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Upgrading a 400 Zone Gas Density Monitoring System

BY Tony Picagli
ABOUT THE AUTHOR

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Tony Picagli is a Principal Engineer for Circuit Breakers at Dynamic Ratings, Inc, Sussex WI. Tony joined Dynamic Ratings after 37 years of electric utility experience at United Illuminating, Orange, CT. He is past chairman of both the Doble Circuit Breaker Client Committee and the Doble Timing and Motion Committee. He has been involved with EPRI, equipment manufacturers and testing/maintenance companies as a subject matter expert for both circuit breakers and stationary battery systems. He has been an IEEE member for over 40 years and is active participant in the IEEE Standards Association. He is a Registered Professional Engineer in the State of Connecticut and possesses both a BSEE and MBA from The University of New Haven in addition to completing the Power Technology Extended Program at Power Technologies Institute (PTI) now Siemens Power Academy TD – North America.
In 2007, United Illuminating (UI) commissioned what was once the largest GIS installation in North America. The installation consisted of 16 GCBs, arranged in a breaker and one-half scheme, shunt reactors, auto transformers and underground transmission lines. To monitor the over 400 gas zones for this installation, a gas density monitoring (GDM) system was installed along with standard gas density monitoring gauges.

In 2013, several of the GDM hard drives began to fail, presumably due to age and their operating environment. At that time, UI approached the OEM to update the GDM system. Their proposal did little to improve the reporting capabilities and hardware issues. This presentation will discuss the replacement strategy, hardware upgrades, reporting capabilities, and other advantages of the new system.
Singer Substation
Bridgeport, CT
Original Hardware Architecture
Each of the 402 gas zones is equipped with both a pressure gauge and a density sensor.

The pressure gauge is temperature compensated and provides alarm points for all zones and trip initiation signals for the breaker gas zones.

The density sensors operate on the quartz oscillator principle. The sensors do not provide any control, but supply an analog signal to the monitoring system.
Other Components

13 Nodes were installed with 2 units located at remote sites about 1/4mile distant. The Nodes consisted of a Windows XP based PC, the power supply for the sensors and a signal conditioner.

The Main Control Unit consisted of an industrial grade Windows XP based PC.

2 Ni-CD based UPS systems and the SCADA alarm interface. Data was not transmitted to the company’s Operating Center and a reporting system was not provided.
Issues Driving the Upgrade

Nodes
- Installed in 2007
- Hard Drives began to fail
- Windows XP based
  - Support has ended
- USB 1.0 slow to backup
- Overheating issues with outdoor nodes
- Excessive power consumption at outdoor nodes
  - Resulted in loss of multiple nodes due to power supply overload

Primary Controller
- Windows XP based
  - Support has ended
- Lack of reporting software
  - Copy and Paste screens
- Manual Data Backup Required
- NiCd based UPS Systems require maintenance
- Desire to update system to same system as newer GDM System
New Hardware and Improvements

Nodes
- Replacement of PCs with PLCs
  - No Moving Parts
  - Readily Available Parts
  - Wide Operating Environment
  - Use Less Power
  - Run Cooler

Primary Controller
- Replacement of Cabinet with UI Standard Cabinet
- Replacement of PC
- Installation of 8-port KVM switch with built in 17" LCD screen, keyboard and touchpad
- Installation of Data Concentrator
- Power Inverter
  - UPS Systems Removed.
  - Normal feed from Station Battery System with inverters

General
- Re-Used
  - Node Cabinets, Terminals and Wiring
  - Power Supplies
  - Communication Hardware
  - Minimal Wiring Changes Required
Updated System Architecture
How These Changes Enhance Condition Based Maintenance

Minimize SF₆ Emission Potential by:

- Reliable Hardware
- Use of Sensors Rather than Gauges
  - Real-Time Information
  - Allows for Identification of Small Leaks
- Improved Reporting
  - Zone Specific
  - Tracking
  - Trending
  - Enhances Inventory Tracking for EPA Reporting
How These Changes Enhance Condition Based Maintenance

- 20,000 PI Historian Point Created
- Automatic Data Backup
- Custom Reports Can be Created by UI
- Access Across Established Corporate Network
- Eliminates Need for Field Response to Unknown Alarms
- Drill Down Screens for Ease of Use
- Simple Expandability to Other Assets and Asset Classes
- Upgrade Makes This a True Monitoring System
Conclusions

• Hardware and Software Needs are Constantly Changing and Improving
• Systems Must be User Friendly to Everyone
• Systems Must be Reliable and Resilient
• Need to Manage Large Amounts of Available Data
Thank You!

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