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CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

GENERAL DYNAMICS
Mission Systems

Power Quality and Generator Monitoring

Edward Tillistrand, Bouvard Hosticka, Greg Kline, Matt Wright

General Dynamics Mission Systems

T4.1-P24

OVERVIEW

General Dynamics Mission Systems (GDMS) operates, maintains, upgrades, sustains, and recapitalizes the installed U.S. Radionuclide Particulate and Noble Gas systems and station infrastructure in support of the CTBTO International Monitoring System. Power monitoring is essential to maintaining high levels of data availability for IMS station operations. Power availability and waveform quality are two key factors in ensuring station operation and effectiveness, respectively. GDMS is currently researching various methods of monitoring both of these major influencers. From the extracted data, risk assessment can be performed and potential downtime avoided.

POWER QUALITY

A quality waveform is essential for system-wide noise reduction, upstream issue tracking, equipment deterioration monitoring, reactive load interaction troubleshooting, and sensor signal stability. GDMS has investigated the use of the Eaton PX8000, as well as site investigation with the Fluke 43B Power quality meter.

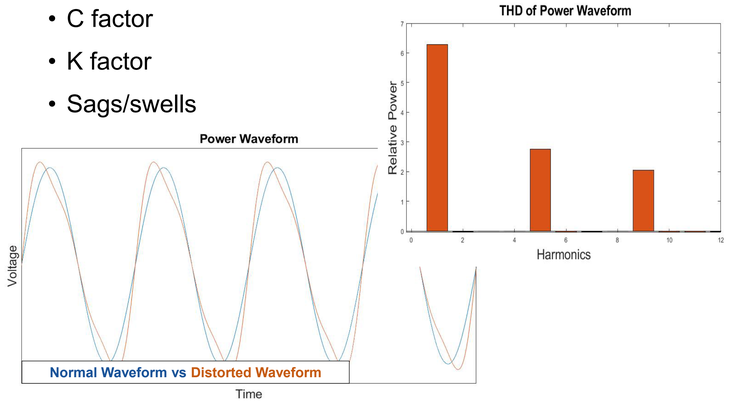
The Eaton test was conducted in the GDMS testbed using simulated events and local power fluctuations. The Fluke was used in the field to narrow down waveform distortion within the station grid.

METRICS REPORTED BY EATON PX8000

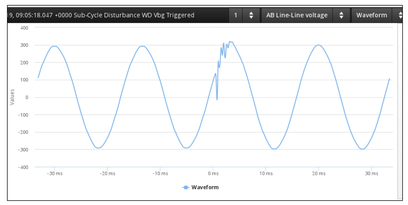
- **Total Demand Distortion (TDD):** distortion on the power signal
- **Total Harmonic Distortion (THD):** harmonic distortion present on the system at peak demand
- **C factor:** noise present on the electrical grid
- **K factor:** heating effects of harmonics on transformers
- **Flicker:** perceived change of brightness in fluorescent lighting due to voltage fluctuations.
- **Sags/swells:** short term RMS voltage and current fluctuations
- **dV/dt:** Voltage spikes typically caused by harmonics at 10-20 kHz

METRICS MEASURED BY 43B (VOLTAGE, CURRENT, & POWER)

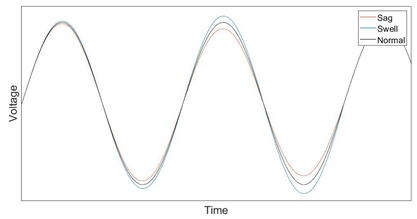
- Total Harmonic Distortion (THD)
- C factor
- K factor
- Sags/swells



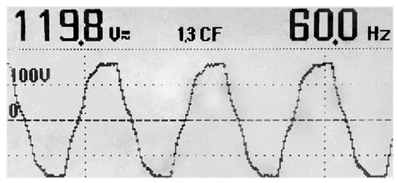
Eaton PX8000 Power Quality Monitor



Sub-cycle Disturbance Waveform Capture [PX8000]



Sag and Swell



Reactive Load Interaction on Station Power [43B]

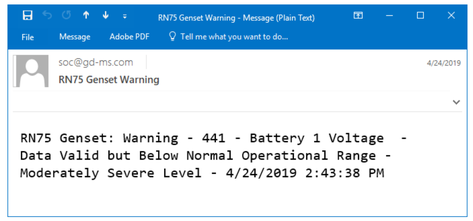
POWER AVAILABILITY

Reliable backup power systems are required for continuous operation and equipment safety. GDMS evaluated the Cummins PC500 Remote Generator Monitoring tool for its use in extended generator state of health and control capabilities.

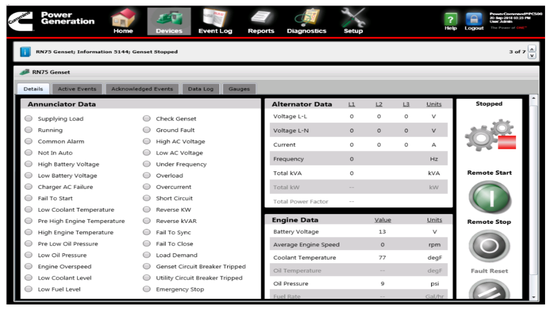
Cummins PC500 Generator Monitor

CUMMINS PC500 REMOTE GENERATOR MONITORING

- Improved GDMS Sensor Operations Center (SOC) capabilities
  - Remote monitoring allows for improved system awareness and easier troubleshooting
- Remote generator start/stop
- Additional sensing
  - Engine data:
    - Battery voltage, Engine speed, Coolant temperature
  - Generator data:
    - Phase voltages, line currents, frequency, total load (kVA & kW)
- Long term generator data logging
- Annunciator with email alerting:
  - Fault conditions
  - Start/stop
- Browser-based interface accessible from local network



Actual Cummins PC500 Battery Voltage Alert



Cummins PC500 Browser Interface

CONCLUSIONS AND FUTURE WORK

- The Eaton PX8000 provides a potential solution for continuous power quality monitoring and alerting with its simple user interface and extensive metrics. Further development and vendor coordination is underway to improve portability and ease of install at field sites.
- The Cummins PC500 allows for GDMS to remotely monitor key generator factors and allow minor remote system control, and is recommended for install at all generator stations.
- Fluke 43B, or similar power measurement devices allow for improved power troubleshooting. This makes it a useful tool for stations with infrequent power quality problems.

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