# Time-Travel Analysis Training Course for Substation Leaders: Curves, Limits and Replacement Calls

25 – 29 January 2027
Cape town

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**Ref:** 908_41363 **Date:** 25 – 29 January 2027 **Location:** Cape town **Fees:** 4800 GBP

## Programme Summary

Time-travel analysis for circuit breakers is the subject of this one-week training course for substation maintenance managers, testing supervisors, asset engineers and reliability leads, taught at managerial level and ending in a breaker fleet review. A slow or uneven breaker may fail to clear a fault, yet timing records are often filed without a decision rule. The programme moves from measurement to trace reading, limits, and repair or replacement, using prepared test records from a utility substation and an industrial plant. Mars Training Centre UK delivers this programme on time-travel analysis for circuit breakers to mixed-organisation cohorts.

## The Business Case

Leaders who can read timing and travel evidence, set action limits and rank breakers by duty make sound maintenance, outage and renewal decisions. The programme works on the measures below.

- Breaker Failure Risk: Falls when slow or uneven operation is caught from traces.
- Maintenance Cost: Reduces when work follows measured condition, not fixed intervals.
- Outage Exposure: Improves when repair and replacement follow duty and spares.

## Principles and Evidence Base

- IEC 62271-100: The IEC standard for high-voltage alternating-current circuit-breakers, defining rated operating times and mechanical characteristics, applied in Sessions 1 and 3 to frame what results are compared with.
- Condition-based maintenance: The principle of acting on measured condition, applied in Sessions 3 and 4 to set action bands and intervals.
- Trend analysis: The statistical practice of reading change against a baseline, applied in Session 4 to judge a fleet.

## Intended Participants

- Substation maintenance managers who decide when a breaker is tested, repaired or renewed.
- Testing supervisors who answer for the quality of timing and travel records.
- Asset engineers who set limits and rank breakers by duty.
- Reliability leads who review fleet trends and recurring mechanism faults.

Typical settings include power transmission, electricity distribution, oil and gas facilities and heavy industry.

## Learning Outcomes

1. Participants will be able to evaluate the quality of a timing and travel test record.
2. Participants will be able to diagnose a mechanism fault from contact timing, travel curves and velocity.
3. Participants will be able to construct warning and action bands from limits and a baseline.
4. Participants will be able to compare repair with replacement using condition and duty.
5. Participants will be able to prioritise breakers across a fleet by evidence and consequence.
6. Participants will be able to justify a breaker fleet review to an asset manager.

## Programme Structure

## Day 1: Time-Travel Analysis Foundations for Circuit Breakers

What do timing and travel measurements reveal about the condition of a breaker?

- Breaker Operating Sequence Diagram
- Contact Timing and Travel Measurement Layout
- Rated Operating Times Under IEC 62271-100
- Test Record Quality Checklist
- Breaker Duty and Criticality Ranking

## Day 2: Reading Contact Timing and Travel Curves

How are close, open and travel traces read to find a mechanism fault?

- Close and Open Timing Trace Reading
- Pole Spread and Synchronism Table
- Travel Curve Shape Guide
- Velocity Calculation From Travel Data
- Coil Current Signature Review

## Day 3: Acceptance Limits and Condition Judgement

Which result is acceptable, which is a warning and which needs action?

- Manufacturer Limit Interpretation Sheet
- Baseline Versus Latest Trace Comparison
- Warning and Action Band Setting
- Mechanism Wear Indicator Matrix
- Measurement Uncertainty Allowance

## Day 4: Repair or Replacement and Fleet Evidence

When does the evidence justify repair, and when does it point to replacement?

- Repair or Replace Decision Tree
- Fleet Trend Dashboard Design
- Spare Mechanism and Parts Plan
- Outage Window and Risk Trade-Off Table
- Test Interval Review Rule

## Day 5: Time-Travel Analysis Review for One Breaker Fleet

Do the findings join into a review that an asset manager can approve?

- Applying the Session 1 Duty Ranking
- Testing the Session 2 Trace Guide
- Checking the Session 3 Action Bands
- Reviewing the Session 4 Decision Tree
- Completing the Breaker Fleet Review

## Methodology

The programme is a data workshop built on prepared traces, coil current records and test histories from a utility substation and an industrial plant. Participants read traces, apply limits, rank breakers and decide on repair or replacement, then defend the review to peers acting as an asset management panel.

- Suggested activity: Reading a travel curve with a slow opening stroke.
- Suggested activity: Setting warning and action bands from a baseline trace.
- Suggested activity: Ranking twelve breakers for repair or replacement.

## Capstone Output

Each participant completes a breaker fleet review. It holds a duty ranking, a trace reading guide, action bands, a decision tree and a fleet trend view. At work it goes to the asset manager for approval and sets the routine for judging later results.

## Frequently Asked Questions

### Is time-travel analysis for circuit breakers training suitable for managers who are not test technicians?

Yes. Time-travel analysis for circuit breakers is taught through prepared traces and templates. You need responsibility for maintenance, testing or asset decisions, but no test set experience.

## Which standard does time-travel analysis for circuit breakers rest on in this training?

Time-travel analysis for circuit breakers here rests on IEC 62271-100 for rated operating times and mechanical characteristics, with condition-based maintenance and trend analysis for decisions.

## How is the review from time-travel analysis for circuit breakers training used at work?

You take the breaker fleet review to your asset manager, use its action bands to judge new results, and keep its decision tree as the repair rule.

## How does time-travel analysis for circuit breakers differ from a programme on switchgear safety?

Time-travel analysis for circuit breakers concentrates on reading timing and travel evidence for condition, while a programme on switchgear safety concentrates on arc flash exposure and safe working.