TechTalk

NovaTech, LLC
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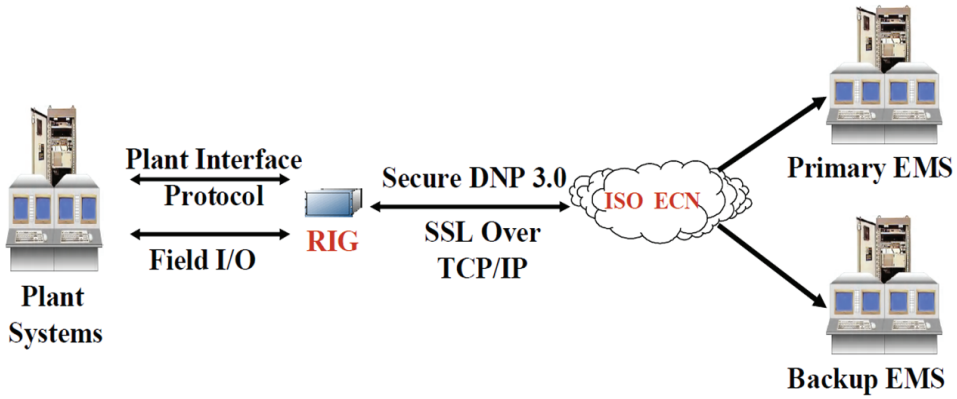
OrionLX Added to CAISO Vendor and Third Party Engineering Firm List

The latest California Independent System Operator (CAISO) specification for Remote Intelligent Gateways (RIGs) calls for secure, encrypted DNP3 communication between EMS and RIGs, per the diagram shown at right.



The OrionLX will serve as a Remote Intelligent Gateway for CAISO, providing encrypted data over secure TCP/IP to ISO EMS systems. Diagram excerpted from the CAISO paper "Remote Intelligent Gateway (RIG) Specification"

The OrionLX has been enhanced to meet this latest CAISO security requirement and has been added to the CAISO Vendor and Third Party Engineering Firm List, opening the door for expanded application in California wind farms and generation sites. Other OrionLX enhancements for CAISO included a health-check heartbeat every second and bumpless transfer of generator control from local to remote.

The OrionLX security implementation is provided by wrapping DNP3 with SSL/TLS protocols in the transport layer level. Transport Layer Security (TLS) and its predecessor, Secure Socket Layer (SSL), are cryptographic protocols that provide security for communications over networks such as the CAISO ECN or the Internet. TLS and SSL encrypt the segments of network connections at the Transport Layer end-to-end.

For more details, please see "Remote Intelligent Gateway (RIG) Technical Specification" and the document with the complete list of approved vendors at http://www.caiso.com

Bitronics® 50 Series Update

All Bitronics 50 Series models and options are now available for order. This includes the M350 A3 ammeter and V3 voltmeter and both the 0-1 mA and 4-20mA transducer output options for the M650 and M350 families. The option for a fully configurable DNP3 point list or Modbus register set is also now supported in the latest firmware, as is the ability to customize the display.

Pennsylvania Congressman Charlie Dent recently visited our Bethlehem, PA facility to learn more about the the U.S. power grid and the Bitronics line of U.S. made, globally deployed measurement products.

Third Annual (&Totally Free) Midwest Technical Symposium

July 15th in Overland Park, Kansas

We're looking for another strong turnout to this year's Midwest Technical Symposium. Three customer papers are scheduled:

Orion Substation RTU
Scott Souders, Westar

Orion Applications at LES
Paul Ladd, Lincoln Electric

Orion Applications at TEP
Jeremy Anderson, Tucson Electric

Technical Sessions

- OrionLX Email Event Reports
- OrionLX Security Configuration
- Orion5rL Upgrade
- Orion Distribution Automation
- Bitronics M650 Configuration
- Bitronics 70 series NERC Recording

The symposium runs from 8:30am to 4:15pm. A continental breakfast (7:45 am) and lunch will be provided. This symposium is free for participants. To obtain a registration form and more details, please contact Jim Siders at (913) 451-1880 or jim.siders@novatechweb.com

Visit the Events Section on our website for full symposium details and agenda.

Controlled Switching Systems Paper Available

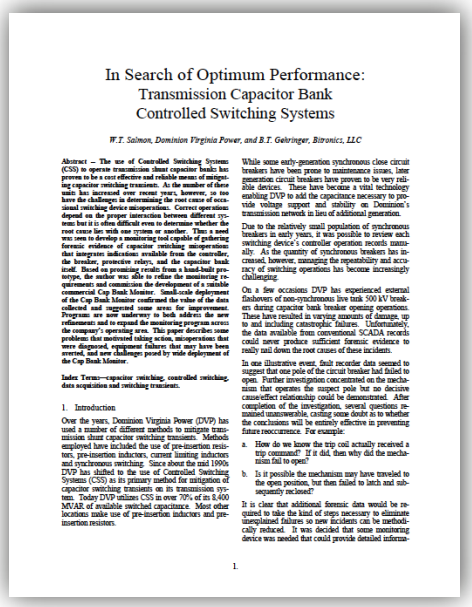
Bitronics Senior Application Engineer Bryan Gehringer co-authored a paper with Tommy Salmon of Dominion Virginia Power that was presented at the recent Georgia Tech Fault and Disturbance Analysis Conference. The paper and presentation detailed Dominion's use of the M87x in monitoring transmission capacitor bank controlled switching systems.

NovaTech produces a NEMA-4 rated box (shown below) in Lenexa for Dominion that contains a Bitronics M87x and M870D along with auxiliary equipment such as satellite clock, antenna, heater, fuses and test point terminals.

Abstract -- The use of Controlled Switching Systems (CSS) to operate transmission shunt capacitor banks has proven to be a cost effective and reliable means of mitigating capacitor switching transients. As the number of these units has increased over recent years, however, so too have the challenges in determining the root cause of occasional switching device misoperations.

Correct operations depend on the proper interaction between different systems but it is often difficult even to determine whether the root cause lies with one system or another. Thus a need was seen to develop a monitoring tool capable of gathering forensic evidence of capacitor switching misoperations that integrates indications available from the controller, the breaker, protective relays, and the capacitor bank itself.

Based on promising results from a hand-built prototype, the author was able to refine the monitoring requirements and commission the development of a suitable commercial Cap Bank Monitor. Small-scale deployment of the Cap Bank Monitor confirmed the value of the data collected and suggested some areas for improvement. Programs are now underway to both address the new refinements and to expand the monitoring program across the company's operating area. This paper describes some problems that motivated taking action, misoperations that were diagnosed, equipment failures that may have been averted, and new challenges posed by wide deployment of the Cap Bank Monitor.



In Search of Optimum Performance:
Transmission Capacitor Bank
Controlled Switching Systems

W.T. Salmon, Dominion Virginia Power, and B.T. Gehringer, Bitronics, LLC

Abstract -- The use of Controlled Switching Systems (CSS) to operate transmission shunt capacitor banks has proven to be a cost effective and reliable means of mitigating capacitor switching transients. As the number of these units has increased over recent years, however, so too have the challenges in determining the root cause of occasional switching device misoperations. Correct operations depend on the proper interaction between different systems but it is often difficult even to determine whether the root cause lies with one system or another. Thus a need was seen to develop a monitoring tool capable of gathering forensic evidence of capacitor switching misoperations that integrates indications available from the controller, the breaker, protective relays, and the capacitor bank itself. Based on promising results from a hand-built prototype, the author was able to refine the monitoring requirements and commission the development of a suitable commercial Cap Bank Monitor. Small-scale deployment of the Cap Bank Monitor confirmed the value of the data collected and suggested some areas for improvement. Programs are now underway to both address the new refinements and to expand the monitoring program across the company's operating area. This paper describes some problems that motivated taking action, misoperations that were diagnosed, equipment failures that may have been averted, and new challenges posed by wide deployment of the Cap Bank Monitor.

Index Terms—capacitor switching, controlled switching, data acquisition and switching transient.

1. Introduction

Over the years, Dominion Virginia Power (DVP) has used a number of different methods to mitigate transmission shunt capacitor switching transients. Methods employed have included the use of pre-insertion resistors, pre-insertion inductors, current limiting inductors and synchronous switching. Since about the mid 1990s DVP has shifted to the use of Controlled Switching Systems (CSS) as its primary method for mitigation of capacitor switching transients on its transmission system. Today DVP utilizes CSS in over 70% of its 8,400 MVAR of available switched capacitance. Most other locations make use of pre-insertion inductors and pre-insertion resistors.

While some early-generation synchronous close circuit breakers have been prone to maintenance issues, later generation circuit breakers have proven to be very reliable devices. These have become a vital technology enabling DVP to add the capacitance necessary to provide voltage support and stability on Dominion's transmission network in lieu of additional generation.

Due to the relatively small population of synchronous breakers in early years, it was possible to review each switching device's controller operation records manually. As the quantity of synchronous breakers has increased, however, managing the repeatability and accuracy of switching operations has become increasingly challenging.

On a few occasions DVP has experienced external flashovers of non-synchronous live tank 500 kV breakers during capacitor bank breaker opening operations. These have resulted in varying amounts of damage, up to and including catastrophic failures. Unfortunately, the data available from conventional SCADA records could never produce sufficient forensic evidence to really nail down the root causes of these incidents.

In one illustrative event, fault recorder data seemed to suggest that one pole of the circuit breaker had failed to open. Further investigation concentrated on the mechanism that operates the suspect pole but no decisive cause-effect relationship could be demonstrated. After completion of the investigation, several questions remained unanswerable, casting some doubt as to whether the conclusions will be entirely effective in preventing future reoccurrence. For example:

a. How do we know the trip coil actually received a trip command? If it did, then why did the mechanism fail to open?
b. Is it possible the mechanism may have traveled to the open position, but then failed to latch and subsequently reclosed?

It is clear that additional forensic data would be required to take the kind of steps necessary to eliminate unexplained failures so new incidents can be methodically reduced. It was decided that some monitoring device was needed that could provide detailed informa-

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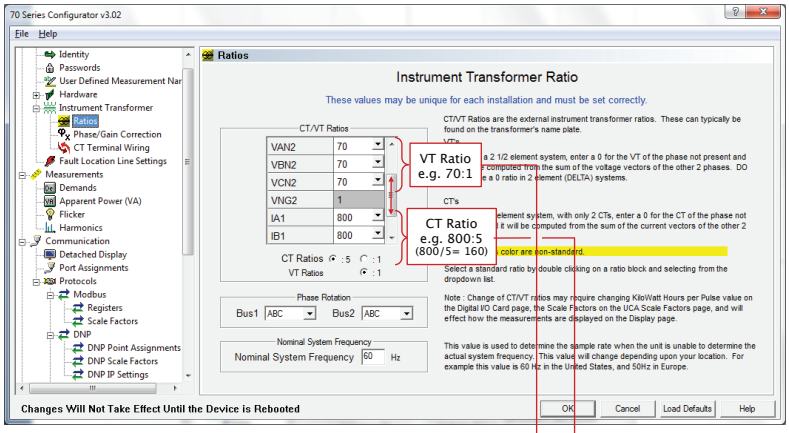
Download the complete conference paper and associated PowerPoint in our Documentation Library

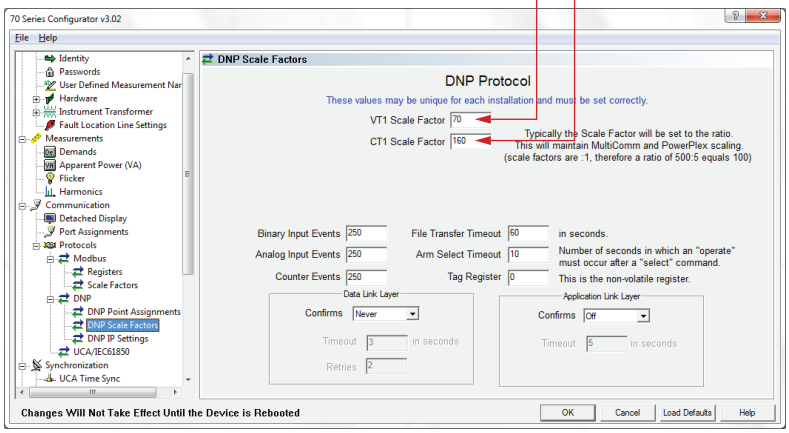
Ask Bryan:

Q: My SCADA software gives me one field to enter a scale factor and a field to enter a zero offset for converting each DNP analog point into primary engineering units. The Bitronics configuration software asks me to enter a CT scale factor and a VT scale factor, but it doesn't mention anything about what scaling to use for power, frequency, or other kinds of points besides the current and voltage. How do I choose the best scale factors to enter in the Bitronics software? Then what should I enter in SCADA?

A: The settings for Modbus and DNP scaling on the 70 Series IED are designed to make most analog points work out for an optimum balance between range and resolution if you enter the same value for the CT and VT scale factors that you use for the CT and VT ratio settings. That is, if the current and voltage are optimized, then the watts, VArs and VA will also work out. Some measurements, like power factor and frequency do not depend on the CT and VT scale factors at all, and are handled a little differently. And some measurements, like line-to-line volts may require you to choose a different value for the VT scaling factor than you use for the VT ratio under certain circumstances.

To keep this from getting confusing, let's break the answer into three parts. In the first part, I'll describe the typical case where the scaling factors are the same as the instrument transformer ratios. In the next issue of *TechTalk* we'll handle exceptional cases, where you might want to use a scale factor that's different from the transformer ratios. Then in the final part, we'll describe points where the scaling factor doesn't have anything to do with the CT and VT ratios. At the conclusion of the three-part series, we'll concatenate all three parts into a single white paper that covers all scaling issues comprehensively. I'll even throw in a primer on binary integer math and the significance of "two's-complement" encoding.





DNP Scaling, Part 1:
The Typical Case

The 70 Series Configurator software has one page (above, top) to enter the CT and VT ratio settings. There is another page (above, bottom) for each protocol where the CT and VT Scale Factors are entered. That way Modbus and DNP protocols can be scaled independently. For the IED to work properly, the CT and VT Ratio settings must always be set equal to the actual turns ratios of the instrument transformers connected to the voltage and current terminals of the IED. It is never necessary to "trick the meter" by multiplying a ratio times root-three, or any other value under any circumstances. But the CT and VT Scale Factor settings can be manipulated to adjust the range and the resolution of various measurements according to the unique circumstances that may arise in a substation.

View the rest of Part 1 (and 2&3 when available) of this tutorial at www.novatechweb.com/Scaling101

New Videos Available

Orion Configuration for NERC CIP
Bitronics® 50 Series SCADA/Network Configuration
Orion SCADA Configuration

Our first video on configuring Orion for Distribution Automation received a great response from customers. These and future videos bring NovaTech experts into your office, home, or PDA when it's most convenient for you. Please submit your video suggestions to ray.wright@novatechweb.com

UPCOMING EVENTS

NovaTech Midwest Technical Symposium, Overland Park, Kansas, July 15, 2010

Association of Illinois Electric Cooperatives Annual Conference, Springfield, Illinois, July 29-30, 2010

LATEST SOFTWARE

Orion5/5r Firmware Version: 1.41.0
OrionLX Firmware Version: 1.40.1
Orion NCD3 Version: 3.09
Bitronics 70 Series Firmware and Configurator: 3.02
BiView: 2.32

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