

Capacitor Bank Monitoring & Distributed VAR Control

For the BiTRONICS M871 Multifunction Recording Transducer.

- Extend the life of capacitor banks and breakers.
- Reduce need for tap changers.
- Improve Power Quality to customers.
- Provide superior diagnostic information than relay data.

Introduction

Using relays to protect and monitor capacitor banks has several drawbacks. Their low sample rates and harmonic filters make them blind to, possible, harmful harmonic conditions. Also, in protection schemes where the relay is monitoring only the residual (neutral) current for can failures, it will also nuisance trip for phase imbalances, faults, ferro-resonance, and harmonic disturbances. The BiTRONICS M871 improves on this scheme in a number of ways, leading to higher power quality and longer life from capacitor banks.

How It Works

The six voltage inputs on the M871 can be used to monitor all phases of a capacitor bank. The M871's quarter-cycle RMS measurements include harmonics that relays are blind to, and its 128 sample-per cycle waveform capture allows more correct system diagnosis than relay records.

The six voltage inputs can be split to monitor two points: the high-side (or main line) voltage, and a point half way down the stack of capacitor banks. These two values should remain proportional at all times. An inequality that lasts for several cycles can be interpreted as a can failure and a local control device can initiate

an alarm or breaker opening. In this and other ways, the M871 can provide backup protection functionality.

The I/O inputs of the M871 can also record trip signals to switchgear and help an operator calibrate breaker timing. When closing a bank back into the system, breakers should close at (or as close as possible to) the instant that the voltage sine wave is crossing the zero-axis. Closing too early or late will cause a current spike and a momentary dip in voltage level that can be annoying and costly for industrial customers. The M871 can be set to capture a waveform whenever a breaker closure is initiated. This event record will show the high-side and mid-point voltages as well as the trip signal, and allow an operator to analyze whether the breaker system is functioning correctly.

A forward-thinking wide-area application currently in development at a northeastern utility uses the communications capabilities of the M871 to coordinate wide-area VAR control and PF optimization. The voltage measurements of the M871 are used to coordinate capacitor banks at several substations to flatten the voltage profile along transmission and distribution lines. This minimizes power loss during transmission and will reduce as well as possibly eliminate the need for tap changers at several substations.

Application

Additional Benefits

- In addition to trend data, the M871 captures fault and event waveforms and satisfies the recording needs of multiple utility departments (protection, planning, power quality, and revenue (0.2% Revenue-class accuracy)) in a single platform.
- Distributed architecture minimizes expense and liability of CT wiring in switchyard.
- Multiple communications ports and protocol processing allows easy integration into different networks.
- ¼ cycle measurement speed is fast enough for backup protection applications.
- Flexible modular design allows for future expansion of features and easily upgradeable functionality.