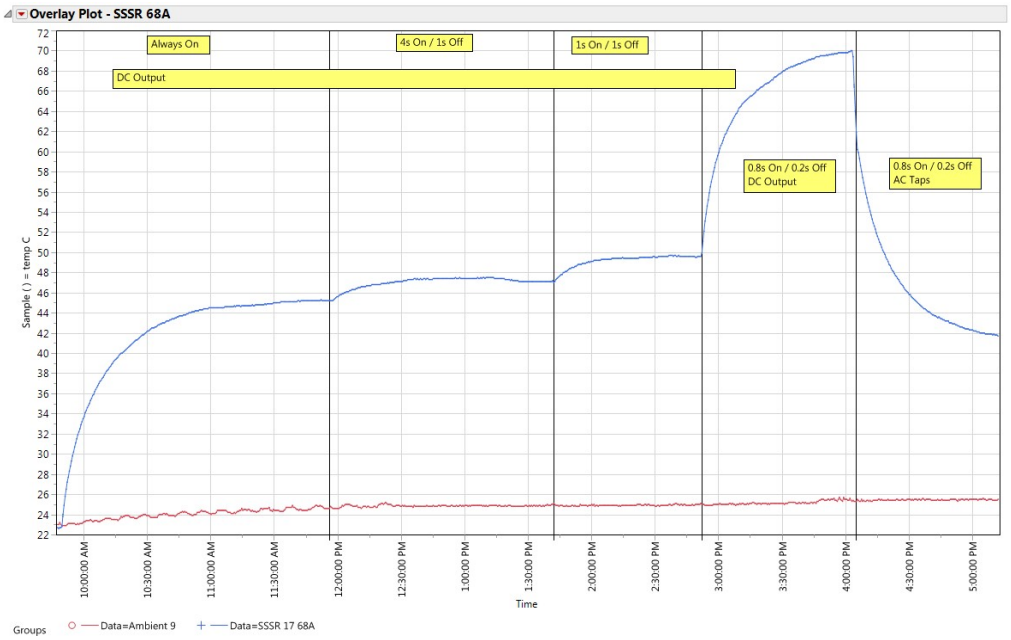


Figure 1 – Test Results

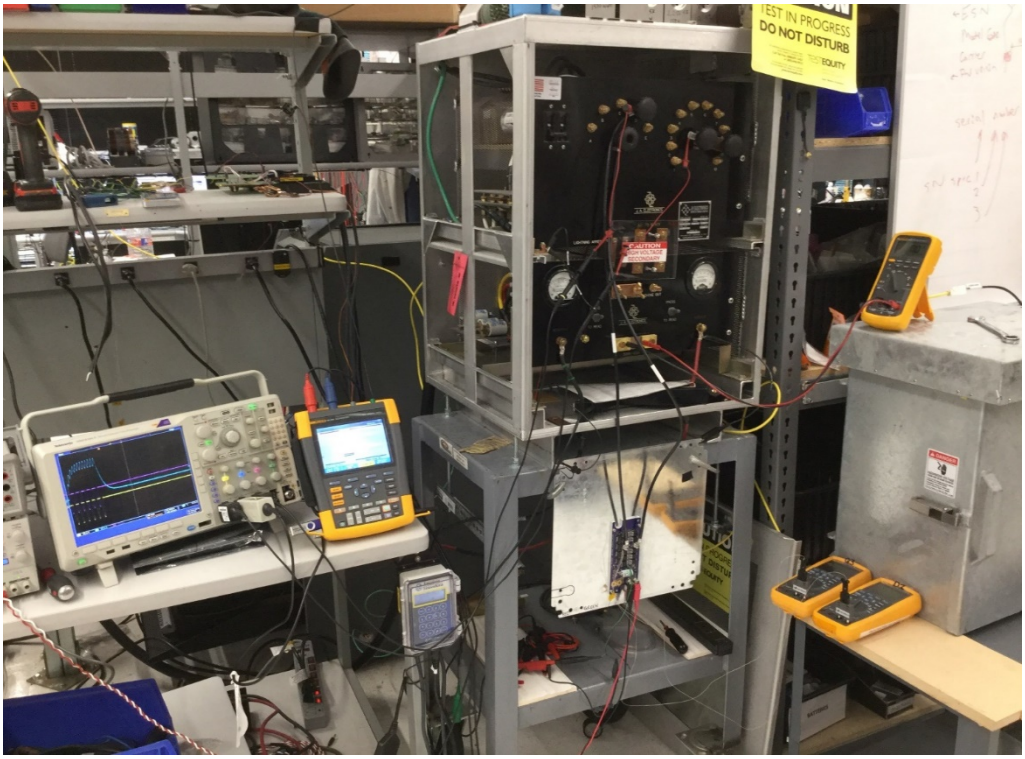


Figure 2 – Test Setup

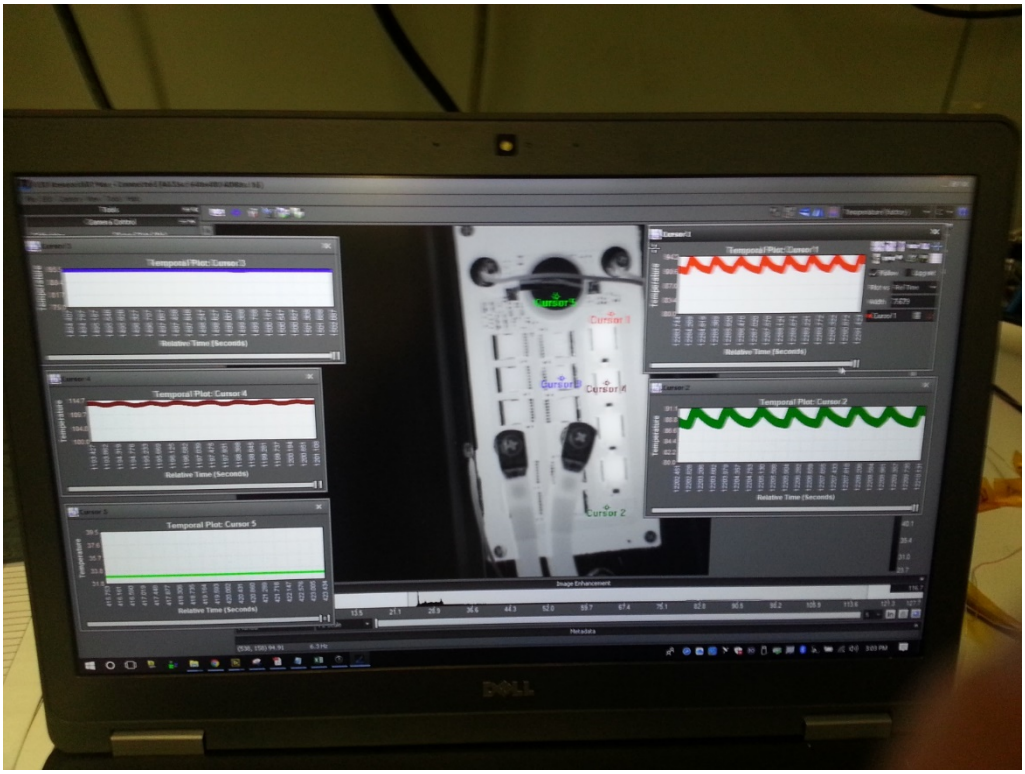


Figure 3 – Thermal Results

In the field these devices were tested with 5 customers across the country. The response to the installation procedure was very positive. Because they are magnetically mounted, connect to the rectifier taps, and have a small footprint installation only takes between 5-10 minutes. Customers ran interruption programs over a two-week period and all devices performed flawlessly. The units are still in use by those customers today.

5. How can the innovation be incorporated into existing corrosion prevention and control activities and how does it benefit the industry/industries it serves (i.e., does it provide a cost and/or time savings; improve an inspection, testing, or data collection process; help to extend the service life of assets or corrosion-control systems, etc.)?

No special equipment is required for the use of these devices. They can be dropped into any rectifier today to replace existing relays so long as the rectifier output is less that 100Vpeak/100A. These units will save users time and money from replacing DC solid-state relays that are easily damaged.

Installation only takes 5-10 minutes since the device is small, can be magnetically mounted, and hooks up right to the rectifier secondary taps.

6. Is the innovation commercially available? If yes, how long has it been utilized? If not, what is the next step in making the innovation commercially available? What are the challenges, if any, that may affect further development or use of this innovation and how could they be overcome?

Yes, this product was released in February 2020.

7. Are there any patents related to this work? If yes, please provide the patent title, number, and inventor.

No.