Protecting Your Pyranometer Investment: Isolation, Grounding, and Protection for Digital Pyranometers

Greg Linder, MSEE, IEEE

INTRODUCTION:

The requirement to install digital pyranometers at the end of long cable runs within the array area with installation dependent ground impedance provides an ideal environment for ground potential rise (GPR) and transient voltage events that can cause pyranometer damage.

The failure of a pyranometer causes loss of data and expenses through re-calibration and field rework.

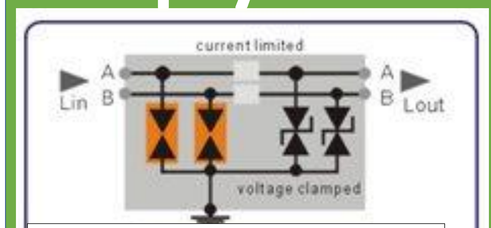
Conventional surge arrestors are not up to the challenge, due to the need for both power and signal to be carried on the same cable.

We share preliminary results for a fully-isolated Surge Protection Device (SPD) for protecting Digital pyranometers.

METHODS:

1. Lightning induced instrument damage has been increasing from a minor nuisance to an measurable O&M cost as fields grow larger.
2. Existing surge protection equipment is not ideal for pyranometer protection under harsh field conditions.
3. A new device, currently under test, explores if full isolation in a sacrificial device poses a good solution for keeping instruments operating.

Galvanically isolated RS-485 isolators prevent pyranometer damage

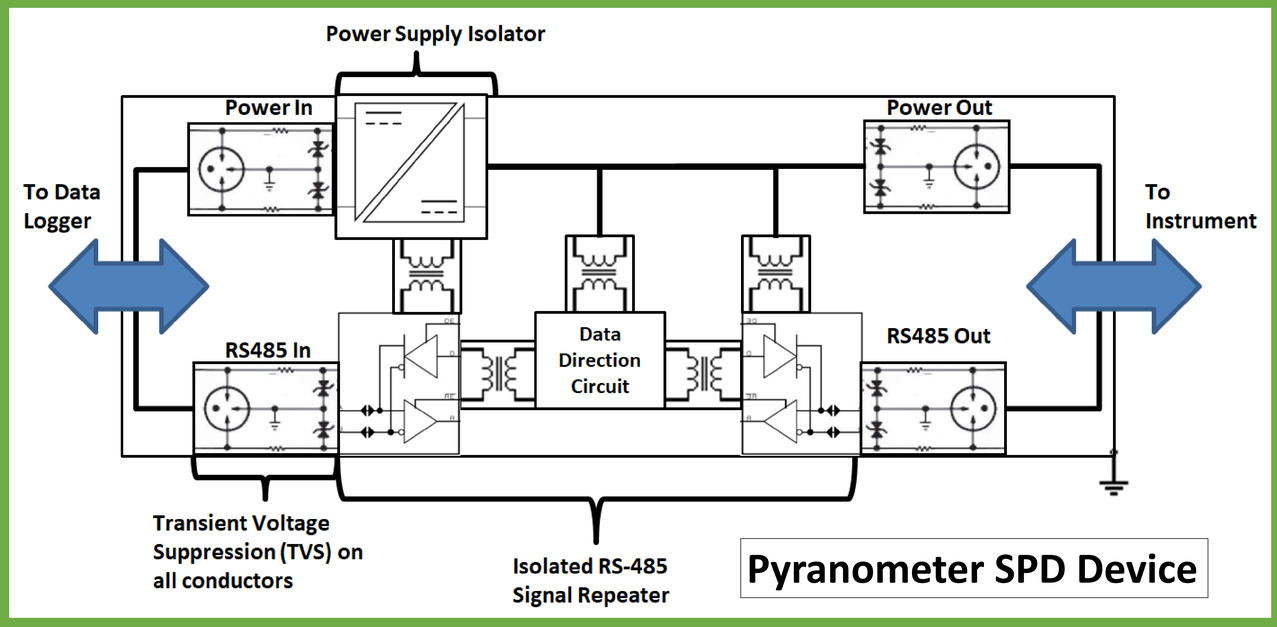


Conventional Arrestor

Conventional RS-485 Surge Arrestors limit surges through data lines. They provide no protection for power lines, or protection against GPR. Using this style of device on communication lines between inverters or other equipment with vigorous local ground bonding is effective against common surges. However, they are not effective at protecting far-apart points that need to share a common ground and lack vigorous ground bonding.

Pyranometers are generally mounted in the array, connected via long, small gauge cables, operating at low voltage DC with power supply ground with the data logger ground. Due to the installation-dependent ground impedance between the data logger and pyranometer, high voltage transients caused by lightning or grid switching events can cause sudden high voltages to appear across the pyranometer cable. These can cause RS-485 errors at best, or equipment damage due to uncontrolled voltage excursions on pyranometer data and power lines.

To address these concerns, the SPD includes a fully isolated DC to DC power conditioner, a communications repeater, and an integral set of conventional surge arrestor elements on both “field” and “instrument” sides. This is effective against GPR, as the grounds on both sides of the SPD can move independently of each other with no current flow through the device.



Pyranometer SPD Device

RESULTS:

- Preliminary testing of (10) prototype units have resulted in the failure of (2) SPD units with no pyranometer damage.
- The root cause of the damage to the SPDs is well understood, and a more robust design is forthcoming.
- The SPD Device works for either end of span, or center of span installation.
- The SPD’s power isolator converts 9-30 Volts DC to 24 VDC for the Pyranometer.
- The SPD breaks the path for fault current by isolation of RS485 In to RS485 Out and Power In to Power Out.
- The SPD is not for Analog-Output Pyranometers
- The SPD is field-installable in just few minutes.

Pyranometer SPD Test PCB Layout

RESOURCES:

- www.solarscada.com
- www.huksefluxusa.com