
Power System Fault Analysis and Protection Coordination Training Course

7 – 11 June 2027
Vienna





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Programme Summary

Power system fault analysis and protection coordination is a five-day training course for electrical engineering and utility leaders at strategic level, culminating in a protection and fault risk improvement plan for their own network or plant. Electrical faults interrupt production, damage costly equipment and expose people to arc flash hazards, yet protection schemes are often left unchanged for years. The approach links fault causes, short-circuit analysis, protection coordination and investigation into one reliability discipline. Mars Training Centre UK delivers this programme in power system fault analysis and protection coordination.

The Business Case

A single uncleared or poorly coordinated fault can trip an entire process unit or substation and cause weeks of repair. Many networks have grown through extensions while protection studies were never updated. Leaders who commission current short-circuit studies, review coordination after every change and learn from each fault record reduce outage frequency, equipment damage and personnel risk.

- Supply Continuity: Reduces unplanned outages by ensuring that only the faulted section is isolated.
- Equipment Damage Cost: Limits thermal and mechanical stress on transformers, switchgear and cables through correct fault clearance.
- Personnel Safety Exposure: Lowers arc flash energy and incident risk through informed protection settings.

Principles and Evidence Base

- IEC 60909 Short-Circuit Currents in Three-Phase AC Systems: Provides the calculation method applied to equipment ratings in Session 2.
- IEC 60255 Measuring Relays and Protection Equipment: Frames relay functions and performance compared in Session 3.
- IEEE 1584 Arc-Flash Hazard Calculations: Supplies the method used to relate protection settings to incident energy in Session 4.
- IEC 61850 Communication in Substations: Supports fault recording and event analysis used in Session 4.



Intended Participants

- Executives accountable for the reliability of industrial or utility electrical networks.
- Senior leaders who approve protection studies, upgrades and electrical safety programmes.
- Heads of electrical maintenance who decide on condition monitoring and asset replacement.
- Leaders who review major electrical incidents and approve corrective actions.

The programme serves electrical engineering, power utilities, maintenance and HSE functions across oil and gas facilities, power generation, petrochemicals and transmission and distribution networks.

Learning Outcomes

1. Participants will be able to diagnose the main causes of electrical faults in industrial and utility networks.
2. Participants will be able to interpret symmetrical and unsymmetrical fault studies and their effect on equipment ratings.
3. Participants will be able to evaluate protection schemes for selectivity, speed and sensitivity.
4. Participants will be able to prioritise arc flash and condition monitoring measures by risk.
5. Participants will be able to construct a structured post-fault investigation and corrective action process.
6. Participants will be able to justify a protection and fault risk improvement plan to senior management.

Programme Structure

Day 1: Electrical Fault Causes and Consequences

Why do electrical faults occur, and what do they cost the organisation?

- Insulation Breakdown and Ageing Mechanisms
- Overload, Lightning and Switching Surge Faults
- Shunt and Series Fault Types
- Consequences for Equipment, Production and People
- Fault History and Outage Data Review

Day 2: Power System Fault Analysis

How are fault currents calculated and used to check whether equipment can withstand them?

- Symmetrical Components for Unbalanced Faults
- Short-Circuit Calculation Under IEC 60909
- Equipment Duty Checks for Breakers, Busbars and Cables
- Earthing Systems and Earth Fault Current Behaviour
- Network Modelling Software and Study Assumptions



Day 3: Protection Schemes and Coordination

How do protection systems detect faults and isolate only the affected section?

- Overcurrent, Distance and Differential Relays
- Relay Performance Requirements Under IEC 60255
- Time-Current Grading and Selectivity Studies
- Generator, Transformer and Motor Protection Philosophies
- Protection Setting Management and Change Control

Day 4: Fault Detection, Arc Flash and Investigation

How are faults detected early, hazards reduced and incidents investigated?

- Partial Discharge, Thermography and Dissolved Gas Analysis
- Arc Flash Incident Energy Using IEEE 1584
- Disturbance Recording and Event Analysis With IEC 61850
- Post-Fault Investigation Method
- Corrective Remedies and Design Improvements

Day 5: Applying Fault Analysis and Protection Strategy

How are analysis, protection and monitoring combined into one plan for a network?

- Reviewing a Refinery Substation Trip Against Session 3 Coordination
- Applying Fault Study Results to a Participant Network
- Ranking Arc Flash and Monitoring Actions by Risk
- Defining Protection Review Cycles and Ownership
- Protection and Fault Risk Improvement Plan Presentation

Methodology

The programme relies on case analysis of real electrical incidents from refineries, power stations and distribution networks, combined with data exercises in which participants interpret fault studies, coordination curves and disturbance records. Session 5 brings the work together in a plan presented to peers.

- Suggested activity: Interpreting a short-circuit study for a gas processing plant switchboard.
- Suggested activity: Reviewing a mis-coordinated relay pair that tripped a power station auxiliary board.
- Suggested activity: Prioritising arc flash mitigation for a distribution substation.



Capstone Output

Each participant completes a protection and fault risk improvement plan for their own network or plant. It sets study update triggers, coordination review cycles, condition monitoring priorities, arc flash actions and an investigation procedure, ready for approval by engineering and operations leadership.

Frequently Asked Questions

Is power system fault analysis training suitable for managers who no longer set relays themselves?

Yes. It is designed for strategic leaders who commission studies and approve protection changes. It assumes an electrical engineering background but focuses on interpreting results and making decisions.

Which standards does power system fault analysis and protection coordination training rest on?

It rests on IEC 60909 for short-circuit currents, IEC 60255 for protection relays, IEEE 1584 for arc flash calculation and IEC 61850 for substation event recording.

How is the plan from protection coordination training used at work?

You can submit it to engineering and operations leadership as the basis for the next protection study, monitoring programme and electrical safety budget.