



POWERFACTORY

Course Content

Digsilent Buyisa (Pty) Ltd

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

PowerFactory Basic

3 Day Course

Objective:

This training gives the participants an introduction to the handling and basic calculation functions of PowerFactory.

To provide a thorough and comprehensive introduction to the basic features of PowerFactory software. The topics Data management, loadflow studies, short circuit calculations, variations, operation scenarios and basic reporting will be covered.

Pre-requisites:

- A good working knowledge of how to operate Windows, Windows Explorer and any normal Windows program (e.g. Word).
- A basic mathematical understanding of loadflow studies and fault calculations.
- Background experience through the use of DigSILENT PowerFactory - this will greatly enhance the participants absorption of the course material. This experience may be acquired by performing the Tutorial Exercises that are found under, Help -> Tutorial, in PowerFactory.

No of participants:

In-house at Customer premises: Minimum: 6; Maximum: 12.

At Digsilent Buyisa Training Centre: Minimum: 10; Maximum 16

Online: Minimum 6; Maximum x12

ECSA CPD Accredited and Points:

- The course is fully accredited with the Engineering Council of South Africa (ECSA).
- 3 points for completion.

Who Should Attend:

The course is intended for

- Utility engineers
- Power system operators
- Project Developers
- Manufacturers
- Consultants and electrical engineers



POWERFACTORY

Whilst no experience with the program is required, it is assumed that the participant is familiar with the network modelling fundamentals and power system analysis methods.

PRICE PER PARTICIPANT:

- For course pricing, kindly visit our website at: <https://digsilent.co.za/training-courses/>
 - For in house prices @ customer premises: contact Digsilent for a quote
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- ❖ Prices are exclusive of VAT
 - ❖ Please note that cost excludes your Company's internal administrative costs.
 - ❖ All prices may change without prior notice - please contact Digsilent Buyisa for the latest prices before booking.
 - ❖ **DISCOUNT** is offered if a company sends more than one delegate per course.
 - ❖ Trainings held at Digsilent Buyisa Training Centre includes light breakfast snack, lunch refreshments.

Training schedule

DAY 1

- 08:30 Introduction to DigSILENT and PowerFactory**
Introduction to DigSILENT company and products. Structure and operation principles of DigSILENT PowerFactory operation. Overview of main functionality. Project management; starting a project from scratch. Creating projects and grids, defining elements and types.
- 09:30 Exercise 1: Graphically modelling a simplified network.**
Building and energising a graphical representation of a network which consists of busbars, transformers, lines, loads, a capacitor, and a motor. This is followed by adding the equipment electrical data to the network, such as rated voltages, powers, cable lengths etc. Lastly, a network data assessment is executed to verify the topology and the input parameters, followed by a load flow to check the cable loading and voltages at the busbars.
- 10:30 Tea/Coffee break**
- 11:00 Creating a Network Model**
Introduction to the *PowerFactory* structure and data model, graphical user interface, diagrams, users, libraries and power equipment modelling.
- 11:30 Exercise 2: Creating Networks Using Standard Substations**
Development of a medium voltage (MV) network. Utilising the default Composite and Single Line Representation of Substations. Modelling of busbars, cables and overhead lines, generators and loads from the Drawing Toolbox. Working with the graphical user interface.
- 12:30 Lunch break**
- 13:30 Exercise 3: Creating User-Defined Substations**
Creating detailed Substations using provided SLDs.
- 14:30 Network Diagrams**
Graphical representation of different type of possible diagrams in PowerFactory, Overview, Single Line, Substation and Geographic. General diagram functions, introduction of function dependent Diagram Colouring, Graphic Layers and the Diagram Layout Tool.



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15:00 **Tea/Coffee break**

15:30 **Exercise 4: Adding User-defined substations to overview /single line graphics and interconnecting substations.**

Using the Diagram Layout tool, substations created in Exercise 3 are now added to the MV Network Overview diagram. Thereafter, the transmission lines are connected between the Substations. Using Copy and Paste is demonstrated as well as optionally adding geographic coordinates to Substations and Lines and using the Redraw option to accurately trace an OHL route on the geographic diagram using OpenStreetMap Layer.

16:30 **End of the first day**

DAY 2

08:30 **Pre-calculation Network data assessment**

Introduction to PowerFactory's data verification process in which certain checks are performed, such as whether a line is connected between nodes of the same voltage, and the correct voltage orientation of transformers, etc. Interpretation of error messages to debug the user data.

09:00 **Load Flow Analysis**

Theoretical introduction to the Load flow calculation methods and settings. Reactive power and voltage control using synchronous generators and tap changing transformers. Reactive power limits of generators.

09:30 **Exercise 5: Load Flow Calculations**

Setting up of automatic tap changing of transformers and shunts and applying reactive power limits to synchronous and static generators. Executing a load flow calculation and how to enable and disable automatic tap adjust and reactive power limits in the calculation. How to interpret messages of load flow calculation in Output Window.

10:30 **Tea/Coffee break**

11:00 **Short Circuit Analysis**

Explanation and comparison of the different short circuit current calculation methods available in PowerFactory.

11:15 **Exercise 6: Short Circuit Calculations**



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Performing fault calculations; single bus fault, all busses faulted, multiple faults, faults on lines and different fault types. Exploring the different results obtained with the different available short circuit methods in PowerFactory.

11:45 Using Multiple Grids in PowerFactory

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.

Using Paste and Paste Graphic Only Concepts

Demonstrating the difference between paste and paste graphic only. Lastly, delete and delete graphic only.

12:30 Lunch break

13:30 Exercise 7: Building MV Network Exercise 7.1 and 7.2

Modelling a medium voltage (MV) network in a new grid and utilising the Paste Graphic Only option. Adding electrical data to the MV network, cable information, load data, and creating a new cable type using a manufacture datasheet.

15:00 Coffee break

15:30 Exercise 7.3 and 7.4

Creating a new substation and using the Diagram Layout tool to represent the substation in a new diagram. Lastly, interconnecting two substations modelled in two separate grids using the Paste Graphically Only diagram concept.

16:30 End of the second day

DAY 3

08:30 Displaying Results

Theoretical introduction to the results analysis and reporting. Result colouring in the single line diagram. Introduction to the Network Model Manager window and how to select Flexible Data parameters. Exporting of pictures and reports and tables. Configuration of results boxes to suit the user's needs.



POWERFACTORY

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| 09:30 | Exercise 8: Getting Out Results
Load flow and Short Circuit calculations are performed and results are analysed in the single line diagram, results tables and reports. |
| 10:30 | Tea/Coffee break |
| 11:00 | Operation Planning and Management
Usage of Operation Scenarios to consider different operating conditions. Explanation of the properties of an Operation Scenario and its functionality. |
| 11:30 | Exercise 9: Operation Scenarios
Defining Operation Scenarios in PowerFactory for various load and generation conditions and switching states in the grid. Introduction to the scenario scheduler and comparison of scenarios. |
| 12:30 | Lunch break |
| 13:30 | Network Planning and Grid Expansion
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. Introduction to the permanent diagram concept. |
| 14:00 | Exercise 10: Variations and Expansion Stages
Modelling of time dependent variations by means of Expansion Stages in order to perform load flow studies for network planning and expansion. Executing a load flow calculation and analysing the results. |
| 15:00 | Tea/Coffee break |
| 15:30 | Study Cases
Introduction to the use of Study Cases in PowerFactory and their advantage in easily reproducing results. Utilising the comparing of results function to compare results between different Study Cases. |
| | Exercise 11: Study Cases
Use of study cases to combine active operation scenarios, variations and grids for a convenient analysis of different possible scenarios. Setup various cases and compare results. |
| 16:30 | End of the third day |