Training Content

Introductory course: Load Flow and Short Circuit Calculation

DAY 1

MODULE 1: Network Modelling

Presentation: Introduction to *PowerFactory* **1 ½ h**

Introduction to the *PowerFactory* structure and data model, graphical user interface, diagrams, users, libraries and power equipment modelling. Creating projects and grids, defining elements and types. Single line and geographical diagrams, detailed substation diagrams.

Coffee break

Exercise: Creation of a Network Model **1 ½ h**

Development of a high voltage network. Modelling of busbars, cables and overhead lines, transformers, generators and loads. Working with the graphical user interface, Data Manager and Network Model Manager. Single line diagram and detailed substation layout diagrams.

Q&A session

Lunch break

MODULE 2: Load Flow Analysis

Presentation: Load Flow Analysis **½ h**

Theoretical introduction to the Load flow calculation methods and settings. Results analysis and reporting. Result colouring in the single line diagram.

Exercise: Load Flow Analysis Part I **1 h**

Executing a load flow calculation and analysing the results. Results are analysed in the single line diagram, results tables and reports. Evaluation of overloading and voltage violations.

Coffee break

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Exercise: Load Flow Analysis Part II **1 ½ h**

Advanced load flow calculation settings. Reactive power and voltage control using synchronous generators and tap changing transformers. Reactive power limits of generators.

Q&A session

DAY 2

MODULE 3: Network Enhancement

Exercise: Network Enhancement **1 ½ h**

Expansion of an existing medium voltage network in an separate grid. Data management and diagrams for multiple grids. Defining templates.

Coffee break

MODULE 4: Short-Circuit Calculation

Presentation: Short Circuit Analysis **½ h**

Explanation and comparison of the different short circuit current calculation methods. Presentation of the application areas of short-circuit analysis for different processes such as cable dimensioning, equipment dimensioning, etc.

Exercise: Short Circuit Analysis Part I **1 h**

Three-phase short circuit calculation at various locations in the network according to IEC 60909. Evaluation of thermal and mechanical stresses with regard to the network components such as cables and busbars. Dimensioning of a circuit-breaker.

Q&A session

Lunch break

Presentation: Short Circuit Analysis with the Complete Method **½ h**

Comparison between the different calculation methods for short circuit analysis.

Exercise: Short Circuit Analysis Part II **1 h**

Short circuit analysis using the complete method and calculation of multiple faults. Exercise on dynamic voltage support.

Coffee break

Presentation: Earthing Concepts ½ h

Overview on various earthing concepts.

Exercise: Short Circuit Analysis Part III 1 h

Execution of single-phase faults in the medium-voltage network. Neutral point handling at the transformer and investigation of different earthing concepts.

Q&A session

DAY 3

MODULE 5: Connection of Grids

Exercise: Connection of Grids ½ h

Grouping of networks in different grids and diagrams, e.g. according to voltage level or regional subsystems. Connection of different grids or subsystems topologically and graphically.

MODULE 6: Network Planning

Presentation: Grid Expansion and Operational Planning 1 h

Data management including Grids, Variations and Expansion Stages for grid expansion planning. Usage of Operation Scenarios to consider different operating conditions and Study Cases for analysing the network.

Coffee break

Exercise: Grid Expansion Planning 1 ½ h

Grid expansion planning using Variation and Expansion Stages on the basis of the basic network. Defining time dependent network changes in variations and expansion stages. Comparison of network variations.

Q&A session

Lunch break

Exercise: Operational Planning ½ h

Defining Operation Scenarios in *PowerFactory* for various load and generation conditions and switching states in the grid.

Exercise: Network Analysis 1 h

Analysis of the network with the help of the defined operation scenarios at different points in time in the previously prepared network expansion planning. Use of study cases to combine active operation scenarios, variations and grids for a convenient analysis of different possible scenarios.

Coffee break

MODULE 7: Load Scaling

Exercise: Feeders **½ h**

Defining feeders. Feeder load flow analysis using Load Scaling and Voltage Profile Diagrams.

Exercise: Load Scaling **½ h**

Extended network analysis. Use of feeder load scaling to be able to represent operating states based on real measurements.

MODULE 8: Additional Information

Presentation: Additional Information **½ h**

Additional information on the base package. Tips & Tricks for working with *PowerFactory*.

Q&A session

Time Schedule (Central European Time)

	Time
First 90 minutes block	9:00
Coffee break	10:30
Second 90 minutes block	10:45
Q&A session	12:15
Lunch break	12:30
Third 90 minutes block	13:30
Coffee break	15:00
Fourth 90 minutes block	15:15
Q&A session	16:45
End of the training day	17:00

DIgSILENT GmbH
Heinrich-Hertz-Str. 9
72810 Gomaringen
Germany

T +49 7072 9186-0
F +49 7072 9168-88
mail@digsilent.de

www.digsilent.de