2008 ACG Annual Meeting

Commissioning of Network Protector Systems

Presented by:

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Network Protector Commissioning

- Overall goal is to ensure that the Network System functions as one complete system
- Each individual component reacts as anticipated
  - Triggers known effects down the chain and recovers as expected once the problem(s) have been resolved

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Network Protector Commissioning

- Different types of distribution systems
  - Single ended
    - 1 incoming main then distribution
      - Typically used in offices and schools
      - Mostly 480V systems
  - Double ended
    - 2 incoming mains linked together via a tie breaker
      - Typically used in campus settings, larger office buildings
      - Mostly 13.8kV systems stepped down to 480V

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Network Protector Commissioning

- Different types of distribution systems
  - Network system
    - Typically used in critical load institutions
      - Government
      - Data centers
      - Hospitals
    - Always associated with medium voltage source and transformer
    - Very little experience with in the Midwest
    - Largest user is ConEd in NYC[1]

[1] Cutler Hammer, CA08104001E, January 2008

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Network Protector Commissioning

- So what is a network system?
  - In part it is made up of from components:
    - Transformer
    - Breaker
    - Relay
    - Switch
  - Designed to ensure service continuity from a lost utility source without disruption to loads served

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Network Protector Commissioning

- Advantages
  - Redundancy (dependant on utility source)
  - Even distribution of loads
  - Loads never see an outage
    - Depends on distribution and the number of protectors in the system
  - Safety
    - Inherent properties of design and function completely isolate from line and load source in fault
  - Ease of operations and maintenance
- Disadvantages
  - Costs
  - Space required
  - Trained staff

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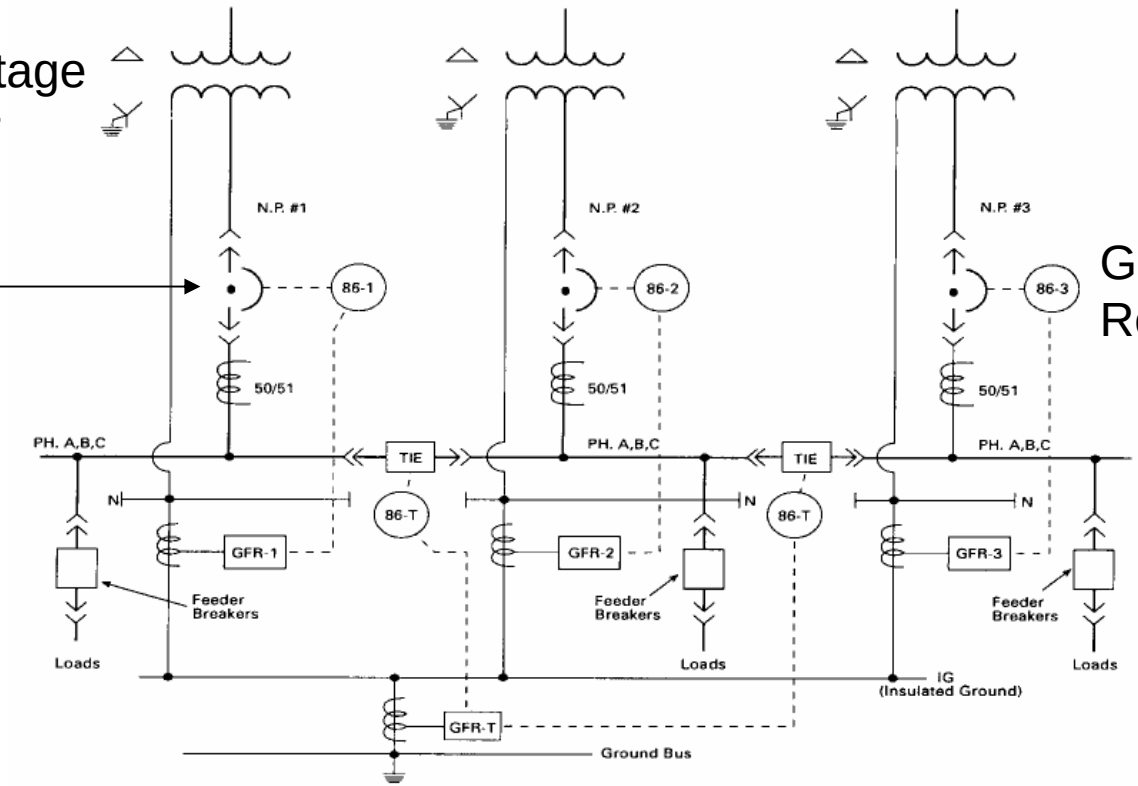
Network Protector Commissioning

- Design Phase
  - Many types of configurations
    - 3 or 4 circuits are most common



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Network Protector Commissioning

- Design Phase
  - Most are 480V or 208V rated
  - Provide instantaneous transfer to prevent system outage due to loss of utility circuit
  - Senses reverse power, system and network voltage
  - Does not provide overcurrent protection
  - Typically associated with a overcurrent relay located in the system switchgear
    - Also tied into a Ground Fault relay and a main Ground Fault relay

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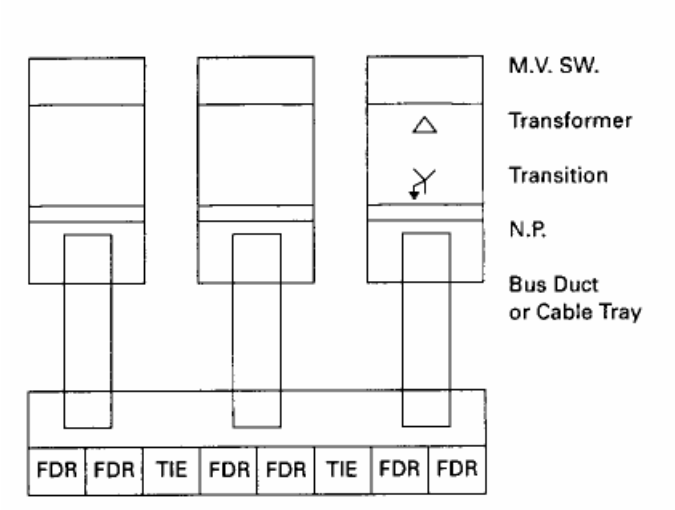
Network Protector Commissioning

- Design Phase
  - NWP relay provides all reverse current and voltage sensing through current transformer's
    - 1 set in the Protector
    - 1 set in the Switchgear
  - Need to coordinate "default" settings and design engineer requirements with the Operations and Maintenance staff
  - Proper sizing of transformer to carry all loads
  - Proper sizing of Protector and Current Transformers



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Network Protector Commissioning

- Construction Phase
  - Site visits and checklists are critical to confirming that all components and wiring is complete
  - Installation with proper support and bus configuration
  - Many interconnecting wires go between all of the components and other related equipment
    - Protector, transformer, switchgear
    - Interconnecting with Power Monitoring equipment

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Network Protector Commissioning

- Construction Phase
  - Contractor will want to energize at least one circuit during construction for temporary power
    - Need to confirm protection and proper isolation
      - Lock Out / Tag Out
      - Manufacturer startup
      - InterNational Electrical Testing Association (NETA) testing performed
  - Training and warranty based on beneficial usage depending on project turnover

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Network Protector Commissioning

- Construction Phase
  - Submittal and coordination study review
    - Need to verify settings between the overcurrent devices are slower than that of the tie breakers in the distribution switchgear
    - Need to verify settings of the ground fault devices are slower and longer than that of the feeder breaker

It is very important that the protector 50/51 setting be slower than the tie breaker. The faster acting tie is desired for isolation of switchgear faults between one side of the tie and the loadside of a protector. The tie thus clears one transformer's fault contribution, while the unfaulted side remains energized, then the protector experiencing the remaining fault current will trip open, thereby isolating one-half of the network bus for subsequent repair.[2]

Transformer secondary winding faults may open both the tie and a protector, depending upon the magnitude of the secondary fault event. The protector should open first on reverse power; however, should the tie open, it can be reclosed after locking out the protector in the open position. A protector only takes six cycles to open upon any value of reverse power.

[2] Cutler Hammer, CA08104001E, January 2008

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Network Protector Commissioning

- Acceptance Phase
  - NETA testing is very accurate as far as what is required to provide a functioning system
  - Need to verify the complete interaction between all Protectors and Switchgear after installation
  - Verify proper programming of Protector relay with pendulum
  - Verify proper overcurrent and ground fault relays are programmed
  - Verify any monitoring to Building Automation and Power Monitoring Systems

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Network Protector Commissioning

- Warranty Phase and beyond
  - The O&M staff would prefer these systems for option of isolating transformers, breakers, protectors, bus, and conductors for required maintenance
    - A network system can isolate circuits and continue load serving purpose via other circuits

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Questions and Answers

- Questions and Solutions Engineering, Inc.
  - Catherine Melander, P.E., LEED AP
- TLC Engineering for Architecture
  - Mark Gelfo, LEED AP, CxA
- Chinook Systems, Inc.
  - Derek De Jesús