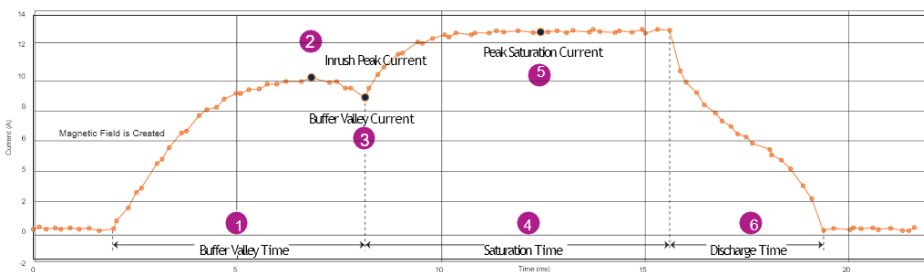


Circuit Breaker Monitoring and Optimizing



Circuit Breaker Monitoring and Optimizing, and analyzes trip & close coil current signatures

www.powerview-energy.com



Pioneering the future of power testing and monitoring

Circuit Breaker Monitoring and Optimizing

For a level of insight into circuit breaker performance never before possible, the Circuit Breaker Monitoring and Optimizing Monitor offers high-fidelity trip coil signature analysis. By recording the waveform characteristic of every trip and close operation and comparing it to a baseline, proprietary Circuit Breaker Monitoring technology can identify possible circuit breaker flaws and facilitate preventative maintenance.



High-fidelity analysis of trip signatures

Circuit breaker trip coil signatures may be captured and analyzed with exceptional accuracy thanks to **Circuit Breaker Monitoring technology**. Through the tracking of these signatures over time, the system provides a thorough understanding of the breaker's operational behavior in comparison to baseline measurements, allowing for the early identification of possible problems before they become more serious.

NERC PRC-005 COMPLIANCE Simplified

Every six years, NERC PRC-005 demands that each trip coil's ability to operate the circuit breaker be verified. Testing compliance is made easier with the **Circuit Breaker Monitoring and Optimizing**, which eliminates the need for expensive offline testing costs.

ASSISTS IN MAINTENANCE BASED ON CONDITION

Utilities can intelligently and only when necessary implement maintenance when they have a high level of insight into circuit breaker functionality.

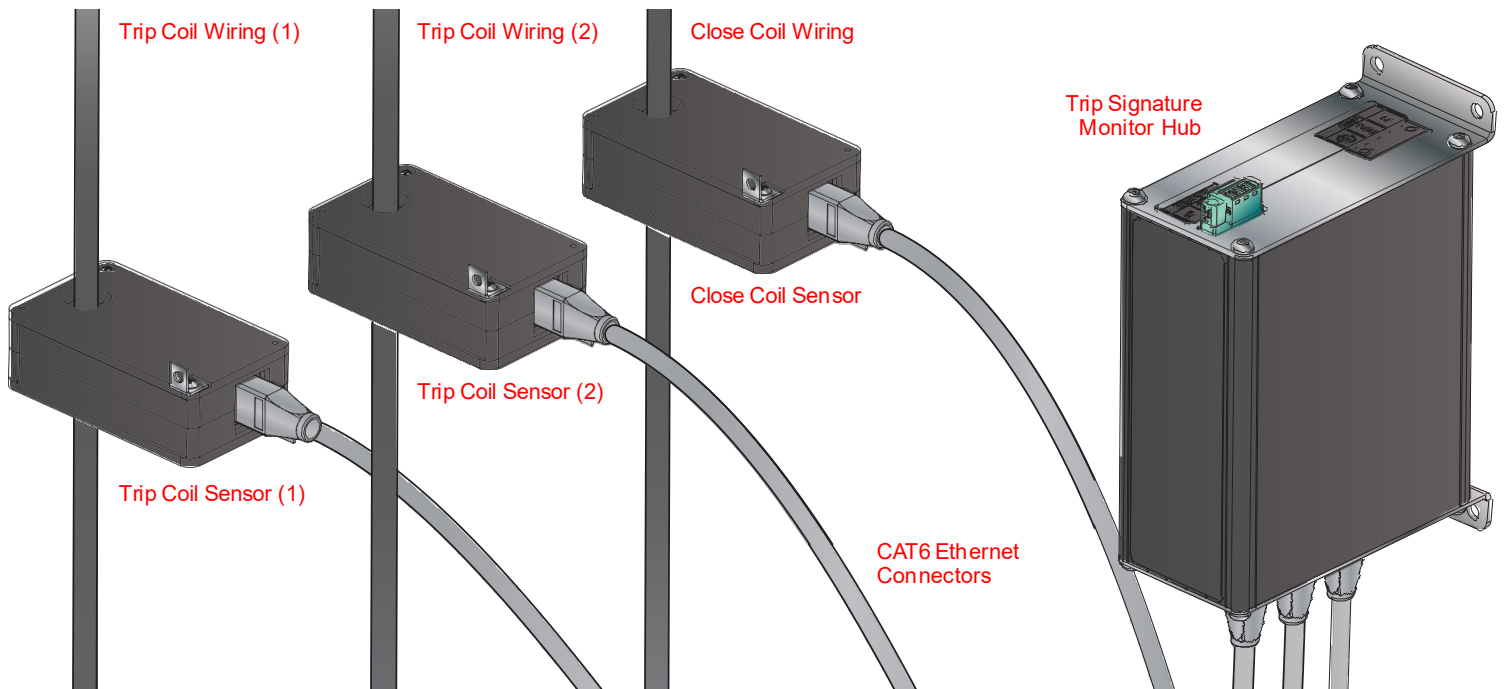
The **Circuit Breaker Monitoring and Optimizing** system offers advanced, high-fidelity analysis of trip and close coil signatures, enabling early detection of mechanical and electrical issues within circuit breakers. By continuously comparing each operation to a baseline, the system supports condition-based maintenance, reduces the need for offline testing, and simplifies compliance with NERC PRC-005 regulations. Integrated alarms and real-time notifications ensure swift response to anomalies, while the software with TripTracing provides precise waveform analysis and secure data export in COMTRADE or CSV formats. This innovative solution enhances system reliability, improves safety, and lowers operational costs.

Accessory to the Circuit Breaker Monitoring and Optimizing, and analyzes trip & close coil current signatures

- **Compares each new signature to a baseline to detect deviations**
- **Signature deviations can identify breaker deficiencies**
- **Deviations can trigger user-configured threshold alarms**
- ✓ Alarms can be used to apply data-driven maintenance
- ✓ Records signature, date, and time of each breaker operation
- ✓ Provides simplified NERC PRC-005 testing compliance
- ✓ SFTP communication protocol via COMTRADE or CSV files
- ✓ Can aid in deferring or eliminating offline testing

Improves safety, minimizes truck rolls, reduces costs

Includes hub, coil current sensors, CAT6 Ethernet connectors



1 Wiring for trip and close coils passes through existing sensors

Routing the Trip and Close Coil wiring through the existing sensors is the first step in the monitoring procedure. Three sensors are used by the system: one for the close coil wiring and two for the trip coil wiring. When the breaker is operating, these sensors record the current waveforms.

2 The Trip Signature Monitor Hub's Data Collection

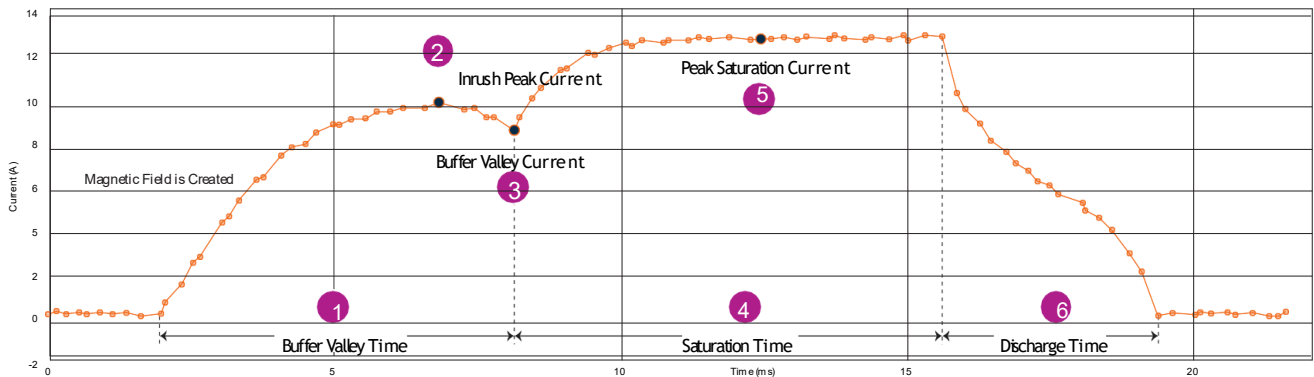
Coil current readings from the sensors are gathered by the Trip Signature Monitor Hub. The Hub continually tracks the current flowing through the coils as the breaker runs and communicates that information to the Optimizer3, guaranteeing that every detail is precisely documented.

3 Analysis and Retrieval of Trip Signatures

The signature is thoroughly analyzed using POWERVIEW technology in comparison to the baseline. This research offers insights into possible problems with the breaker's latch mechanisms by assisting in the identification of any anomalies or departures from the baseline.

Circuit Breaker Monitoring and Optimizing ANALYSIS

Each peak and dip in a high voltage circuit breaker trip signature (waveform) analysis provides a distinct narrative about the performance and operation of the breaker. These facts provide important new information about the breaker's internal workings.



While a decreasing current on the waveform implies that the latch action is free and unhindered, a rising current typically indicates that motion within the breaker latch mechanism has ceased or grown more difficult.

Timing between these events must be consistent; longer durations may indicate higher resistance, such as friction, or decreased coil force. To interpret the breaker's operation and spot possible problems before they become more serious, it is essential to comprehend these subtleties.

VALLEY TIME BUFFER

- 1 This is the amount of time that passes between the current's first spike (also known as the inrush peak) and the onset of current saturation. While a longer buffer valley time may indicate possible delays in operation, maybe as a result of mechanical or electrical problems, a shorter period may indicate that the breaker is responding rapidly.

CURRENT INRUSH PEAK

- 2 This is the highest current recorded just before to the breaker tripping. A high inrush peak current may be a sign of a shorted coil winding or a high level of friction in the latch mechanism. High coil resistance and imminent coil breakdown may be indicated by a low inrush peak current.

CURRENT BUFFER VALLEY

- 3 During the buffer valley time, this is the current level. An unexpectedly high buffer valley current may be a sign of shorted coil windings or excessive friction in the latch mechanism

TIME OF SATURATION

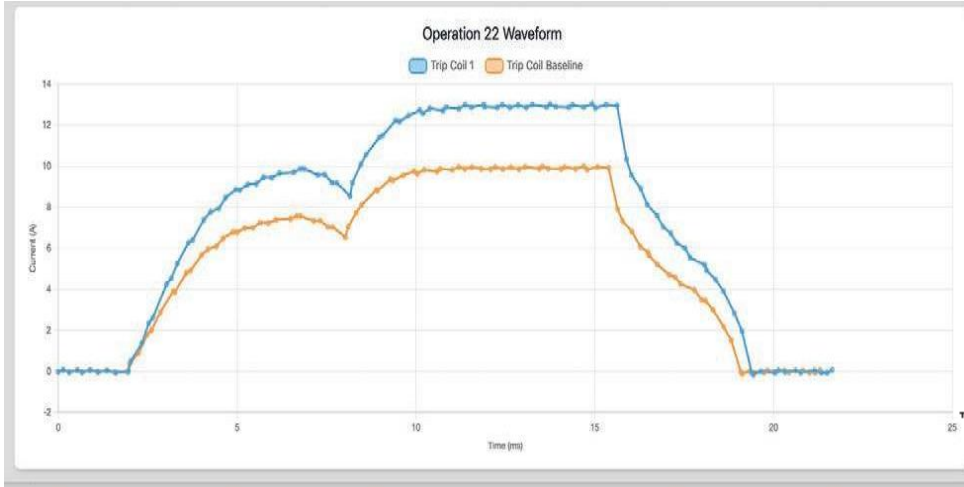
This is the amount of time that passes after the inrush peak when the current is almost constant, demonstrating how quickly the breaker operates. A long saturation time could indicate a slow 52a or 52b switch, significant friction in the working mechanism, or a deficiency in the operating spring pressure.

CURRENT PEAK SATURATION

During the saturation phase, this is the maximum current level. A high peak saturation current may be a sign of an abnormally high station battery voltage or a shorted coil winding.

TIME OF DISCHARGE

This is the amount of time that passes after the peak saturation period before the current drops to zero. Possible shorted coil windings could be indicated by a reduced discharge time.



Trip/Close Coil Data

Show 25 Operations per page

Coil	Occurred	Oper. #	Group #	Inrush Current Peak	Buffer Valley Current	Full Coil Peak Current	Buffer Valley Time	Saturation Time	Discharge Duration Time
Closing Coil	Jan 13, 2024, 9:16:08 AM	24	8	6.7 A	5.9 A	8.8 A	6.1 ms	7.6 ms	3.7 ms
Trip Coil 2	Jan 13, 2024, 9:01:06 AM	23	8	10.0 A	8.8 A	13.2 A	6.1 ms	7.6 ms	3.7 ms
Trip Coil 1	Jan 13, 2024, 9:01:04 AM	22	8	9.8 A	8.7 A	13.0 A	6.1 ms	7.6 ms	3.7 ms
Closing Coil	Dec 23, 2023, 9:01:02 AM	21	7	9.9 A	8.8 A	13.1 A	6.6 ms	8.3 ms	4.0 ms
Trip Coil 2	Dec 23, 2023, 8:46:00 AM	20	7	8.1 A	7.1 A	10.6 A	6.0 ms	7.4 ms	3.6 ms
Trip Coil 1	Dec 23, 2023, 8:45:58 AM	19	7	8.0 A	7.1 A	10.6 A	6.0 ms	7.4 ms	3.6 ms

The software running on the allows users to securely connect directly to Trip Signature Monitoring data.

TripTracing technology, provides a comprehensive view for analyzing circuit breaker trip & close coil current signatures. TripTracing compares new waveforms to an established baseline, identifying potential anomalies that could indicate malfunctions within the breaker's latch mechanisms or trip coil.

Precision Analysis of Coil Current Waveforms

By comparing each new trip signature against a baseline taken during normal operation, the system can detect even the slightest deviations in current or timing. These deviations often signal emerging issues, such as increased friction or mechanical wear, which could compromise the breaker's ability to function correctly.

Automated Alerts for Early Detection

When a deviation is detected that exceeds user-defined thresholds, it can generate an alarm. This proactive alert system allows for quick analysis, intervention, and proactive maintenance if necessary. Users can customize thresholds according to their specific operational needs, ensuring that alerts are both timely and relevant.

Effortless Data Management and Export

For further analysis, sharing, archival, NERC compliance, or reporting purposes, trip signature details can be easily exported from in industry-standard COMTRADE or CSV formats. This flexibility ensures that your data is not only securely stored but also readily accessible for future reference or detailed examination.

Stay Connected with Real-Time Notifications

In addition to system alarms, email notifications keep users informed of any issues in real-time, no matter where they are. This feature ensures that personnel can respond swiftly to potential issues, maintaining the reliability and safety of electrical infrastructure.

Measurements for Each Trip

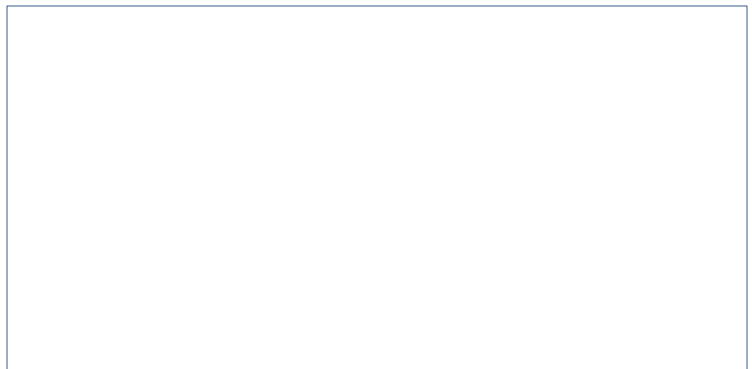
- Peak inrush current
- Full coil peak current
- Saturation time
- Buffer valley current
- Buffer valley time
- Discharge duration time



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