On Thursday, August 11th 2022 a trial installation was successfully completed at Gaskill Dr NE:

Gaskill Dr. NE

Alliance, OH, 44601

[40.93823255536788, -81.11271563406703]

The following nVent team members participated:

* Greg Martinjak [Electrical]
* Tom Bendlak [Mechanical]
* Spencer Allemang [Product Management]

The following NS team members participated:

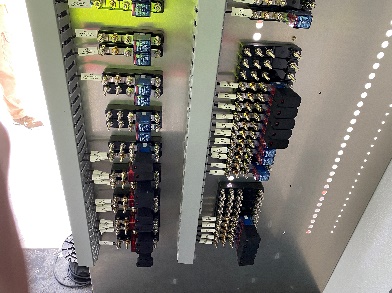
* Joseph B Johns [C&S Supervisor II]
* Billy [Unknown]

## General

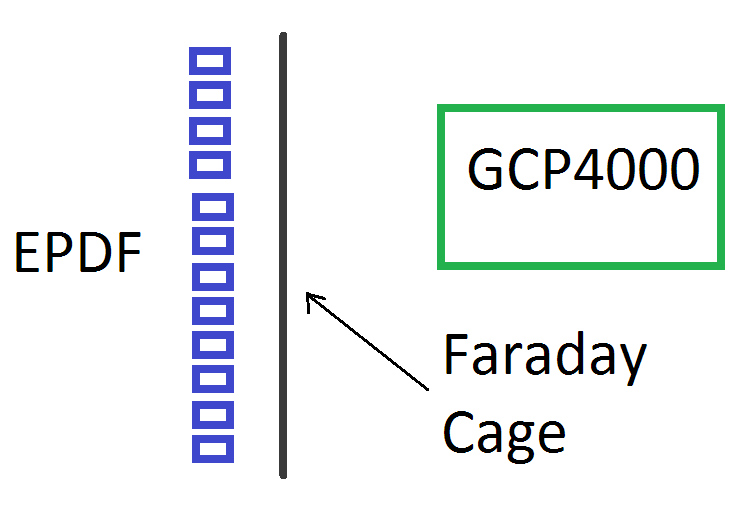
On August 11th, 2022, Spencer Allemang, Greg Martinjak, and Tom Bendlak traveled to a Norfolk Southern Bungalow located in Alliance Ohio for a trial installation of the Smart Surge Product line. The products included 23 sensors that were installed on top of EPD-F surge protectors as well as one hub product. The system was installed from February 9th until August 11th which included the lightning season for that area. The information obtained from that trial install is contained within this report as well as the findings and areas for improvement.



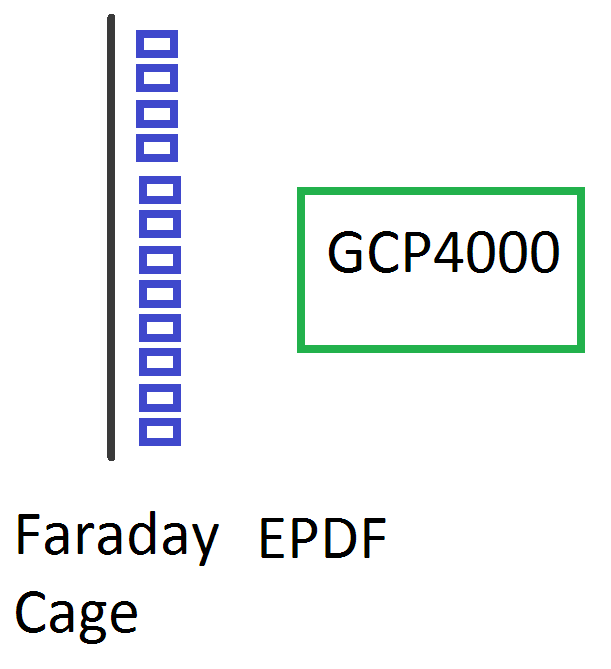
The primary goal of the installation was to determine if the products could communicate to the hub in the presence of a Faraday cage. The secondary goals of the installation included difficulties associated with the installation, future considerations associated with the final product, and battery life assessment after the installation.



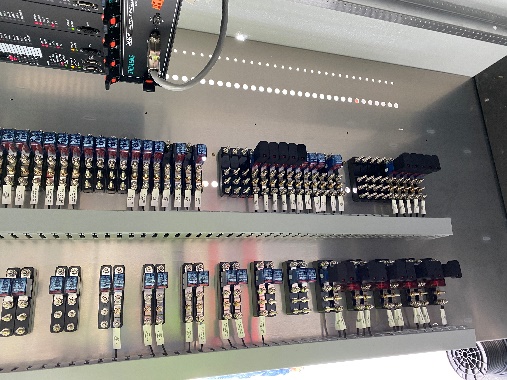
Testing was omitted once the layout of the bungalow was viewed by the team. The expected layout was as shown in Figure 1:



However upon arrival and surveying the location the true layout was as shown in Figure 2.

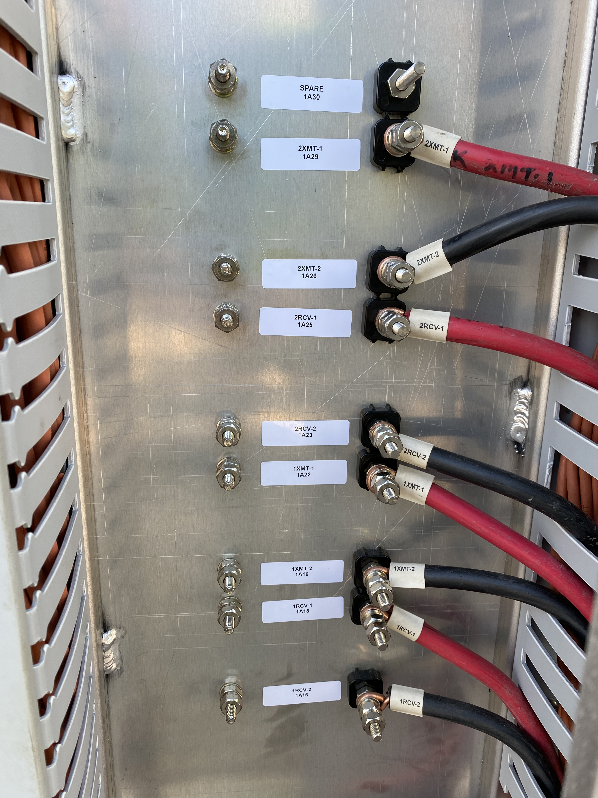


The following images outline the installation:

## Objective

Twenty three sensors were installed on top of EPD-F surge protectors inside of a brand new bungalow for Norfolk Southern. The bungalow included a Faraday cage which is thought to assist with separation of clean and dirty wires. Several sensors were placed over protectors which cover incoming track-side wires. These track-side wires are considered to be the high incidence locations within the bungalow which require replacement of EPD-Fs more frequently than other installation locations.



During installation, the hub which was originally designed to fit on top of DIN rail, needed to be attached to back-plating using zip ties instead of DIN rail. There was minimal DIN available inside of the bungalow in order for the hub to mount to. The following changes are recommended for the hub design:

* Hub to be able to mount to mounting holes in the back plane
* Removal of the I/O’s of the product
* More accessible or easily to install power connectors
* Included ring terminal and cable assemblies for the DC power to the hub



The sensors which attached to the EPD-F utilized a press-on fit. The installation of this press-on design was seamless and easy to quickly retrofit. None of the sensors were disconnected from the surge protectors at the end of the trial. The following changes are recommended for the sensor design:

* Transparent housings for easy inspection

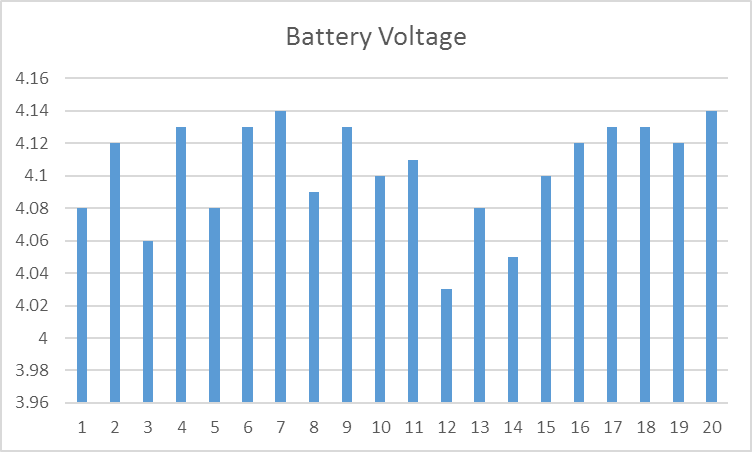
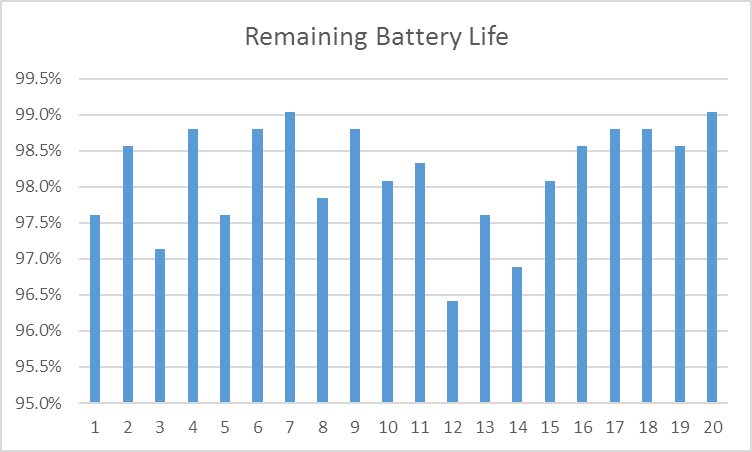


## Testing

As the hub had not detected any events at the time of removal for the trial install, one of the sensors was manually tripped and the hub was able to detect the sensor successfully.



The battery life of all samples was measured and can be seen in the graph below:



## Next Steps

The trial installation was considered to be a success even though the hub recorded no events during the trial. The voice of customer received was positive and indicated we should continue with the product line as there is a viable interest in the product. The following is a list of design improvements suggested as part of this installation:

Hub:

* Hub to be able to mount to mounting holes in the back plane
* Removal of the I/O’s of the product
* More accessible or easily to install power connectors
* Included ring terminal and cable assemblies for the DC power to the hub
* Increased number of sensors allowed to pair to hub

Sensor:

* Transparent housings for easy inspection
* Remove battery from design

# Revision History

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| --- | --- | --- | --- |
| **Rev** | **Prepared by** | **Date** | **Detailed Description of Changes** |
|  | GM | 22AUG22 | DRAFT\_0 |