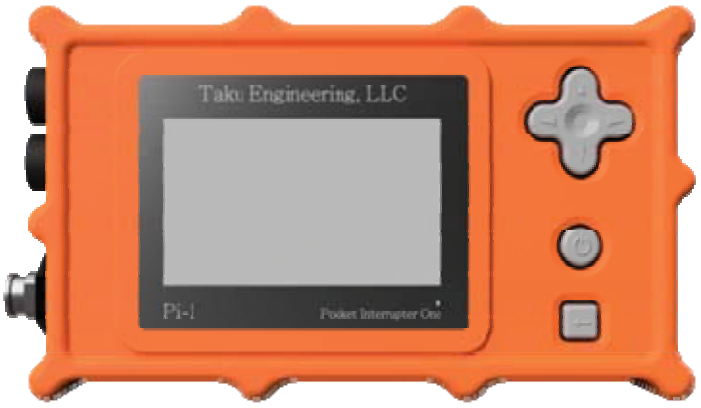
2019 Award Nomination

Title of Innovation:
(Pocket Sized GPS CP Interrupter)



Nominee(s)
Bill Mott & Charlie Petrie,
Taku Engineering, LLC

Category:
Cathodic Protection Testing

Dates of Innovation Development:
October 2013 to Ongoing

Web site: www.takuengineering.com

Summary Description:

The Pocket Interrupter One (Pi-1) is a pocket sized, two channel, GPS synchronized cathodic protection interrupter. This interrupter has a graphical user interface that makes it simple and easy to set up interruption cycles. It incorporates state of the art technology to achieve its small size and 6-day battery life. It also incorporates an incredibly sensitive GPS engine which allows it to acquire GPS time very quickly and in poor reception areas, such as indoors.

We are currently working on integrating a high speed datalogger and Bluetooth to allow continuous waveform capture and analysis during CIS and for telluric nulling. We have developed, patented, and tested a waveform analysis algorithm that can determine accurate instant off readings from highly variable waveforms. This algorithm will run on the Pi-1L (waveform logger enabled) and provide the most accurate CP potentials possible.

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?

The modernization of a pocket-sized GPS interrupter with near future expandability to include highspeed waveform datalogging and automated waveform analysis. The Pi-1 is the size of a cell phone, weighs 12 oz, and gets 6 days of run time from a 5-hour charge. It has two galvanic interruption channels featuring solid state relays with a capacity of 1 amp and 20 volts each. It can also be paired with larger external relays to interrupt high current CP sources such as impressed current rectifiers.

Once waveform logging and Bluetooth have been incorporated, the Pi-1 mated with a tablet PC or iPad will can replace a field PC. It will record continuous waveforms during close interval surveys and provide the most accurate and defensible data possible.

2. How does the innovation work?

The Pi-1 tightly integrates the technologies used in past interrupters. Its custom motherboard incorporates a uBlox Neo 8 GPS engine, a very accurate real time clock, and a powerful 16-bit microcontroller in a small and efficient design. It has a sophisticated power supply that allows it to be powered from 5 to 20 volts AC or DC. It uses non-polarity sensitive solid-state relays to switch CP current and has latching mechanical relays in parallel to allow CP current to flow through the device while it is powered down.

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?

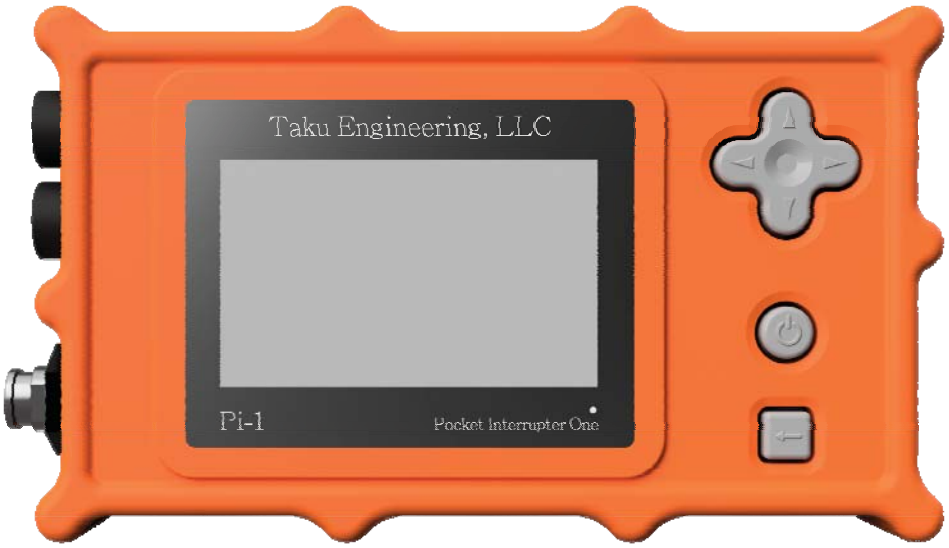
Taku Engineering performs CP surveys throughout the State of Alaska. Many of the locations we work are rural and require small plane travel with multiple flights. GPS synchronized CP interrupters have historically been large and bulky. Mobilizing to the field with enough interrupters for small jobs with several galvanic CP systems could require hundreds of pounds of equipment; sometimes requiring us to ship our equipment ahead of the survey and waiting weeks after the survey for our equipment to return. Often these interrupters require charging daily.

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.

The Pi-1 has been extensively field tested and proven to be competent and reliable. The first fleet of 20 field prototypes were built and deployed in June 2013. See photo of first-generation field prototype below:

These performed well but were limited by their pelican case housing and text based display. A second round of engineering produced a more compact, ergonomic device with a high-resolution graphical display. See photo of a second-generation field prototype below:

The micro controller (MCU) was upgraded from an 8 bit MCU to a 16 bit MCU with digital signal processing capabilities providing the extra processing power necessary for future integration of high speed continuous waveform capture and processing. Twenty-four field prototypes were built and deployed to the field in the summer of 2015. Taku has been using the Pi-1 for interruption of CP current exclusively since 2013. The second generation field prototypes are still in use today with no attrition. In 2017 and 2018 we made the necessary physical changes to achieve IP67 waterproofness and allow the use of injection molding technology for manufacturing. See renderings of final product below: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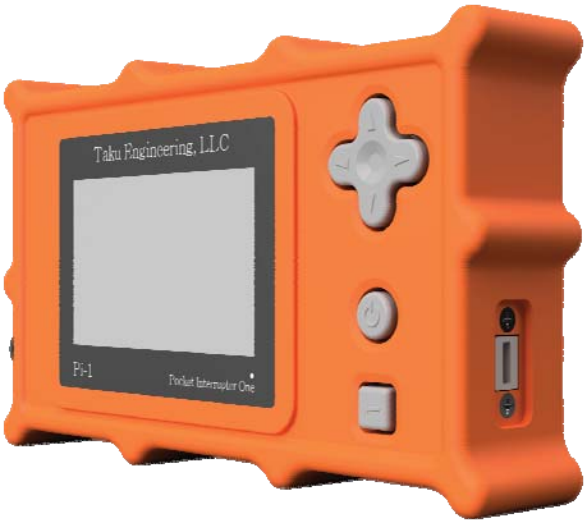
Pi-1
Pocket Interrupter One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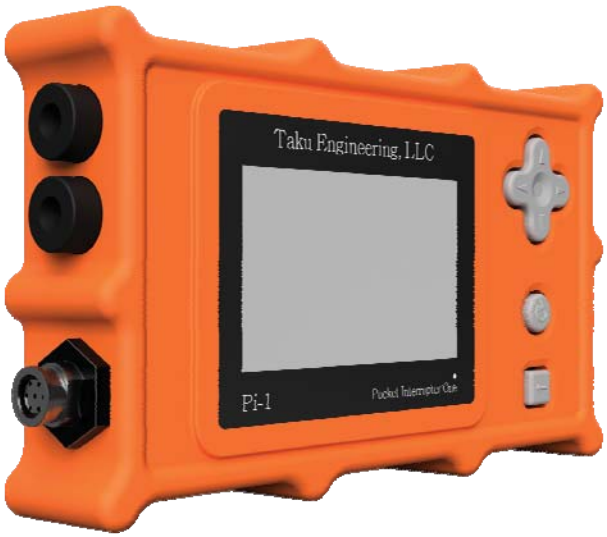

5. How can the innovation be incorporated into existing corrosion prevention and control activities and how does it benefit the industry/industries it serves (i.e., does it provide a cost and/or time savings; improve an inspection, testing, or data collection process; help to extend the service life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

The Pi-1's small size and lite weight make it possible to transport enough interrupters for a large job in your backpack instead of several Action Packers. The Pi-1 is very competitively priced at $950. The six-day battery life allows multi-day jobs to be done on a single charge. The five-hour battery charge time means you can put over a day worth of charge into the Pi-1 per hour. This means if you arrive in the field and find your interrupter battery is completely dead, you can put 12 hours of run time into it with a 30-minute charge. With a small solar panel capable of supplying 25 milliamps at 6 to 20 volts, the run time would be unlimited.

Because the Pi-1 does not require a computer or smart device to setup, it is a simple matter to change interruption cycles on the fly.

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?

The Pi-1 will be commercially available late 4th quarter 2018 or early 1st quarter 2019. The final design and supply chain are set; only leaving the lead times for the injection molded cases for the first production run.

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

The Pi-1 is covered by US Patent # 9,653,932 B2, titled *PORTABLE CATHODIC PROTECTION CURRENT INTERRUPTER*. Charles Petrie, Eric Weiler & Chism Henry.