# Circuit Breaker Timing and Motion Analysis Course

18 – 22 July 2027
Johannesburg

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**Ref:** 981_174669 **Date:** 18 – 22 July 2027 **Location:** Johannesburg **Fees:** 6000 Euro

## Overview

Circuit Breaker Timing and Motion Analysis Course is a one-week advanced course for electrical maintenance engineers, protection technicians, commissioning engineers, and switchgear test specialists who need a repeatable Breaker Motion Diagnostic File. Participants learn to configure timing channels and motion transducers, capture operating sequences, calculate travel and velocity indicators, judge trace quality, and relate deviations to mechanical condition. The course concentrates on measurement evidence rather than general switchgear maintenance. Agile Leaders Training Center delivers focused circuit breaker timing and motion analysis training.

## Who Should Attend

- Teams responsible for condition testing of medium- and high-voltage circuit breakers
- Personnel who commission protection and primary plant interfaces
- Maintenance specialists who investigate slow, unequal, or unstable breaker operation
- Test engineers who configure timing analyzers and travel transducers
- Technical supervisors who review breaker test evidence and return-to-service decisions

The course assumes participants already work safely around isolated switchgear and can read breaker control diagrams; it leaves out protection-relay grading and general switchgear overhaul.

## Departments and Industries

The course supports departments that verify circuit breaker mechanical performance from measured evidence.

- Power generation electrical maintenance and outage teams
- Transmission and distribution substation testing groups
- Oil, gas, petrochemical, and process-plant reliability functions
- Industrial manufacturing electrical services
- EPC commissioning and specialist testing contractors

## Learning Objectives

By the end of this course, participants will be able to:

- Apply safe test preparation and connection controls
- Use timing analyzers and linear or rotary transducers
- Build repeatable open, close, and operating-sequence test plans
- Analyze timing, travel, velocity, overtravel, rebound, and wipe
- Diagnose mechanical defects from synchronized traces
- Compare results with manufacturer limits and previous records

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## Course Agenda

### Day 1: Test Strategy, Safety, and Breaker Mechanics

- Circuit Breaker Timing Test Purpose and Evidence Map
- Operating Mechanism, Linkage, Main Contact, and Auxiliary Contact Model
- Safe Isolation, Grounding, Stored-Energy, and Control-Supply Checklist
- Nameplate, Drawing, Manual, and Baseline Data Review
- Breaker Timing and Motion Test Plan Exercise

### Day 2: Timing Channels and Operating Sequences

- Main, Resistor, and Auxiliary Contact Channel Assignment
- Open, Close, Close-Open, and Open-Close Sequence Configuration
- Operating Time, Pole Discrepancy, Dead Time, and Dwell Time Worksheet
- Trip Coil, Close Coil, Control Voltage, and Trigger Alignment
- Circuit Breaker Timing Analyzer Setup Practice

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## Day 3: Contact Travel and Velocity Measurement

- Linear and Rotary Motion Transducer Selection Matrix
- Transducer Mounting, Direction, Scaling, and Zero Reference
- Stroke, Contact Wipe, Overtravel, and Rebound Calculation Sheet
- Average and Instantaneous Velocity Window Selection
- Circuit Breaker Travel and Velocity Testing Trace Review

## Day 4: Trace Quality and Mechanical Diagnosis

- Noise, Bounce, Lost Motion, Saturation, and Trigger Error Checks
- Slow Operation, Pole Scatter, Damping, and Linkage Defect Patterns
- Coil Current and Motion Trace Correlation Method
- First-Trip and In-Service Timing Evidence Discussion
- Advanced Circuit Breaker Timing Diagnostics Case File

## Day 5: Acceptance, Trending, and Capstone

- Manufacturer Limit, Commissioning Baseline, and Trend Comparison
- Repeatability, Uncertainty, and Retest Decision Record
- Exception Classification and Maintenance Recommendation Table
- Test Report, Trace Annotation, and Technical Handover
- Capstone Exercise: Breaker Motion Diagnostic File

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## Practical Exercises

The course uses structured exercises that turn analyzer traces into defensible maintenance evidence.

- Suggested activity: prepare a safe connection and channel map from a breaker schematic
- Suggested activity: calculate timing spread, travel, velocity, overtravel, rebound, and wipe
- Suggested activity: distinguish a mechanical defect from poor transducer setup or trigger error
- Suggested activity: produce a recommendation from baseline, current, and repeated measurements

## FAQs

### What does circuit breaker timing and motion analysis measure?

It records when main and auxiliary contacts change state and how the moving mechanism travels during operation. The resulting synchronized traces support calculations for operating time, pole discrepancy, stroke, wipe, overtravel, rebound, and velocity.

### How is this different from general switchgear maintenance training?

This course is limited to circuit breaker timing, travel, velocity, trace validation, mechanical diagnosis, and evidence-based reporting. It does not teach the wider inspection, servicing, insulation, protection, and overhaul scope of a general switchgear course.

### Which operating sequences are examined?

Participants examine open, close, close-open, and open-close sequences where applicable. The exact sequence and test limits must follow the breaker design, operating instructions, site procedure, and approved test plan.

### Why does transducer setup matter in breaker motion testing?

Mounting position, direction, conversion ratio, zero reference, free movement, and sampling configuration directly affect the travel curve. An incorrect setup can resemble a real mechanical defect, so trace-quality checks precede diagnosis.

## How should test results be judged?

Results should be compared with manufacturer limits, commissioning baselines, previous measurements, operating conditions, and repeat tests. A single generic limit is not suitable for every breaker mechanism or transducer position.

## Conclusion

Participants leave with a Breaker Motion Diagnostic File containing a test plan, connection map, sequence records, timing and travel calculations, trace-quality checks, defect interpretations, trend comparisons, and a technical recommendation. The file provides a repeatable route from field measurement to review and maintenance action.