AC Network

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ETAP Overview

- One-Line Diagram
- Toolbar Format
- Dumpster
- Project View
- Project Toolbar
- Mode Toolbar
- System Toolbar
- Study Case Toolbar
- Message Log

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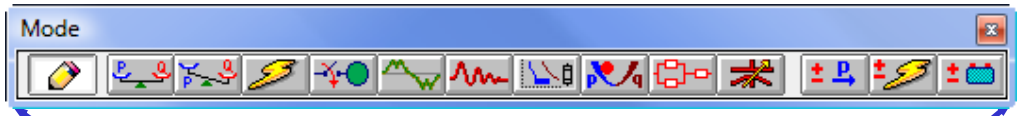
Select Mode
Edit Mode: Drag/Drop & Connect Elements
Study Mode: Load Flow, Short-Circuit, … etc.



Project View

System Toolbar

One-Line Diagram
In Edit Mode

Help Line
Displays the description for every entry field.

Edit Toolbar
AC Elements
DC Elements
Instrument
Devices

Message Logger
View the latest messages related to ETAP Projects.
It can be expanded or reduced.

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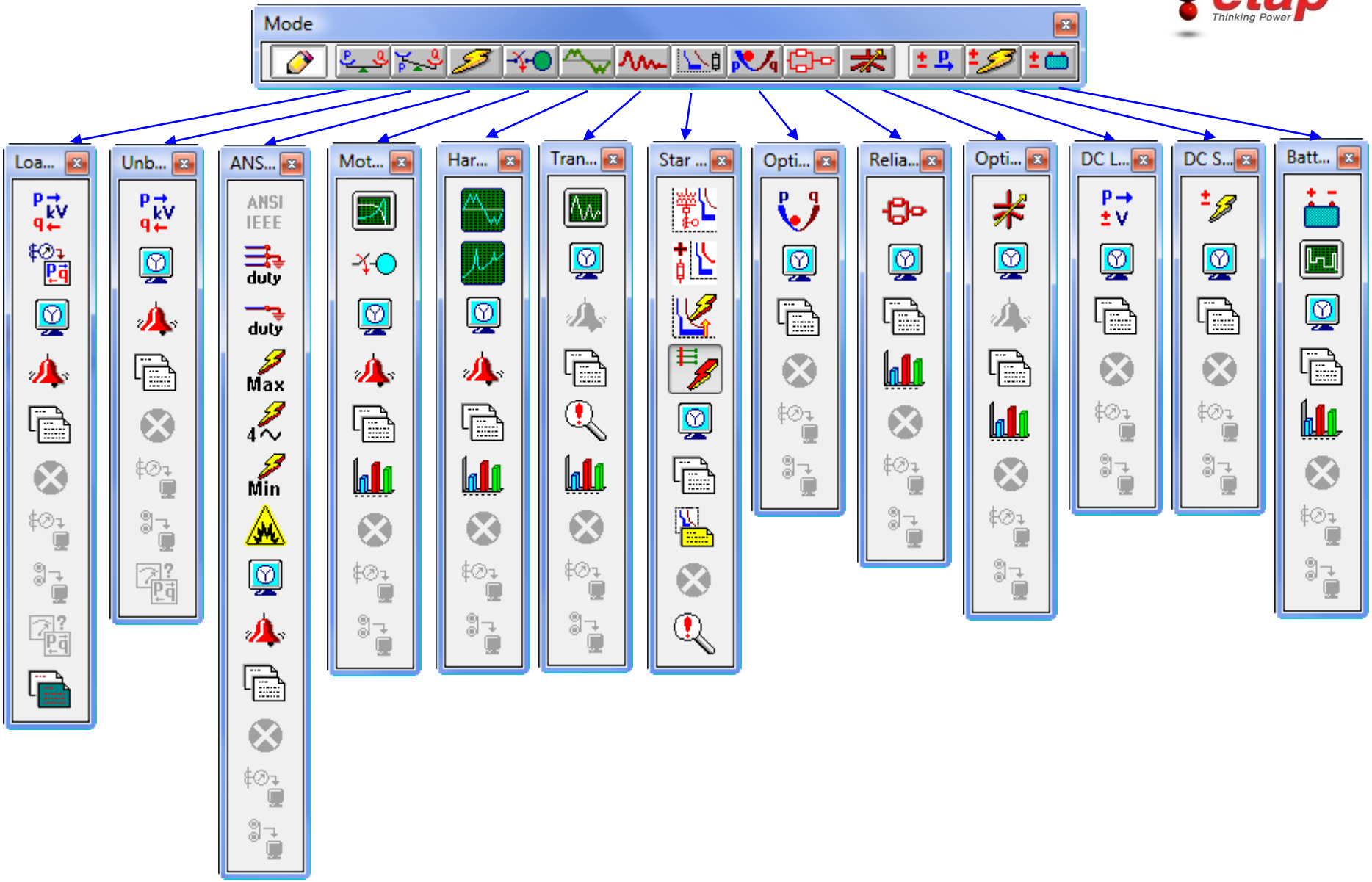
Mode Toolbar Format



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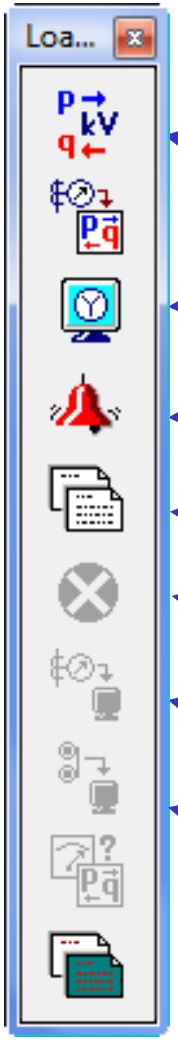
Analysis Toolbar Format

Analysis toolbars have the following sections:



1. **Run the Calculation**
2. **Display Options**
3. **Display Alerts**
4. **View the Generated Reports**
5. **Stop the Calculation**
6. **Get On-Line Data**
7. **Get Archived Data**

All ETAP analysis toolbars follow this general format.

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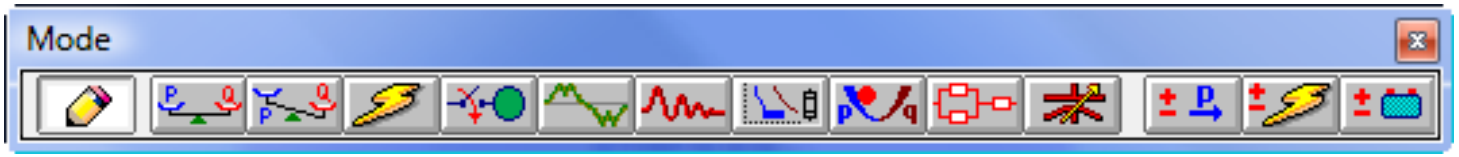
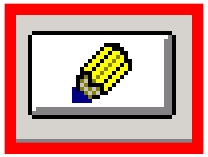
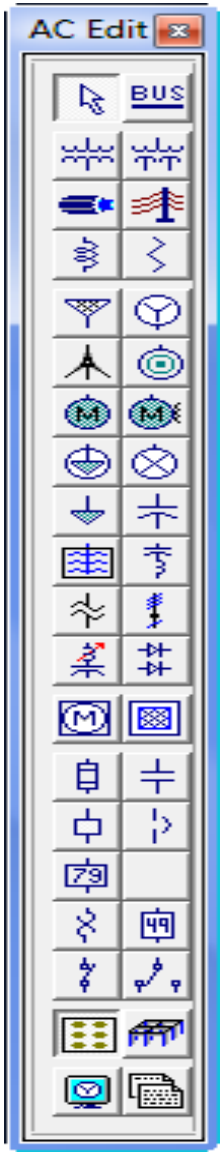


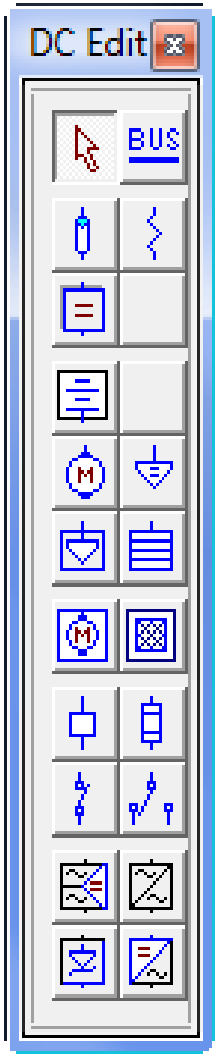


Pointer
2W XFMR
Cable
Reactor
Power Grid
Wind Turbine Gen
Induction Machine
Lumped Load
Static Load
Panels
Remote Connector
SVC
Composite Motor
Fuse
HVCB
Recloser
Overload Heater
SPST
Instrumentation
Display Options



Bus
3W XFMR
Trans. Line
Impedance
Generator
MG Set
Synch. Motor
MOV
Capacitor
Harmonic Filter
Phase Adapter
HVDC
Composite Network
Contactor
LVCB

In-Line Overload Relay
SPDT
Ground Grid
Schedule Report Manager



Pointer
Cable
Converter
Battery
Motor
Lumped Load
Composite
Motor
CB
SPST
UPS
Charger

Bus
Impedance

Static Load
Elementary Diagram
Composite Network

Fuse
SPDT
VFD
Inverter

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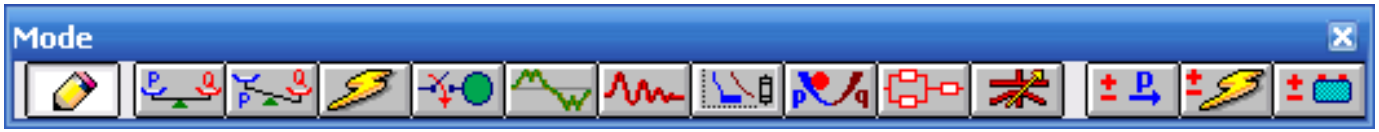
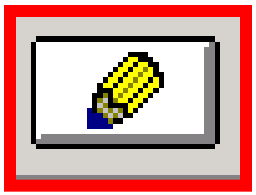
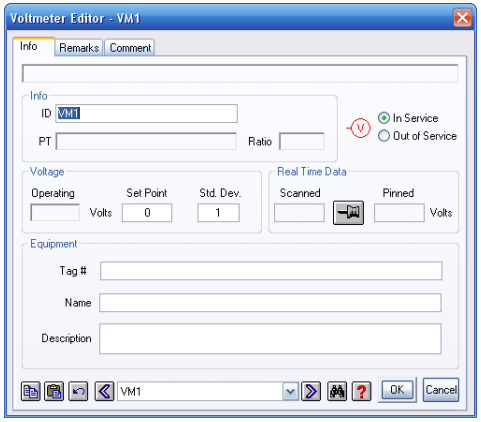
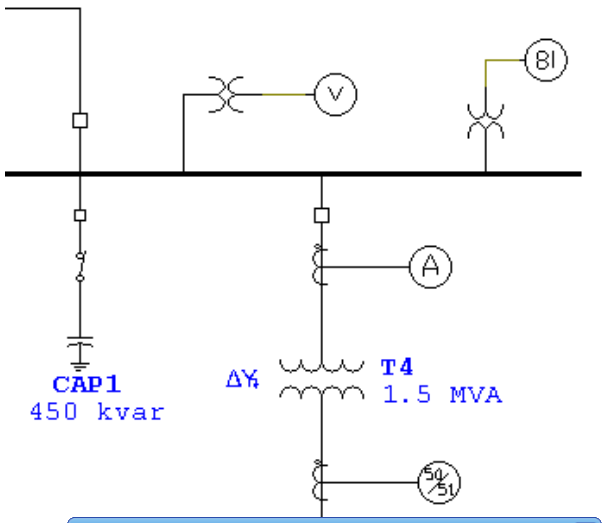
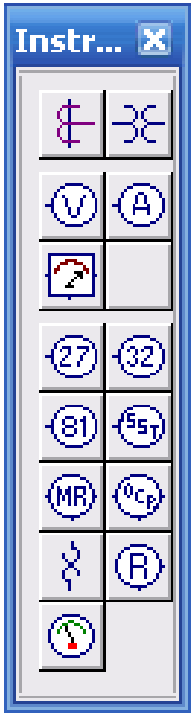










Current Transformer

Potential Transformer

Voltmeter

Ammeter

Multimeter

Voltage Relay 27 / 59

Reverse Power Relay

Frequency Relay 81

Solid State Trip Relay

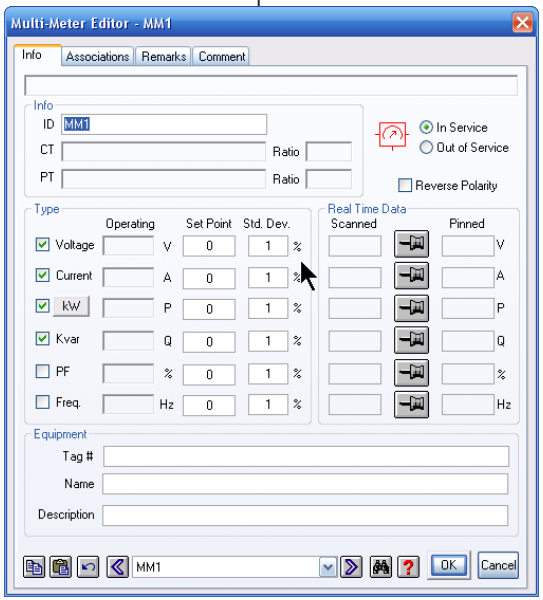
Motor Relay

Overcurrent Relay 50/51/67

Overload Heater

Multi Function Relay

Taglink



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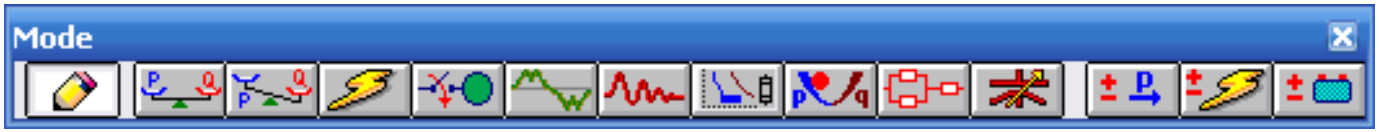
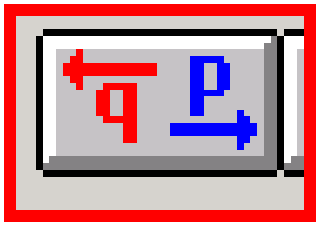




Run Load Flow Calculation

RCAS

Display Options

Load Flow Alerts

Load Flow Report Manager

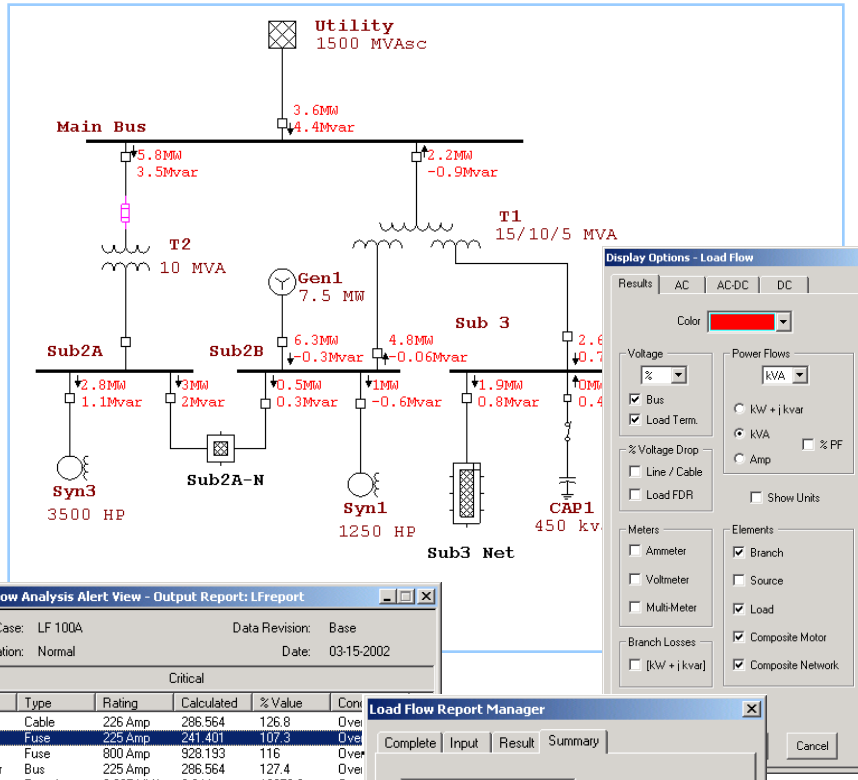
Stop Calculation

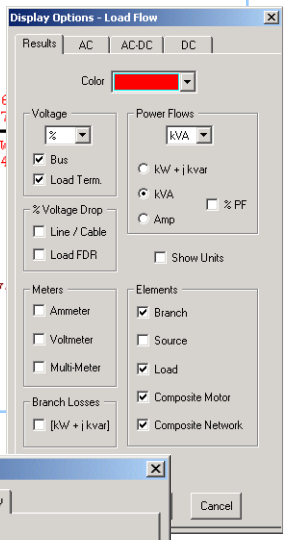
Get On-Line Data

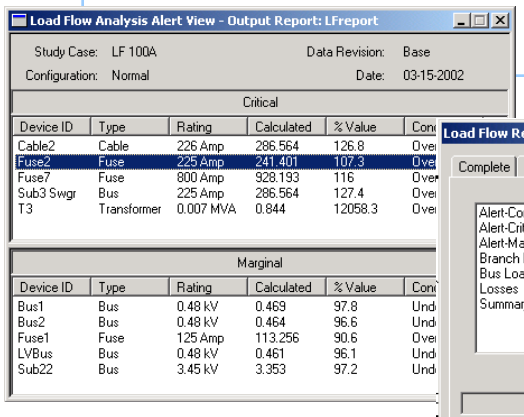
Get Archived Data

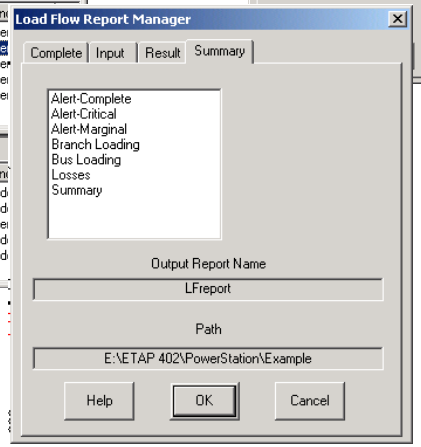
Load Flow Comparator

Load Flow Result Analyzer









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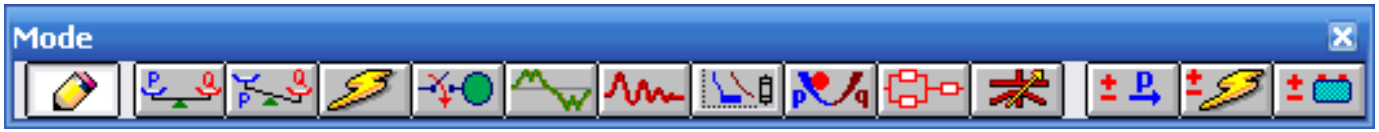
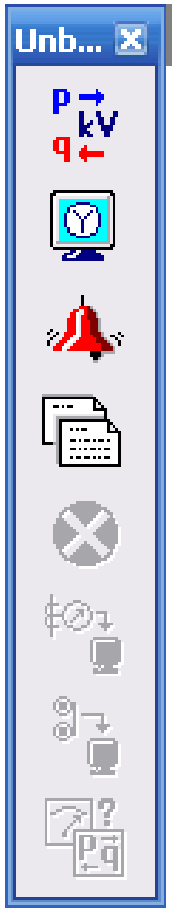




Run Unbalanced Load Flow

Display Options

Load Flow Alerts

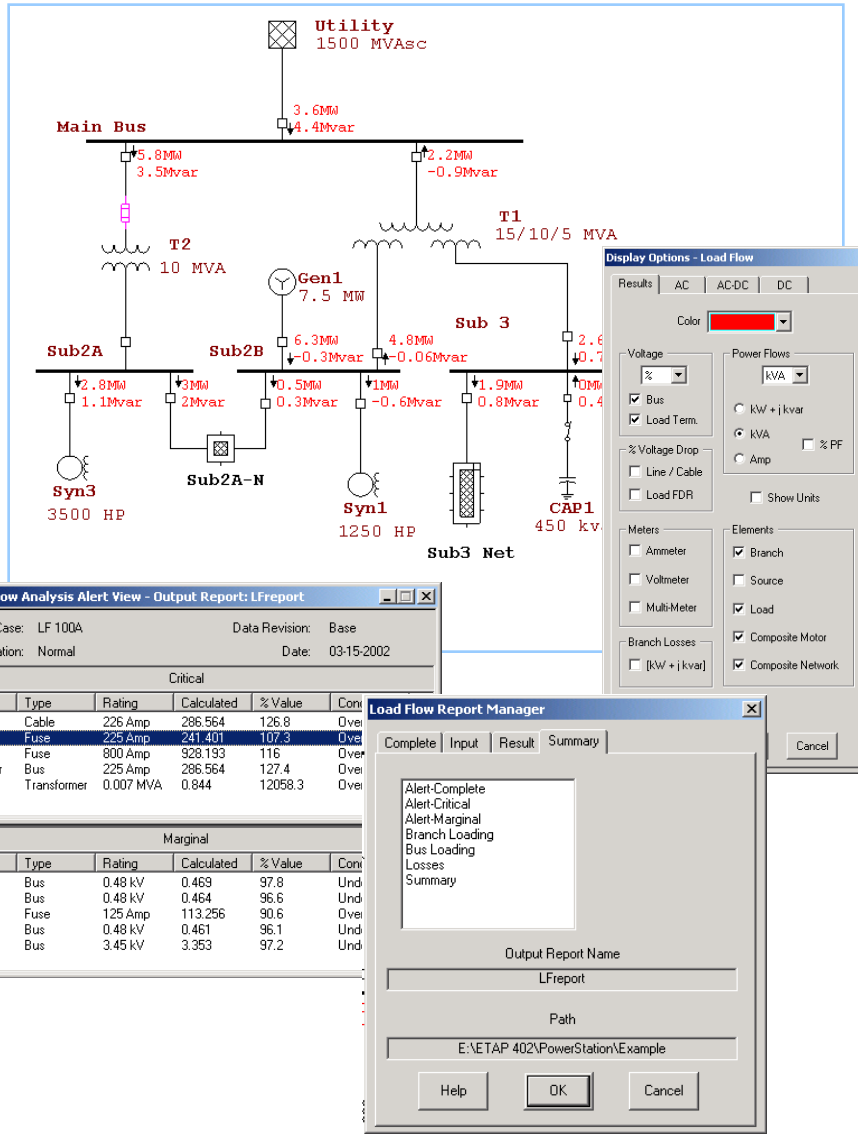
Load Flow Report Manager

Stop Calculation

Get On-Line Data

Get Archived Data

Load Flow Comparator



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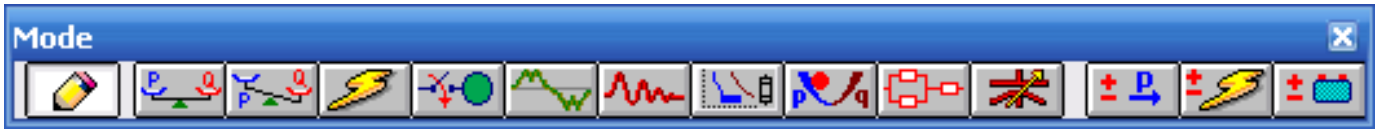
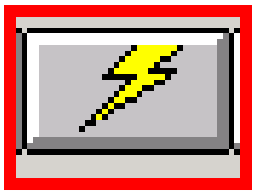




3-Phase SC Duty Calculation

1-Phase SC Duty Calculation

½ Cycle Unbalanced LG, LL, LLG & 3-Phase

½ to 4 Cycle Unbalanced LG, LL, LLG & 3-Phase

30 Cycle Unbalanced LG, LL, LLG & 3-Phase

Arc Flash Analysis (NFPA 70E & IEEE 1584)

Short-Circuit Display Options

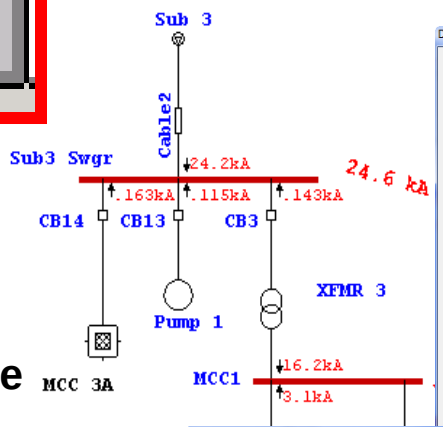
Short-Circuit Alerts for Buses & PDs

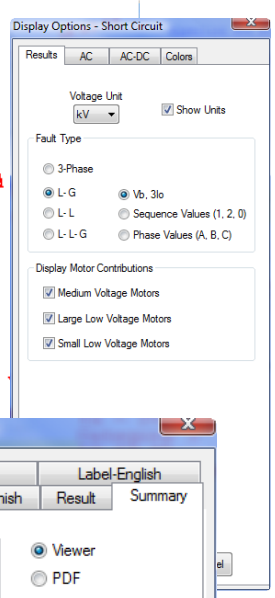
Short-Circuit Report Manager

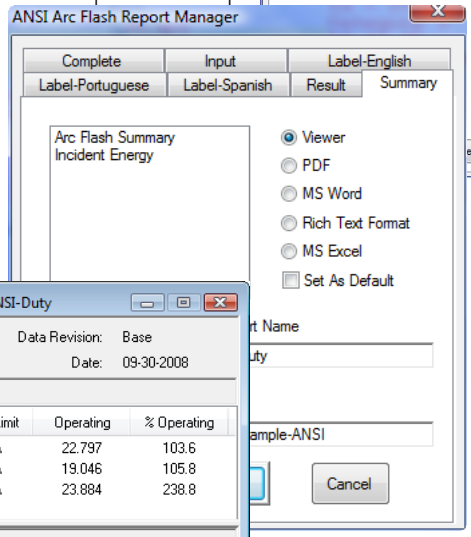
Stop Calculation

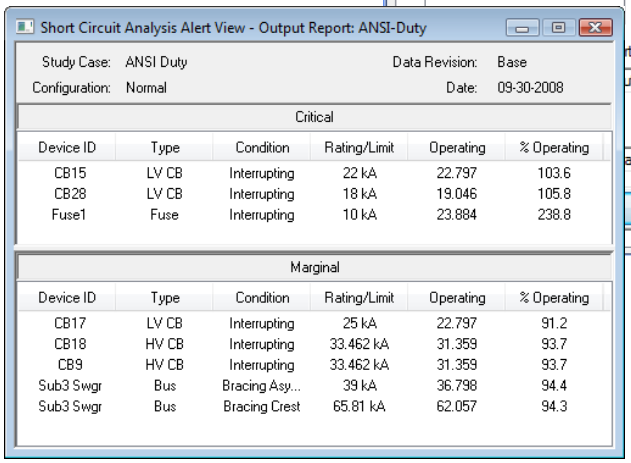
Get On-Line Data

Get Archived Data









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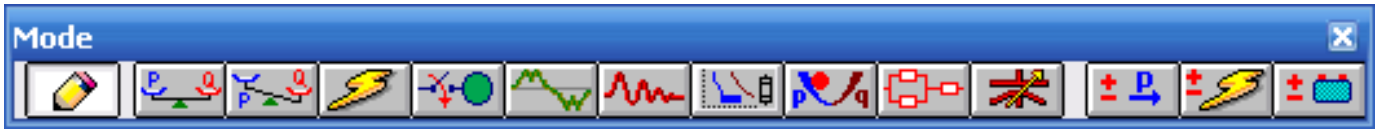
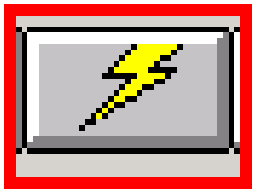
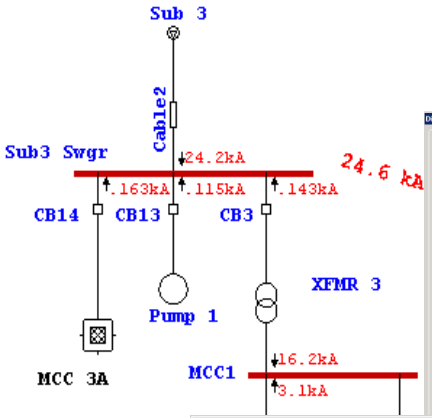
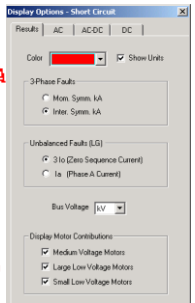
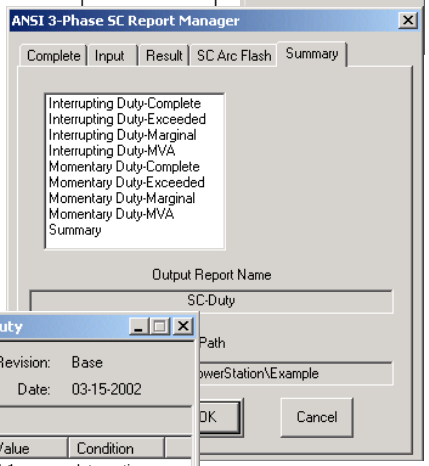


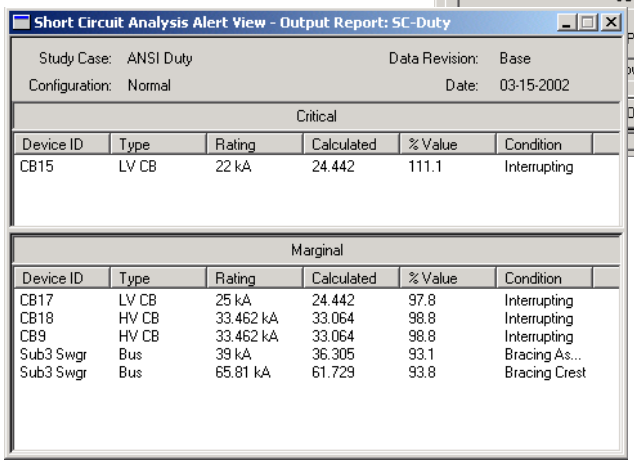


- 3-Phase SC IEC Duty Calculation
- 1-Phase SC IEC Duty Calculation
- 909 Unbalanced LG, LL, LLG & 3-Phase
- Transient IEC 363
- Arc Flash Analysis (NFPA 70E & IEEE 1584)
- Short-Circuit Display Options
- Short-Circuit Alerts for Buses & PDs
- Short-Circuit Report Manager
- IEC 363 Plots / Export COMTRADE
- Stop SC Calculations
- Get On-Line Data
- Get Archived Data









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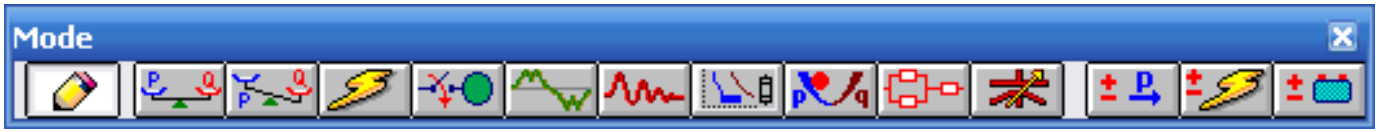
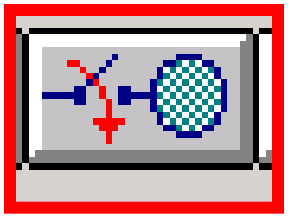
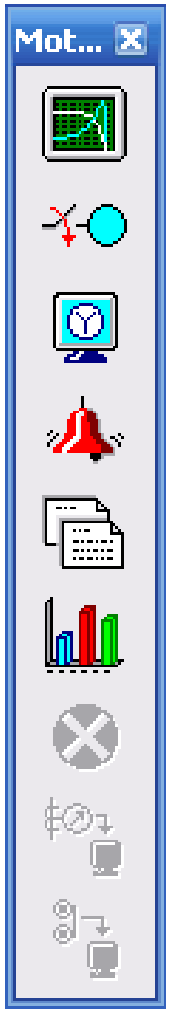






Run Dynamic Motor Acceleration

Run Static Motor Starting

Motor Starting Display Options

Motor Starting Alerts

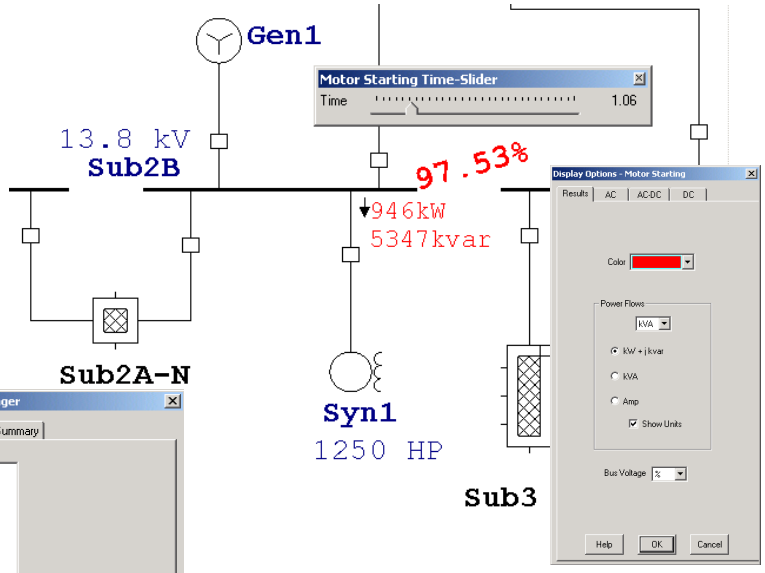
Motor Starting Report Manager

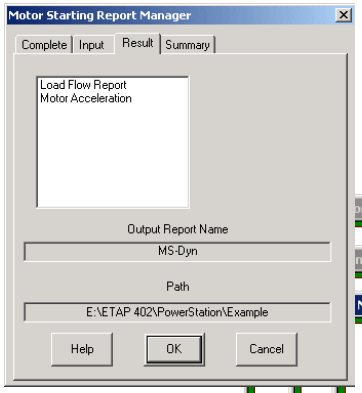
Motor Starting Plot Options

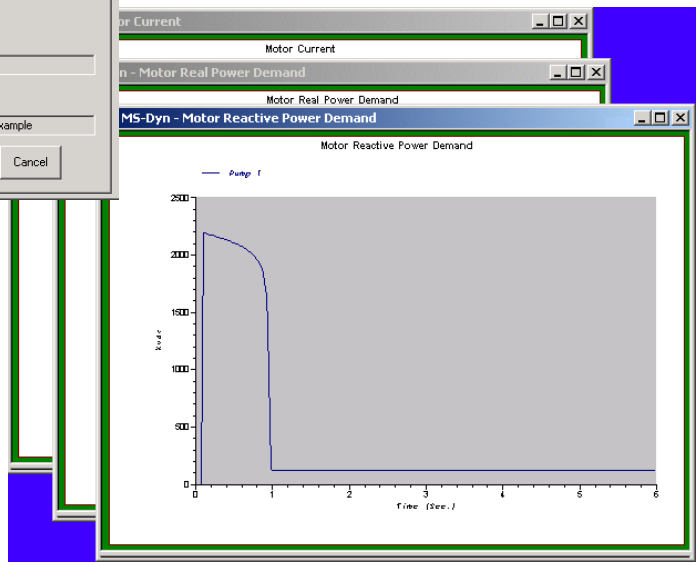
Stop Motor Starting Calculation

Get On-Line Data

Get Archived Data







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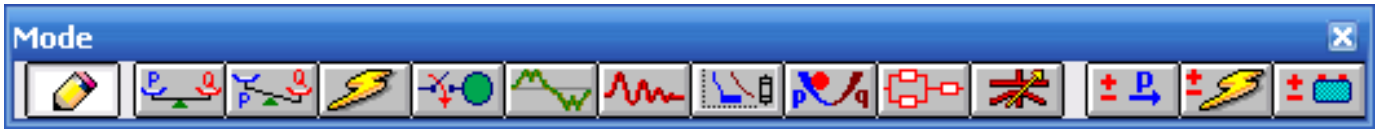
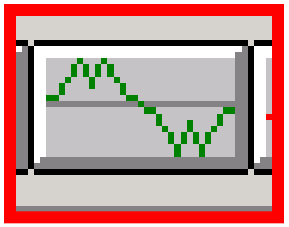




Run Harmonic Load Flow Calculation

Run Frequency Scan

Harmonic Analysis Display Options

Harmonic Analysis Alerts

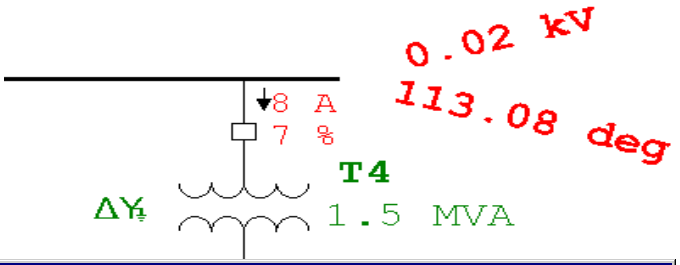
Harmonic Analysis Report Manager

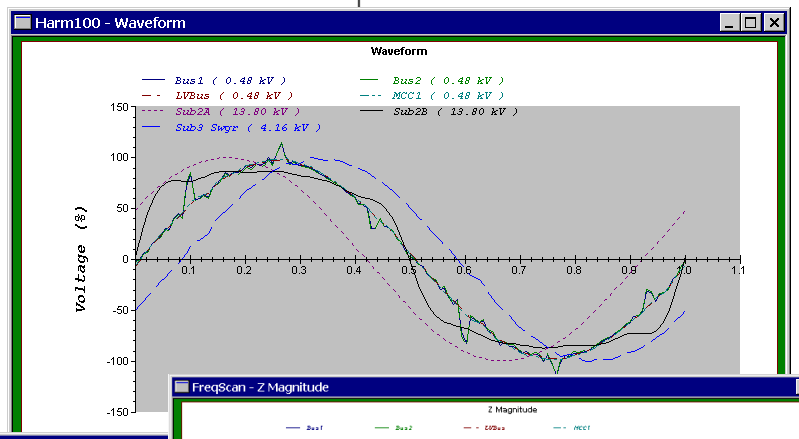
Harmonic Analysis Plots

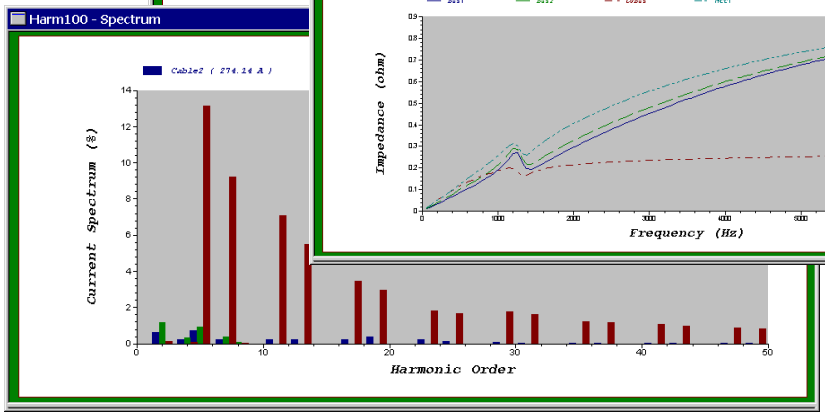
Stop HA Calculation

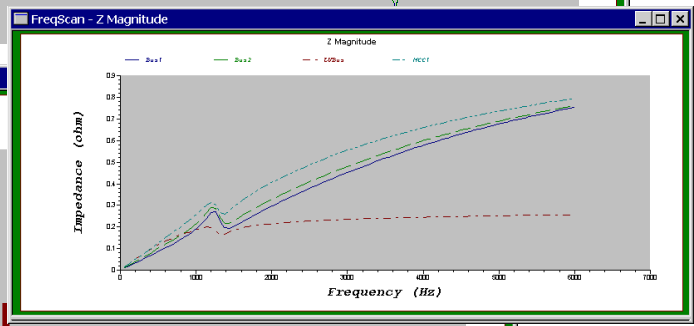
Get On-Line Data

Get Archived Data









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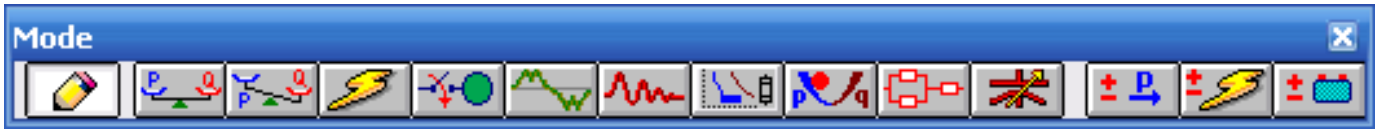
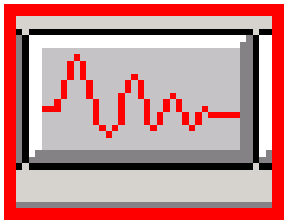




Run Transient Stability Calculation

TS Display Options

TS Alerts (Future)

TS Report Manager

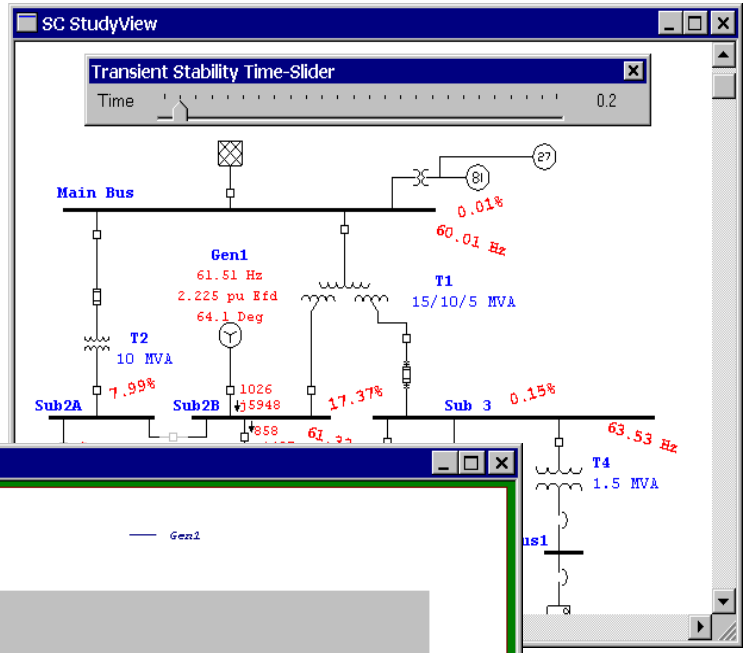
TS Action List

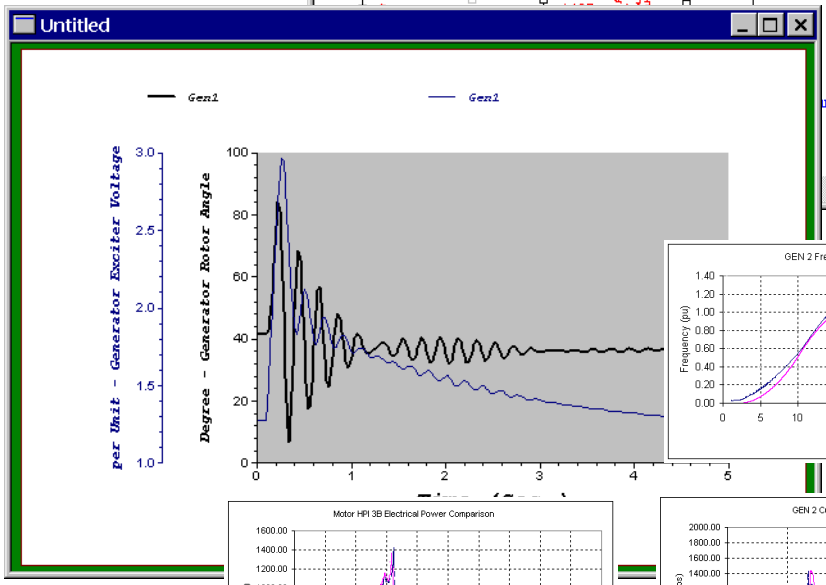
Transient Stability Plots

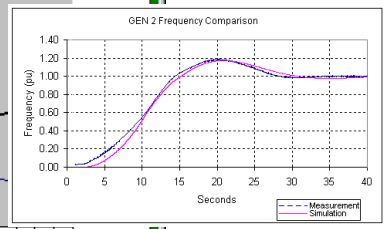
Stop TS Calculation

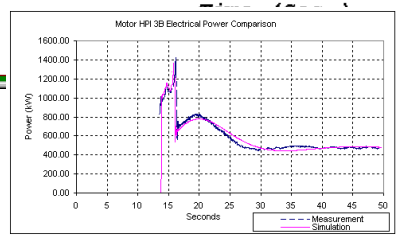
Get On-Line Data

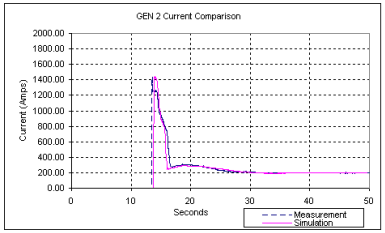
Get Archived Data











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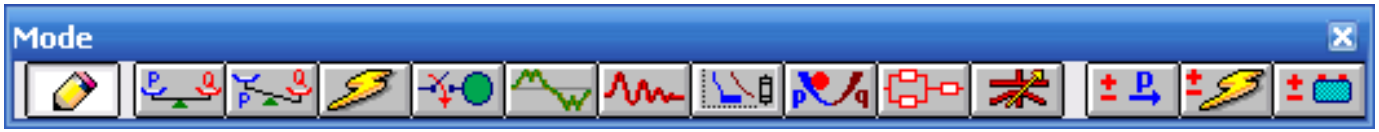
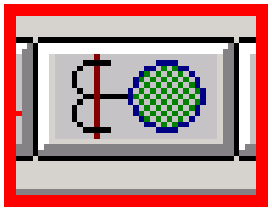
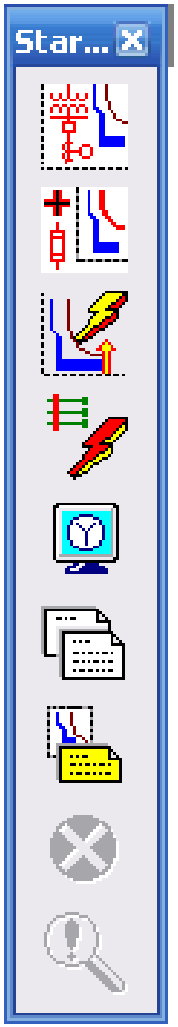






Create STAR View

Append to STAR View

Run / Update SC Clipping kA

Sequence of Operation

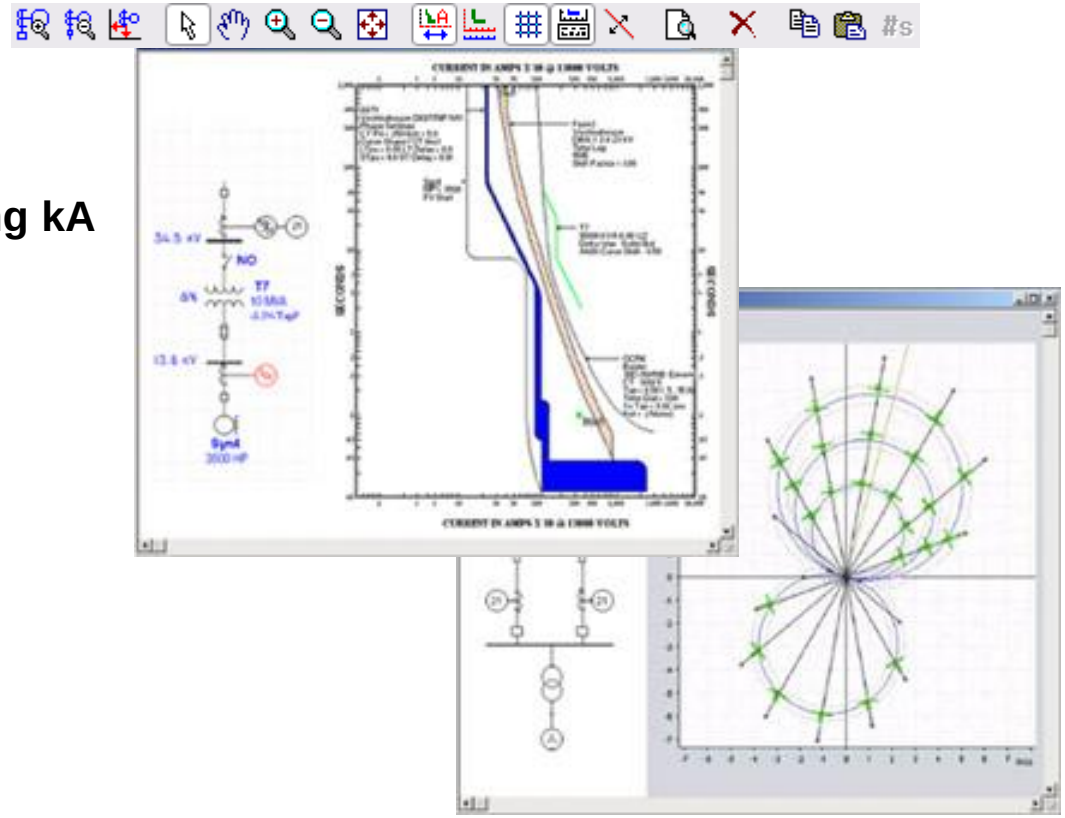
Display Options

Report Manager

Device Settings Report

Stop Calculation

Sequence Viewer



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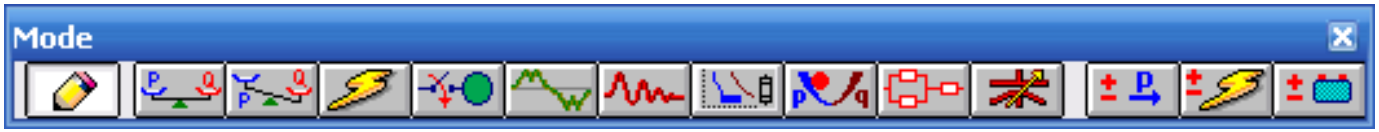
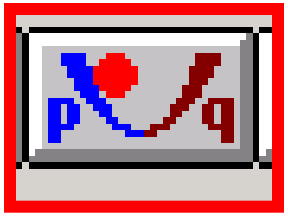
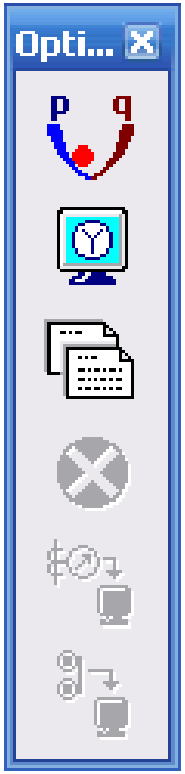






Run Optimal Power Flow

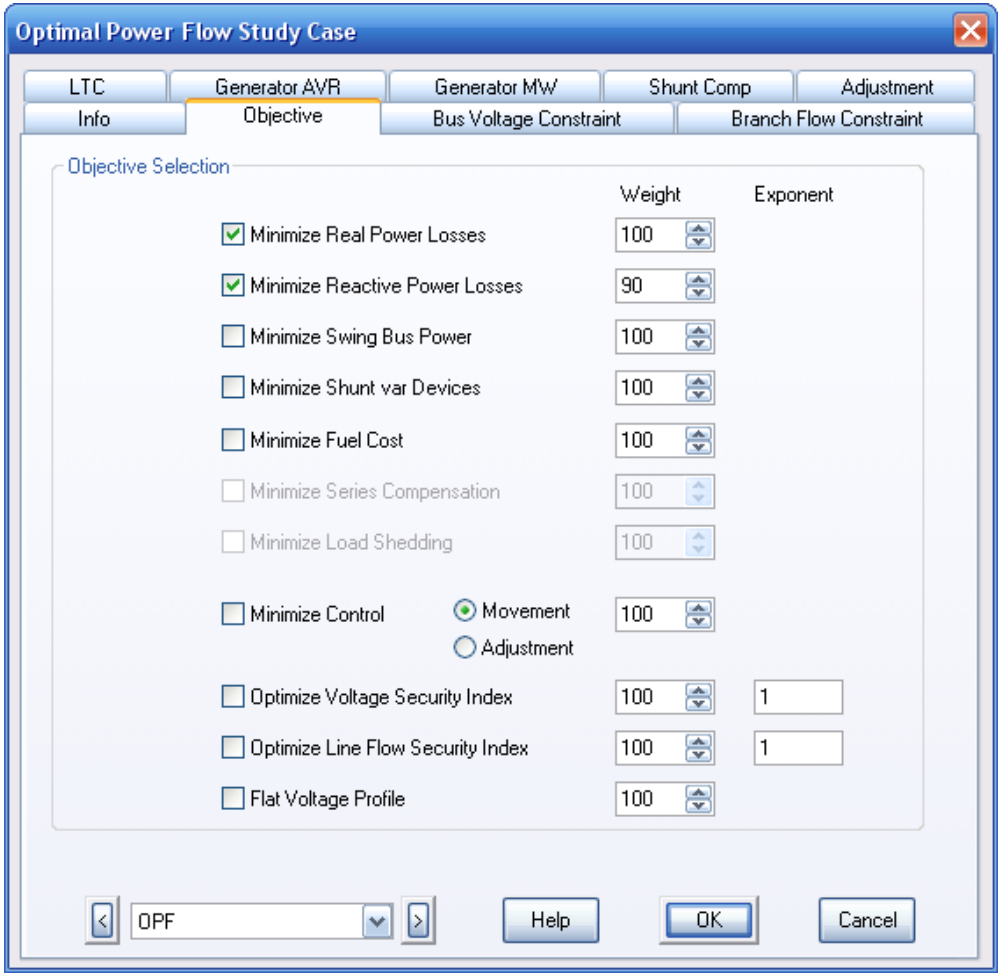
OPF Display Options

OPF Report Manager

Stop OPF Calculation

Get On-Line Data

Get Archived Data



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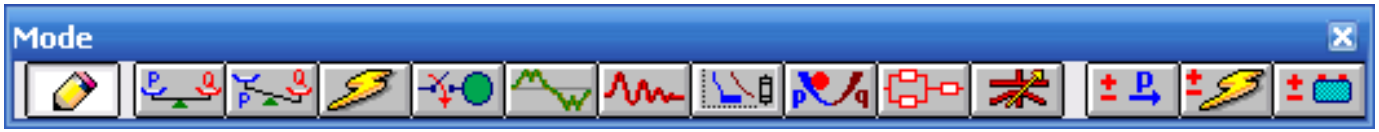
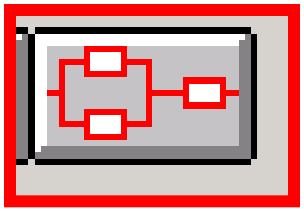
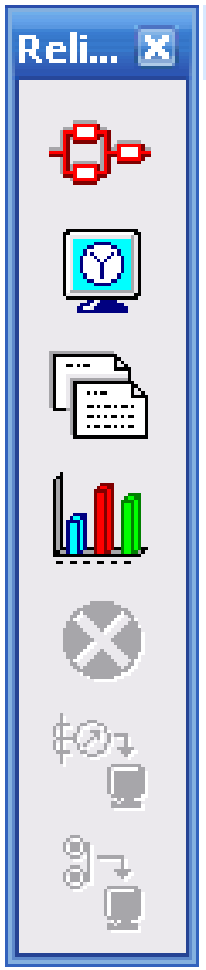






Run Reliability Assessment Calculation

RA Display Options

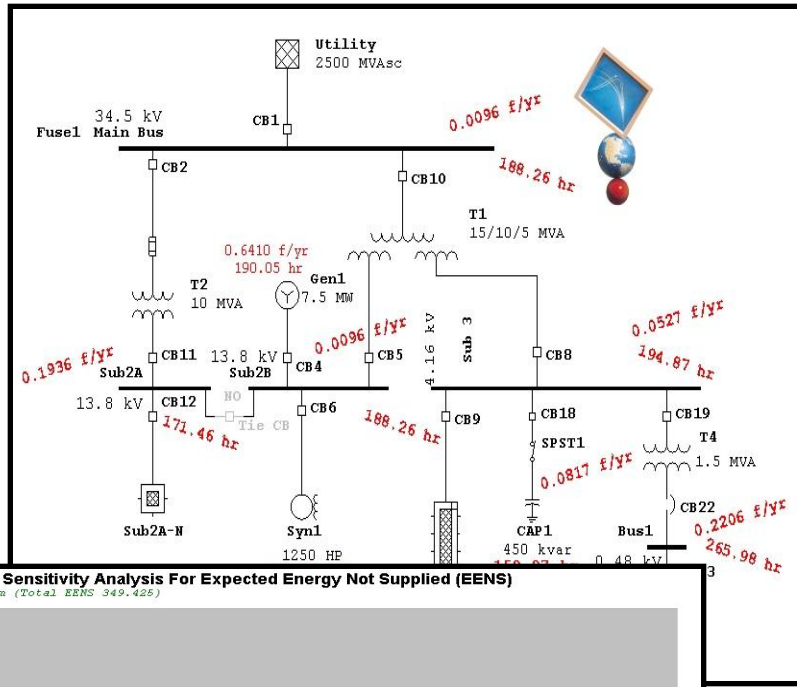
RA Report Manager

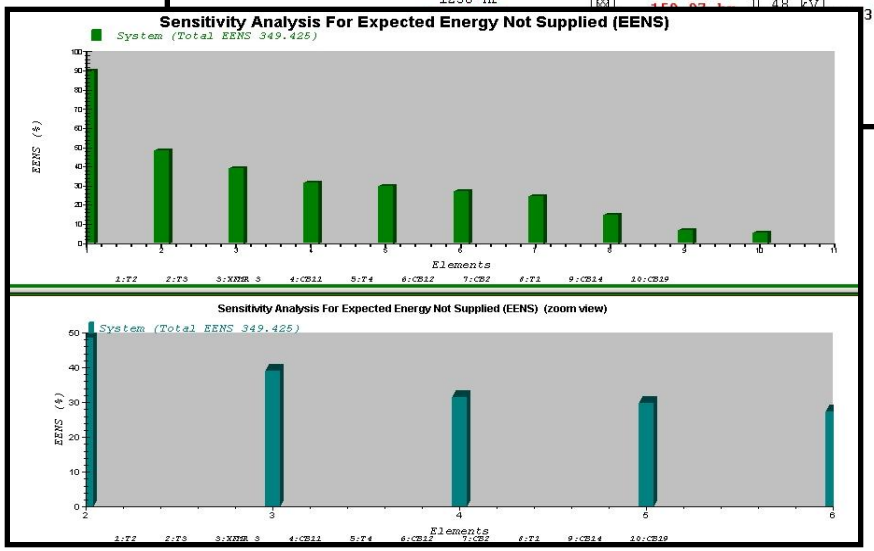
RA Plots

Stop RA Calculation

Get On-Line Data

Get Archived Data





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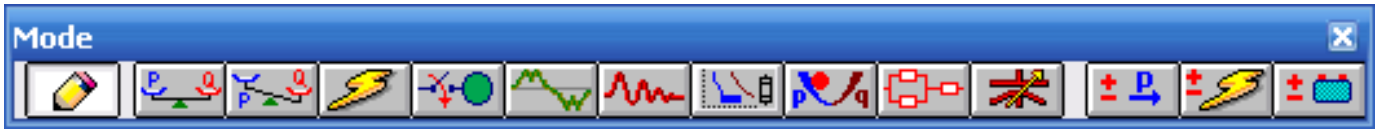
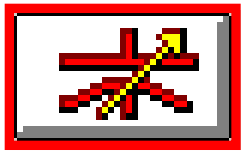
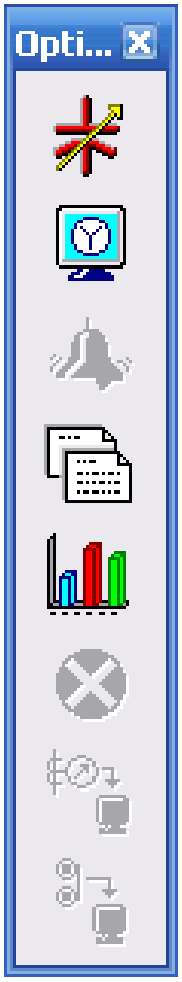






Run Optimal Capacitor Placement

OCP Display Options

OCP Alerts

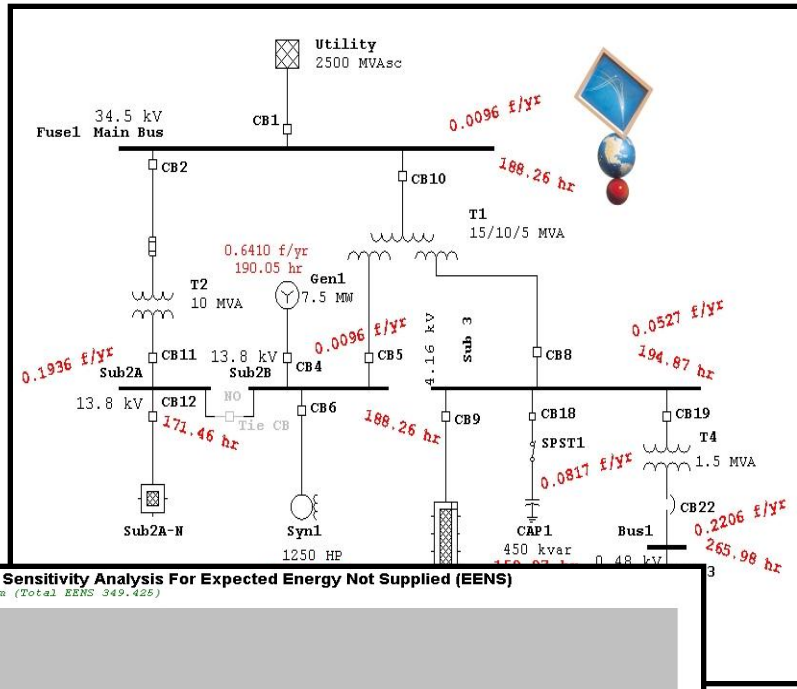
OCP Report Manager

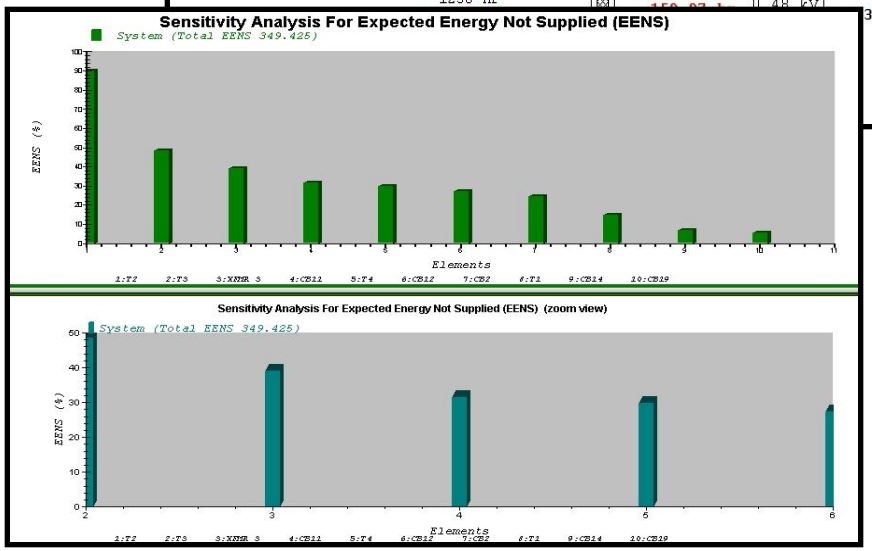
OCP Plots

Stop OCP Calculation

Get On-Line Data

Get Archived Data





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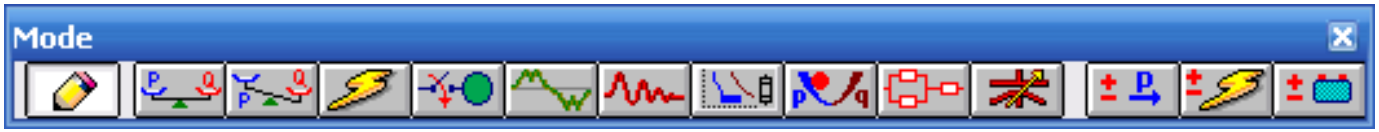
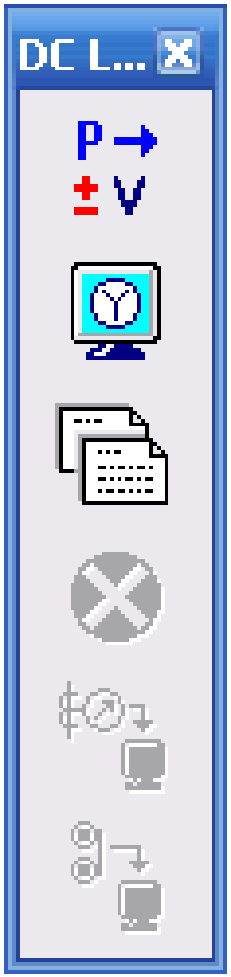




Run DC Load Flow Calculation

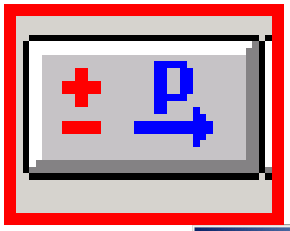
DCLF Display Options

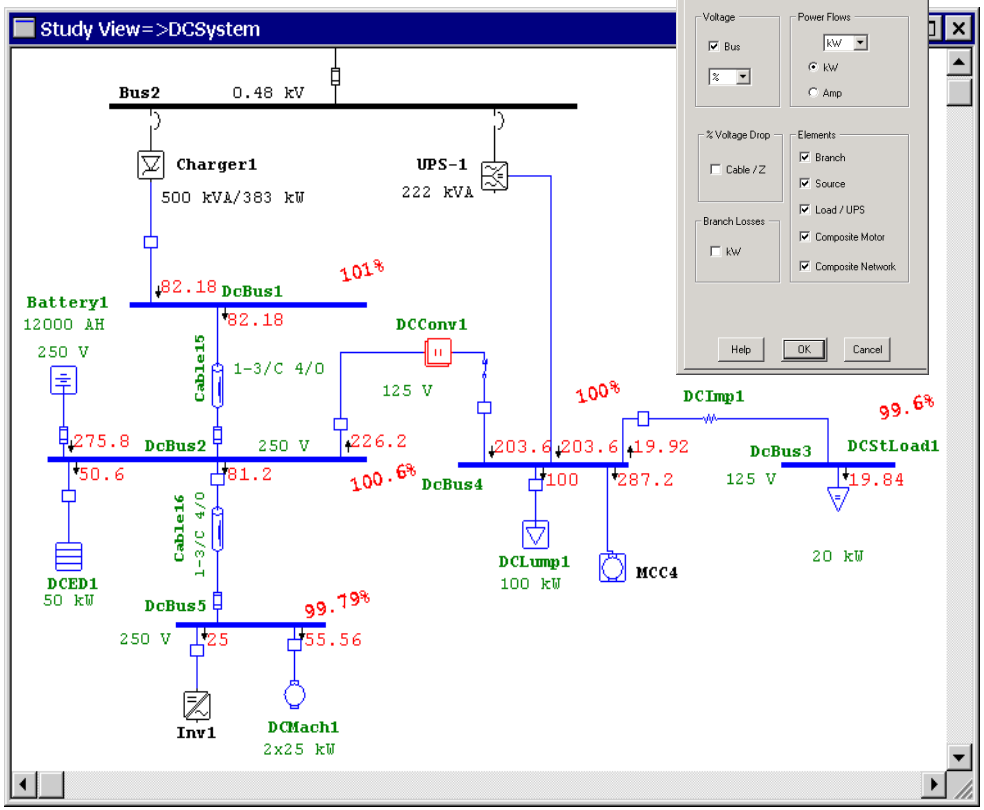
DCLF Report Manager

Stop DCLF Calculation

Get On-Line Data

Get Archived Data





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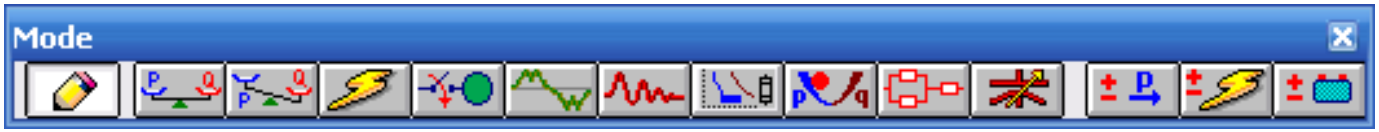
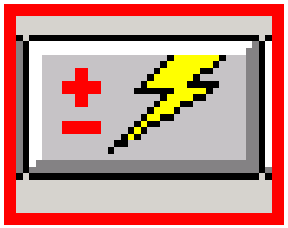
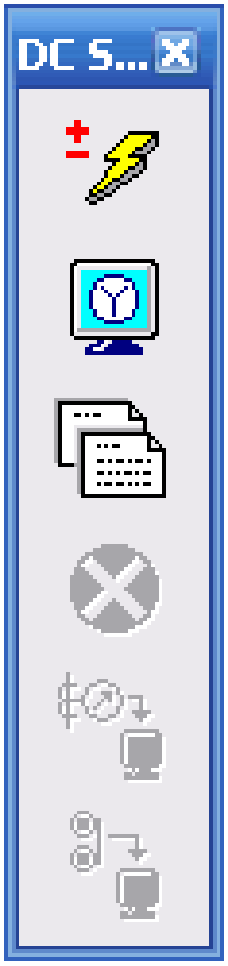






Run DC Short-Circuit Calculation

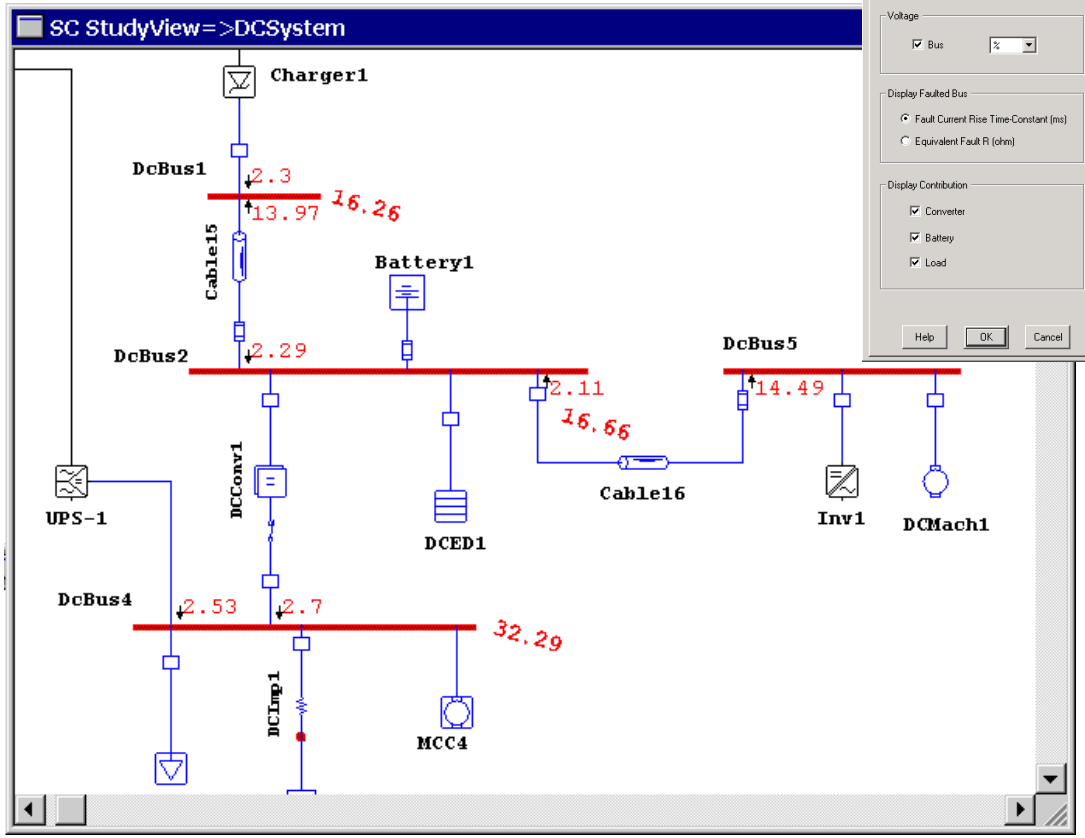
DCSC Display Options

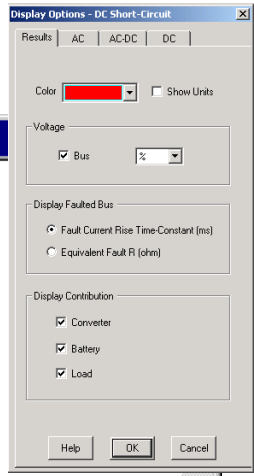
DCSC Report Manager

Stop DCSC Calculation

Get On-Line Data

Get Archived Data





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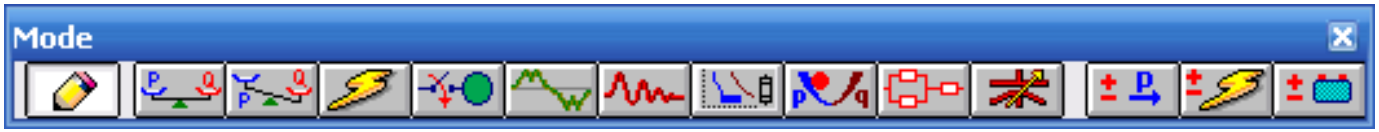
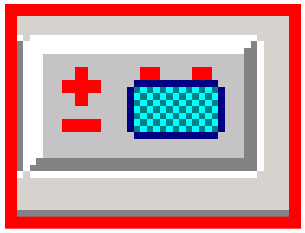
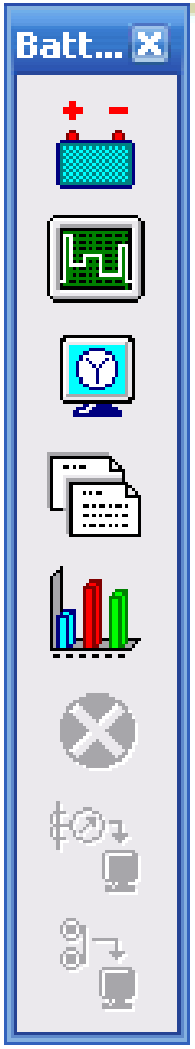






Run Battery Sizing

Run Battery Discharge

Battery Size / Discharge Display Options

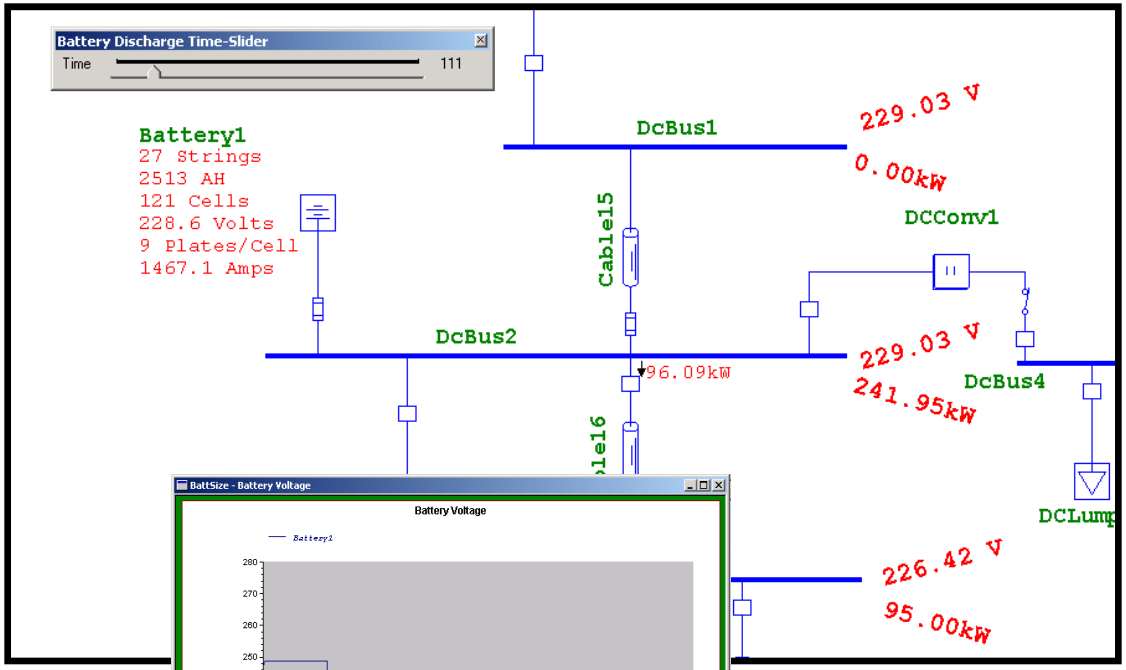
DCBS / DCBD Report Manager

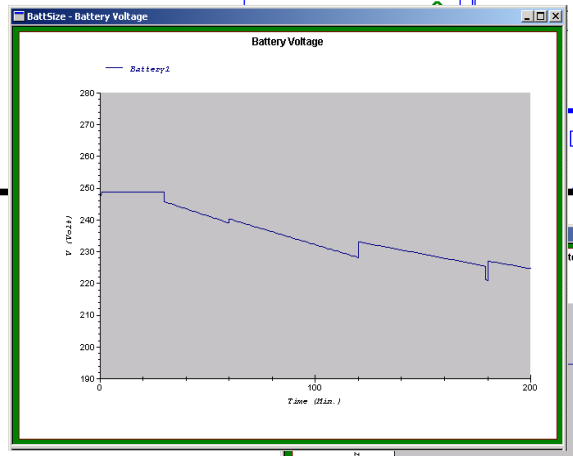
Battery Discharge Plots

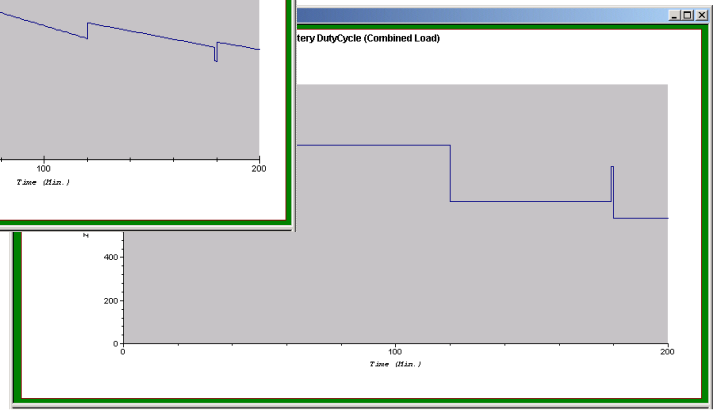
Stop DCBS/DCBD Calculation

Get On-Line Data

Get Archived Data







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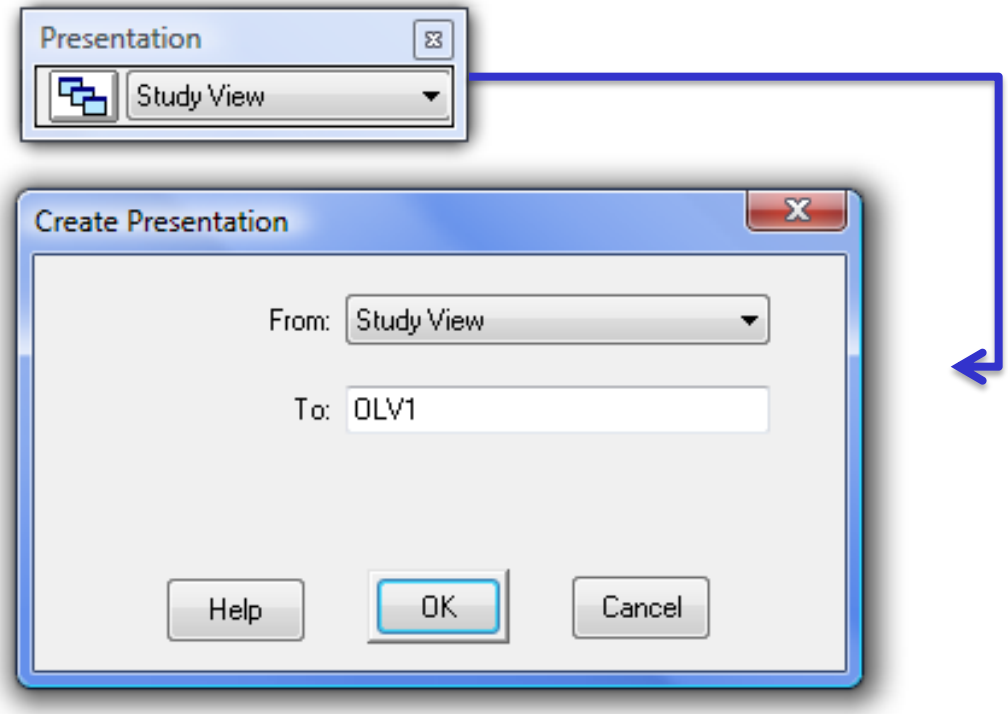
Create a New Presentation



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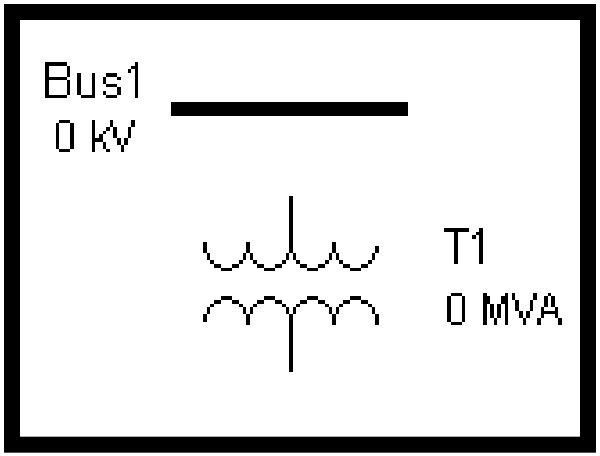
Add Elements



Bus ID = (Default ID) + (A Unique Number) = Bus + 1 = Bus1

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Connect Element - Bus

- Place the cursor over the pin of an element (pin appears in red).
- Drag an element and place its pin on a bus.
- Drop a new element with its pin on top of a bus.
- Buses are considered to be one long pin. Connections are always made from elements to buses.
- Relays cannot be connected to buses.
- Only one pin of an element can be connected to the same bus.

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Connect Element - Element

- Place the cursor on the pin of an element. Click and drag the mouse to the element you want to connect. When the latter element's pin turns red, release the left button.
- Drag & drop a protective device with its pin placed on top of the pin of any branch or load element.
- Drag & drop a protective device onto a connection.
- Branches CANNOT be connected to each other; PowerStation automatically inserts a bus between them.

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Connect Element - Element

- Branches CANNOT be connected to each other; PowerStation automatically inserts a bus between them.
- Branches CANNOT be connected to loads, utilities, composite motors, and composite networks.
- Relays can only be connected to current transformers (CT) or other relays.
- You CANNOT directly connect two buses with a connector or current transformer.

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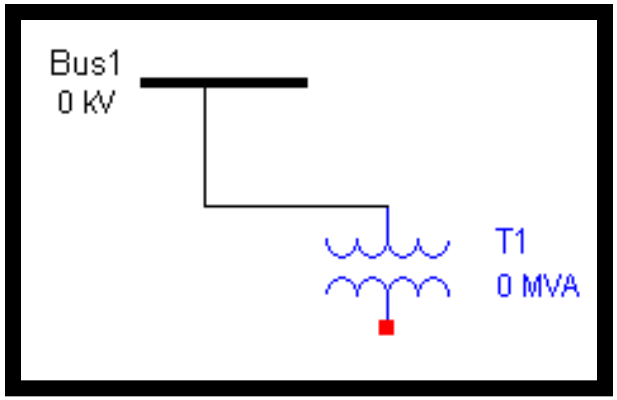
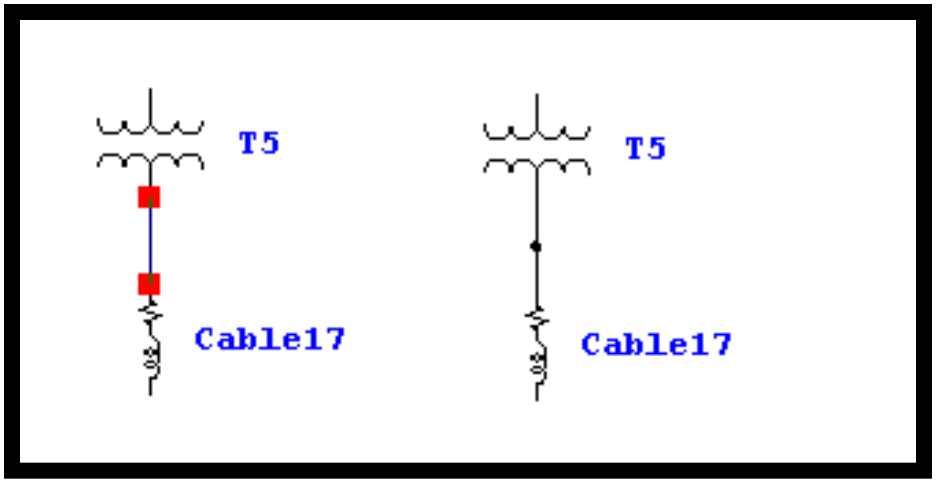
Connect Element - Element





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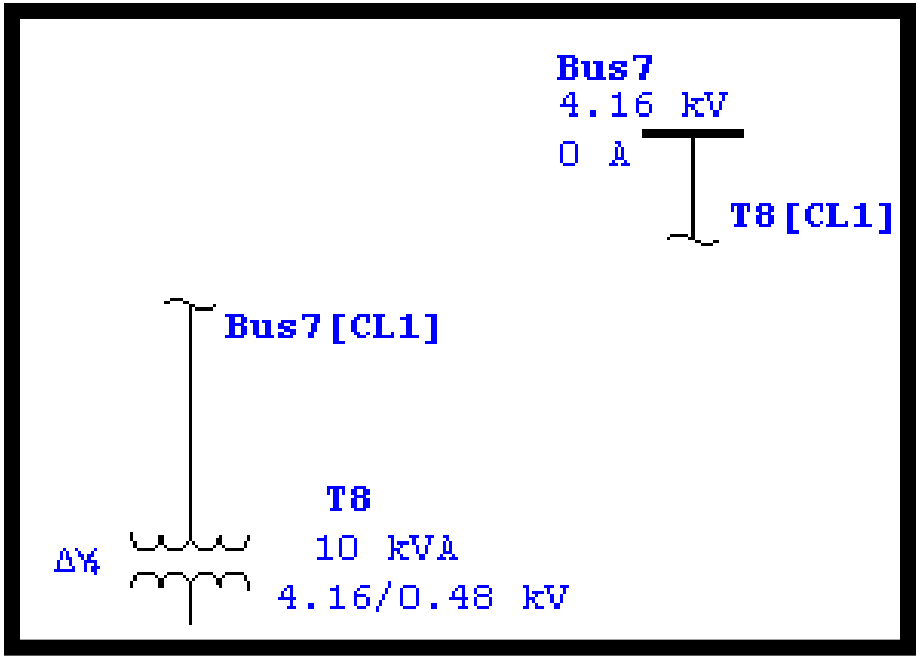
The Remote Connector



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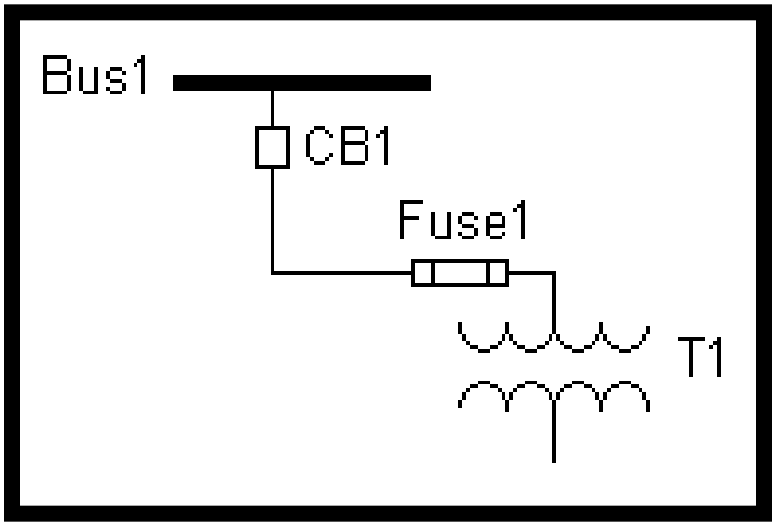
Insert Protective Devices



Example

A Circuit Breaker and Fuse are Inserted Between Bus1 and T1

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Move From Dumpster

- Elements can be moved from the Dumpster into the one-line diagram with the same IDs by two methods:
  - Right-click on the one-line diagram and select Move From
  - Click on Edit on the Menu Bar and select Move From

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Move From Dumpster

- Rules:
  - Move From Dumpster can be done only in Edit mode when Base Data is active.
  - Move CANNOT be done if there are no Cells (element groups) in the Dumpster.
  - When you move a Dumpster Cell to the one-line diagram, the desired cell needs to be active and it gets deleted from the Dumpster after being moved.

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Move From Dumpster

- Move any Dumpster Cell you desire by making it active from the Dumpster presentation
- Entire contents of a cell are moved
- Move any Dumpster Cell into any Composite Network (cannot move cells that contain buses and branches into a composite motor)
- Sections 1 and 2 of the Remote Connector must be moved from the dumpster at the same time
- IDs of the moved elements, along with the connections, status, and properties are preserved

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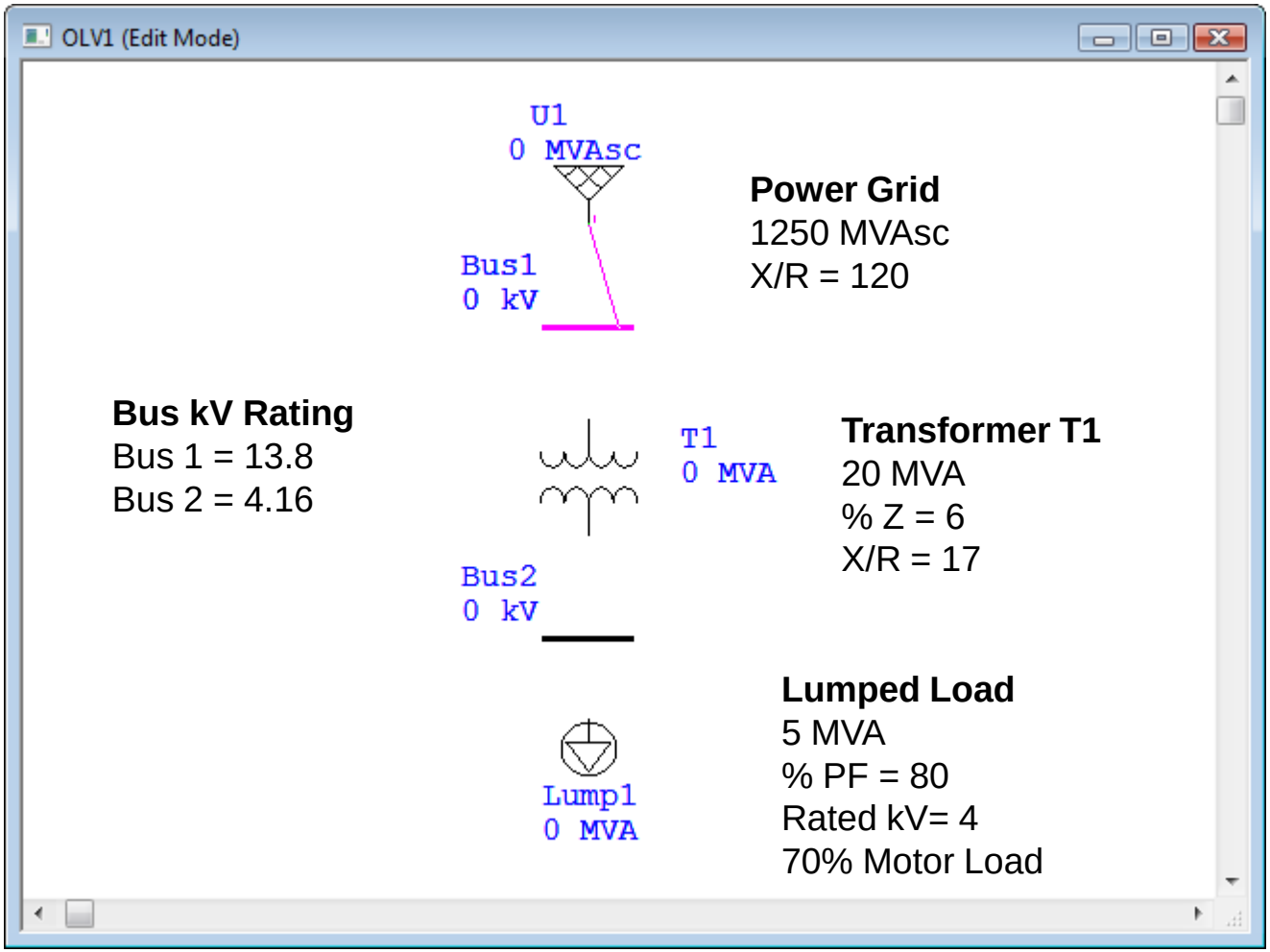
Creating a Project

Enter four new elements into the one-line diagram and proceed to enter the input data for each element



Power Grid
1250 MVAsc
X/R = 120

Bus kV Rating
Bus 1 = 13.8
Bus 2 = 4.16

Transformer T1
20 MVA
% Z = 6
X/R = 17

Lumped Load
5 MVA
% PF = 80
Rated kV= 4
70% Motor Load

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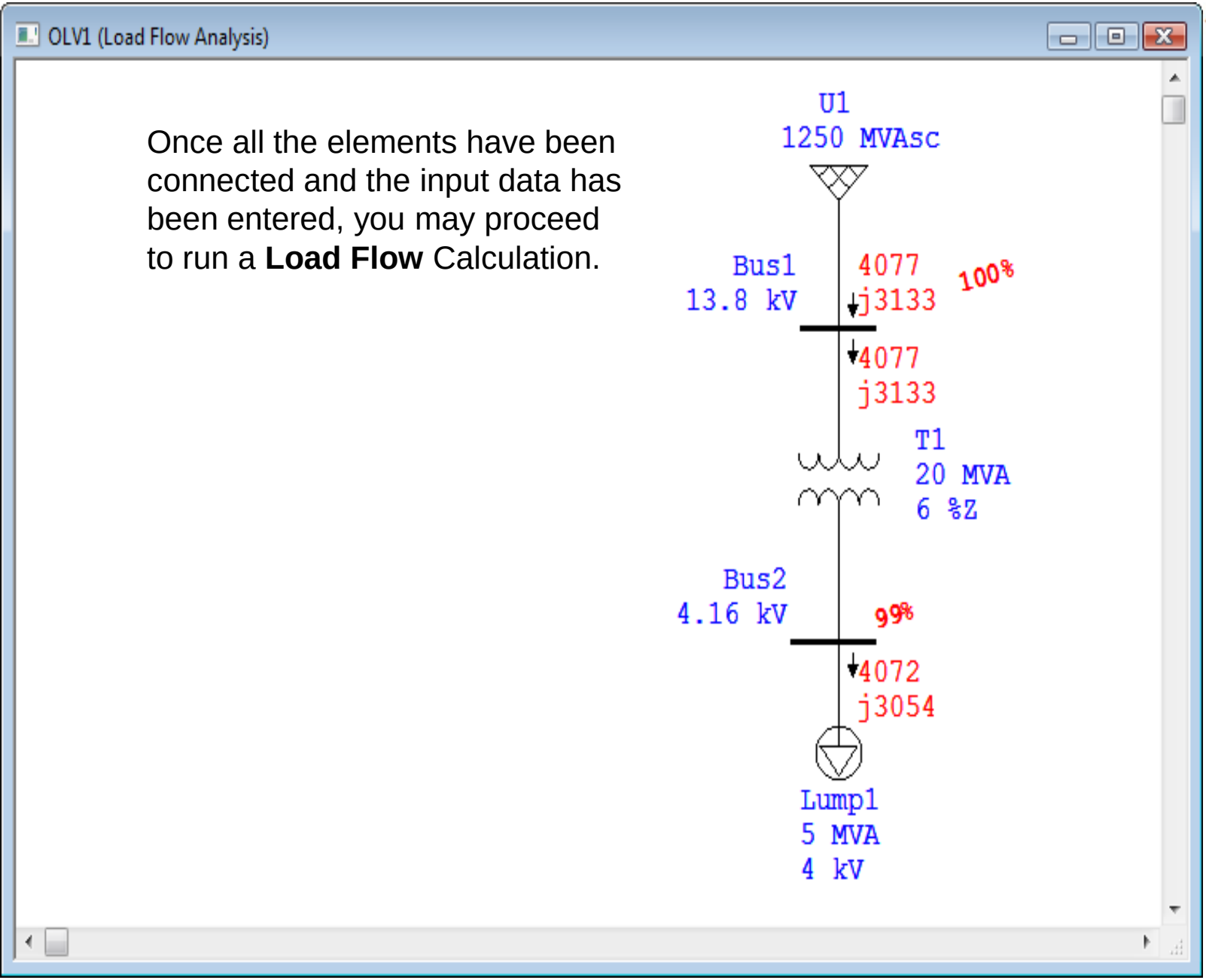
Once all the elements have been connected and the input data has been entered, you may proceed to run a **Load Flow** Calculation.



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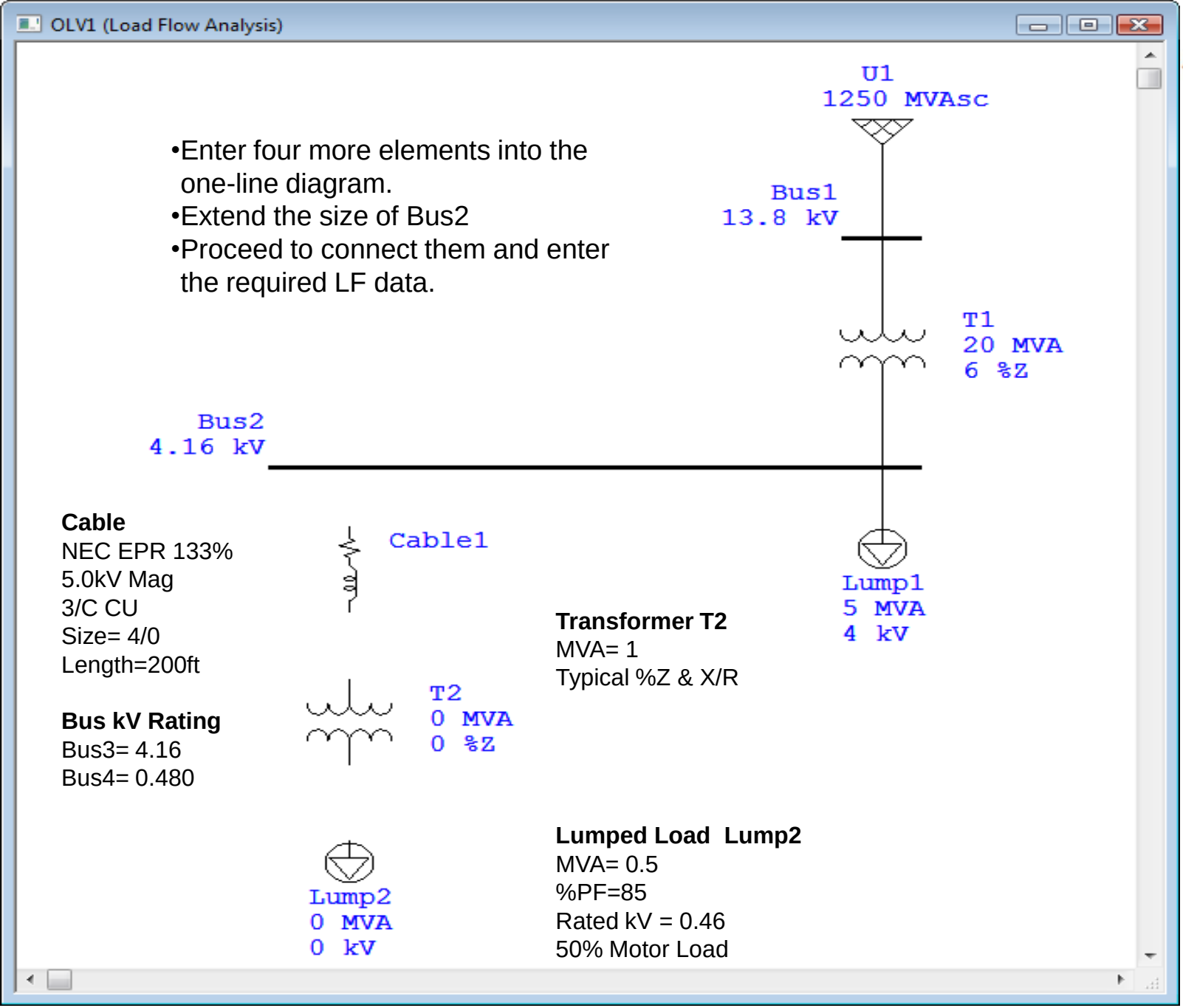

- Enter four more elements into the one-line diagram.
- Extend the size of Bus2
- Proceed to connect them and enter the required LF data.

Cable
NEC EPR 133%
5.0kV Mag
3/C CU
Size= 4/0
Length=200ft

Bus kV Rating
Bus3= 4.16
Bus4= 0.480

Transformer T2
MVA= 1
Typical %Z & X/R

Lumped Load Lump2
MVA= 0.5
%PF=85
Rated kV = 0.46
50% Motor Load

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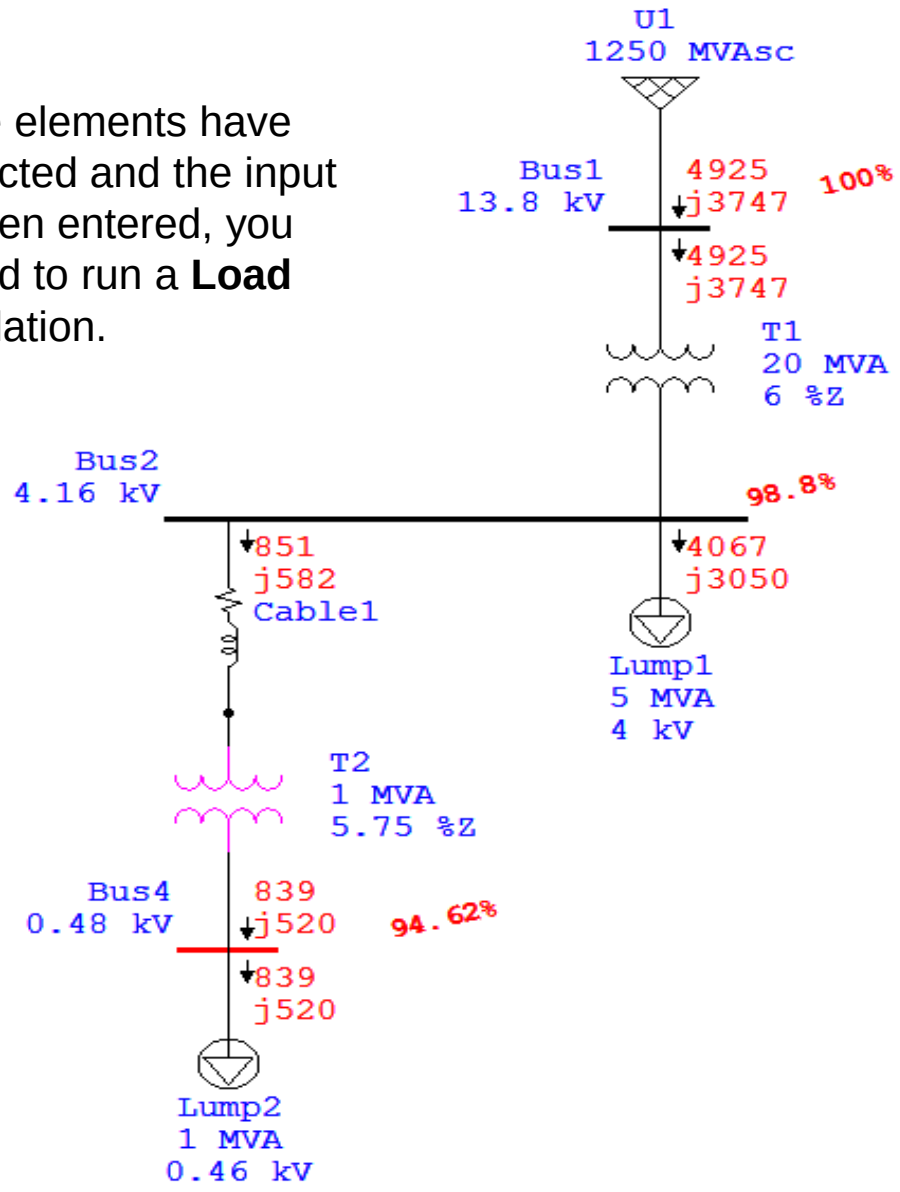
Once all the elements have been connected and the input data has been entered, you may proceed to run a **Load Flow** Calculation.



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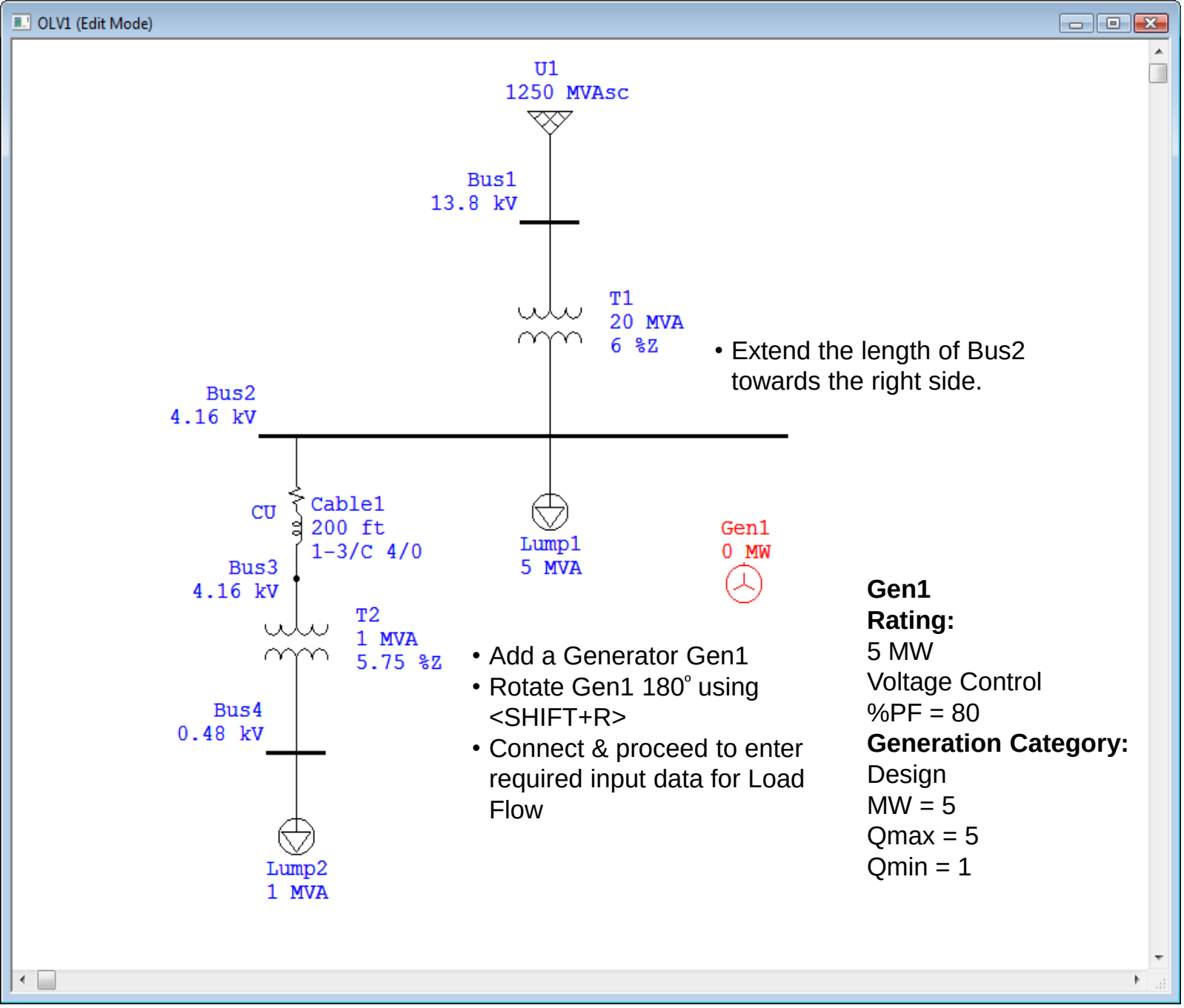

- Extend the length of Bus2 towards the right side.

- Add a Generator Gen1
- Rotate Gen1 180° using <SHIFT+R>
- Connect & proceed to enter required input data for Load Flow

Gen1
Rating:
5 MW
Voltage Control
%PF = 80
Generation Category:
Design
MW = 5
Qmax = 5
Qmin = 1

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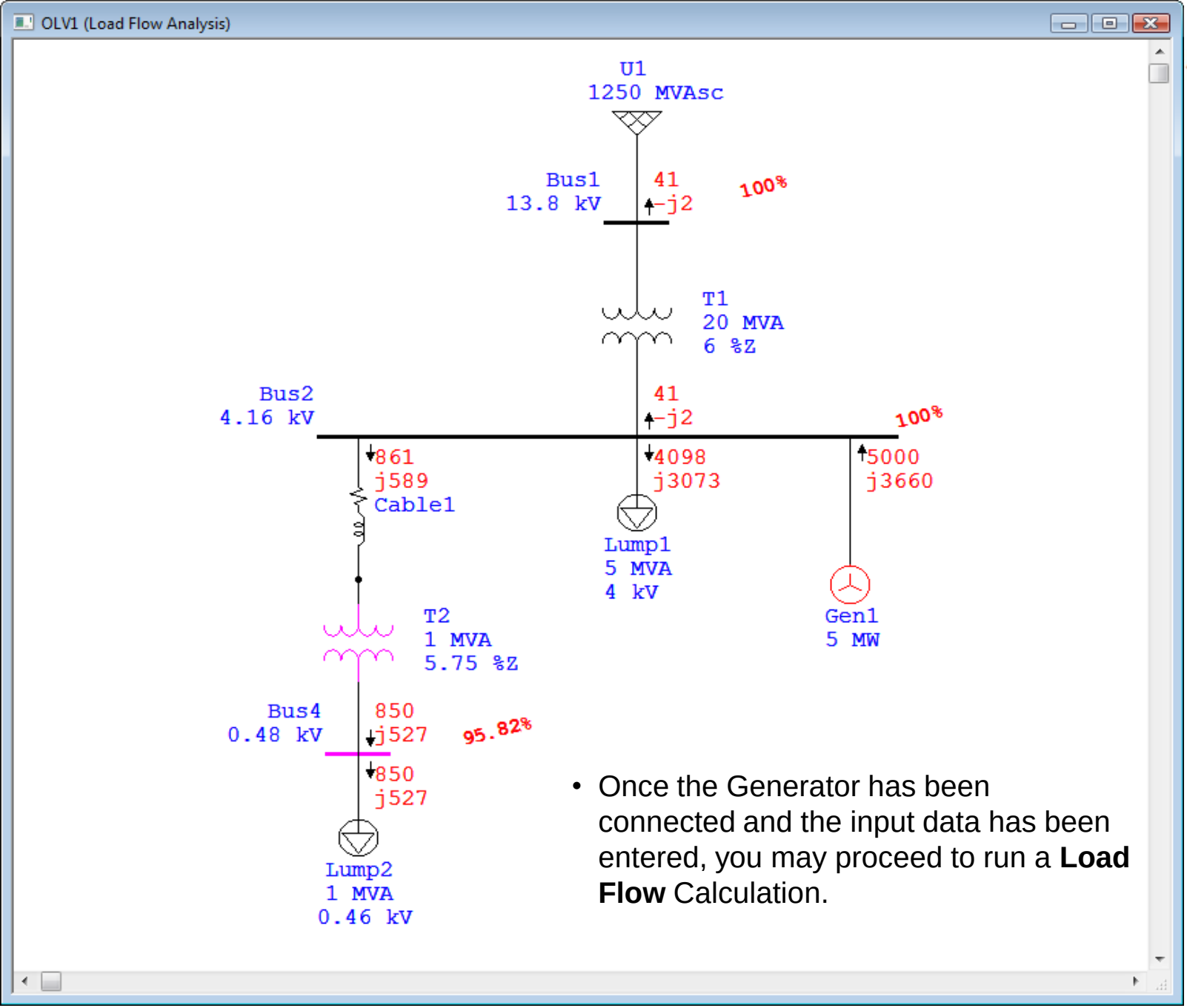

- Once the Generator has been connected and the input data has been entered, you may proceed to run a **Load Flow** Calculation.

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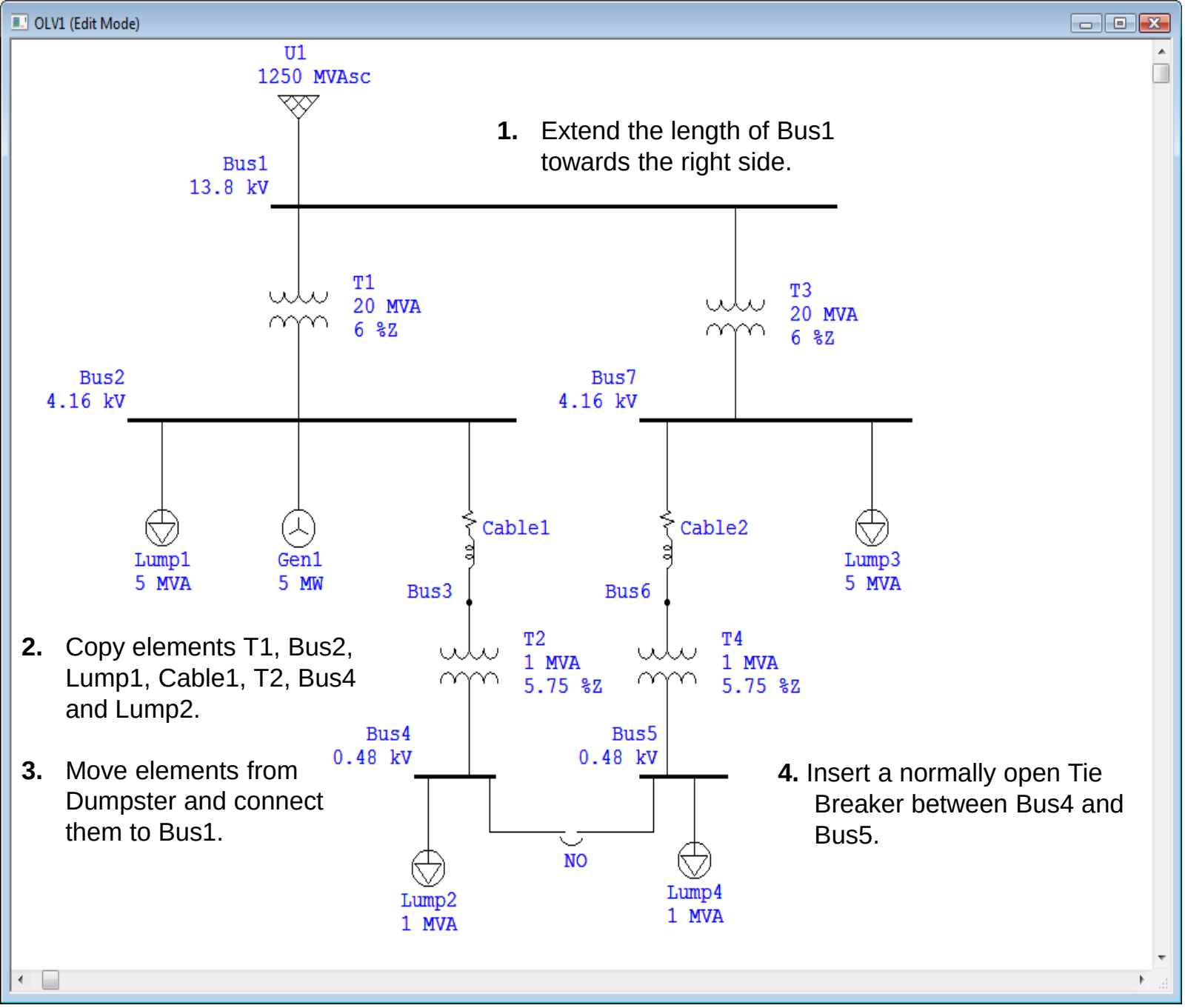

1. Extend the length of Bus1 towards the right side.

2. Copy elements T1, Bus2, Lump1, Cable1, T2, Bus4 and Lump2.

3. Move elements from Dumpster and connect them to Bus1.

4. Insert a normally open Tie Breaker between Bus4 and Bus5.

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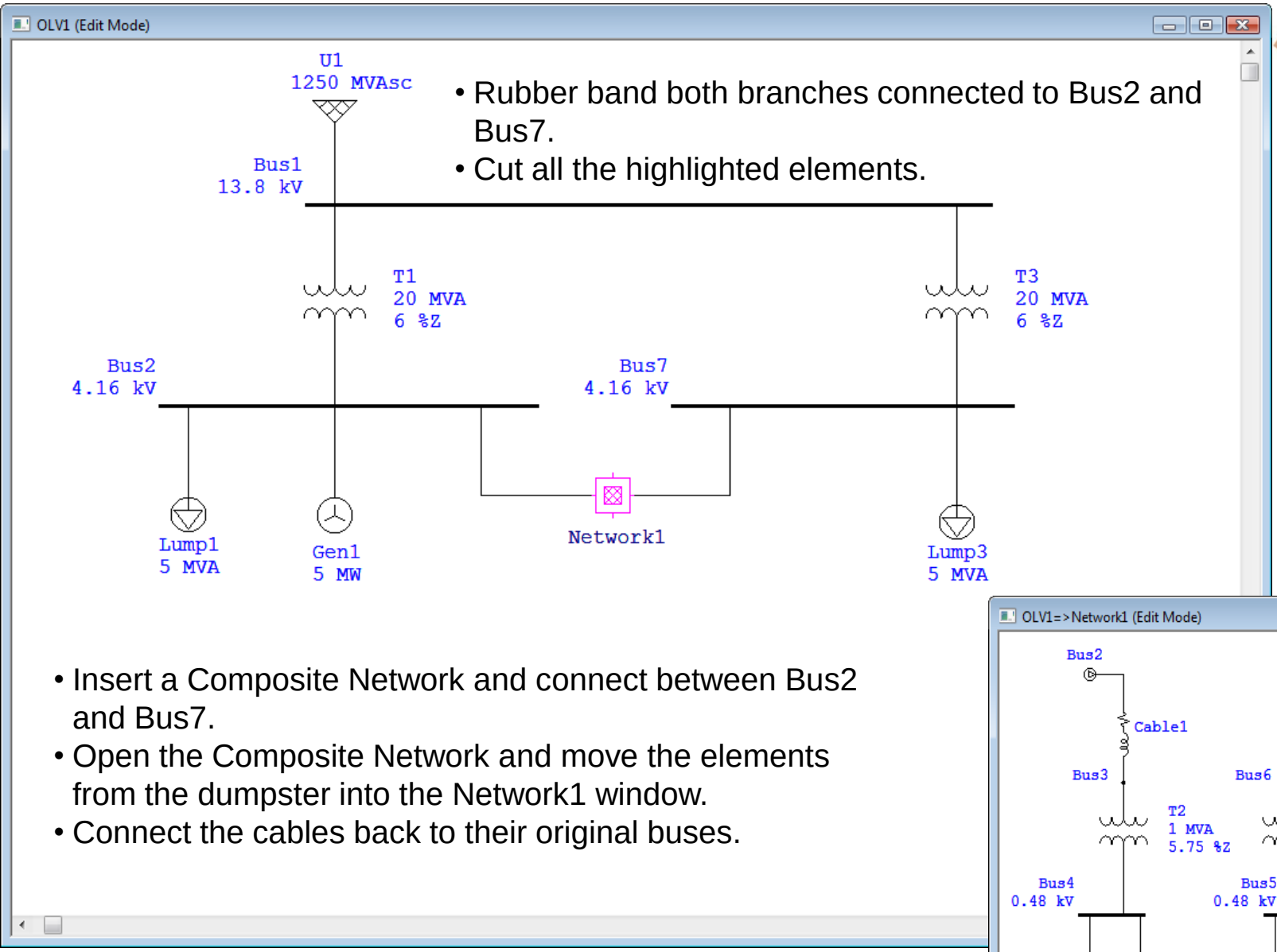
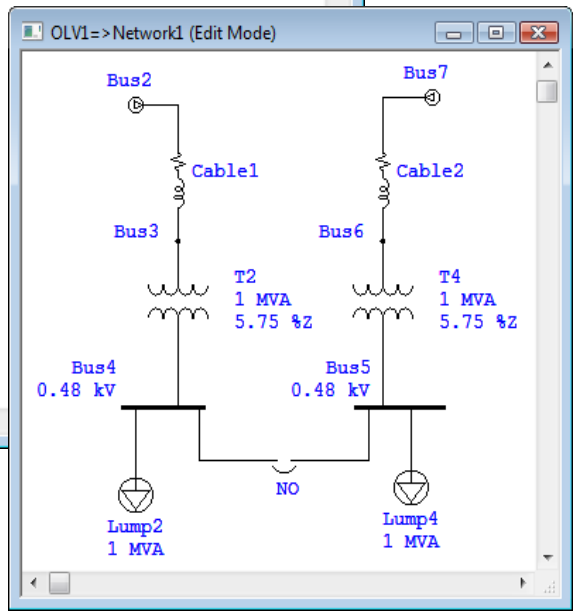


- Rubber band both branches connected to Bus2 and Bus7.
- Cut all the highlighted elements.



- Insert a Composite Network and connect between Bus2 and Bus7.
- Open the Composite Network and move the elements from the dumpster into the Network1 window.
- Connect the cables back to their original buses.

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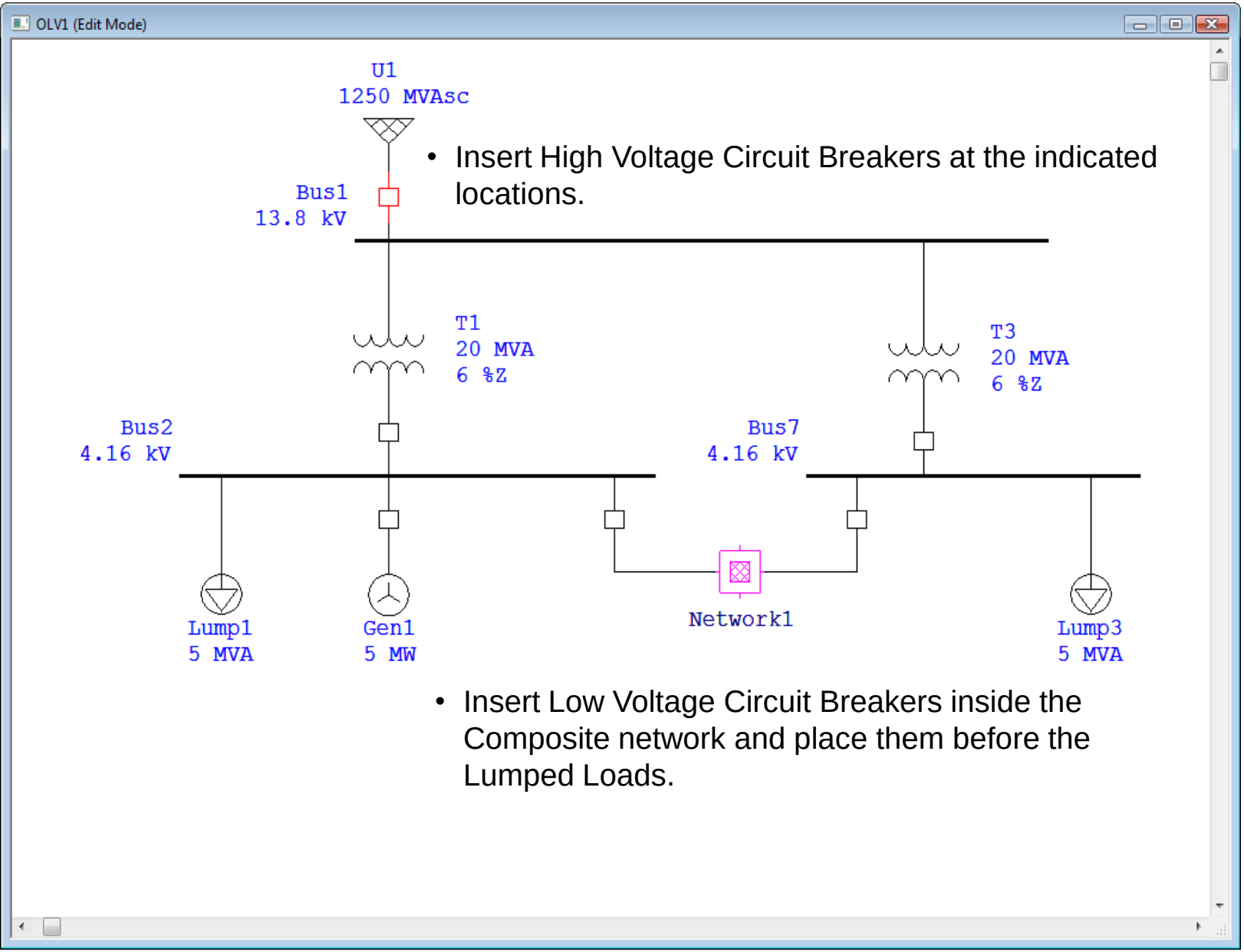

- Insert High Voltage Circuit Breakers at the indicated locations.

- Insert Low Voltage Circuit Breakers inside the Composite network and place them before the Lumped Loads.

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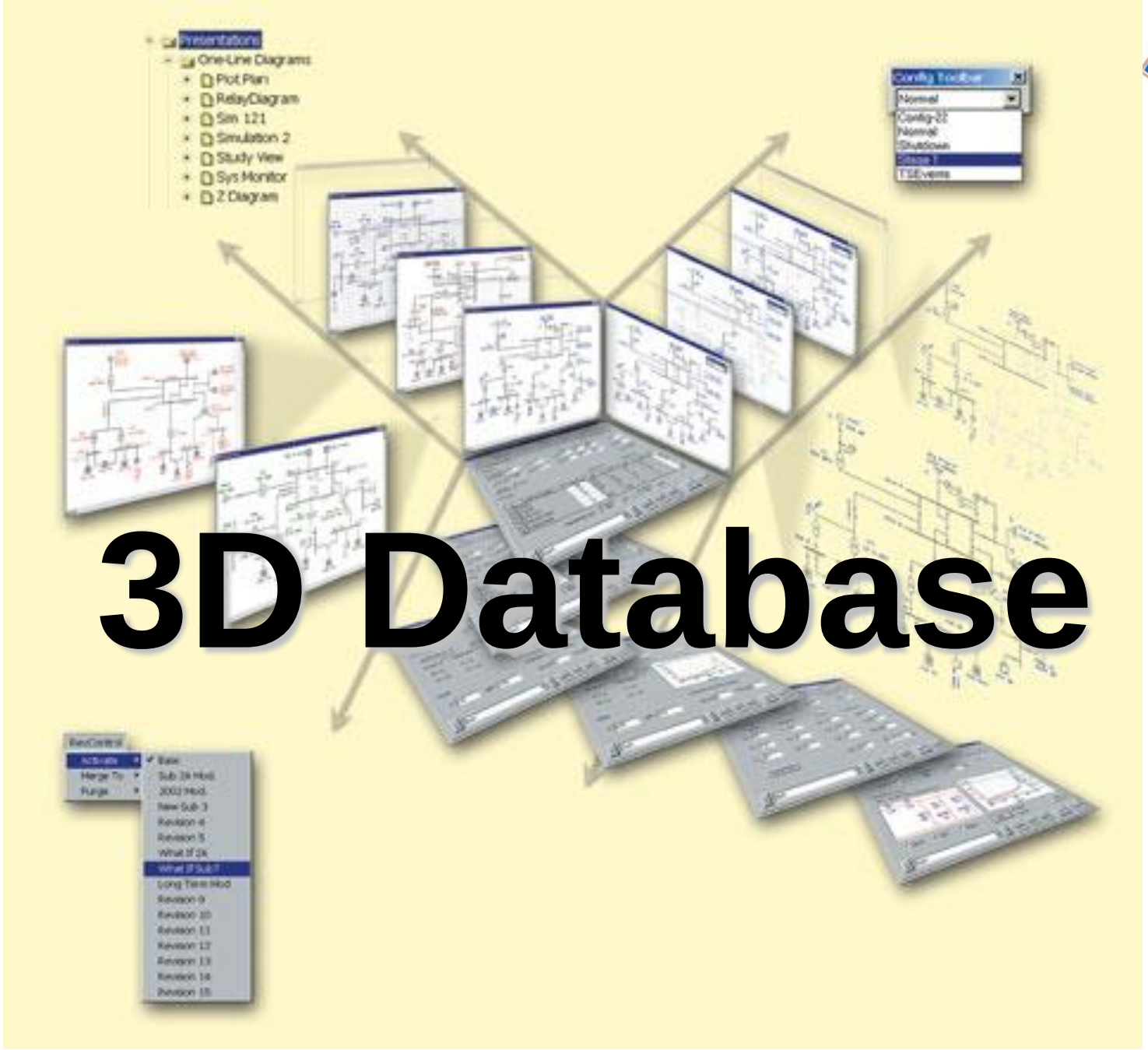

3D Database

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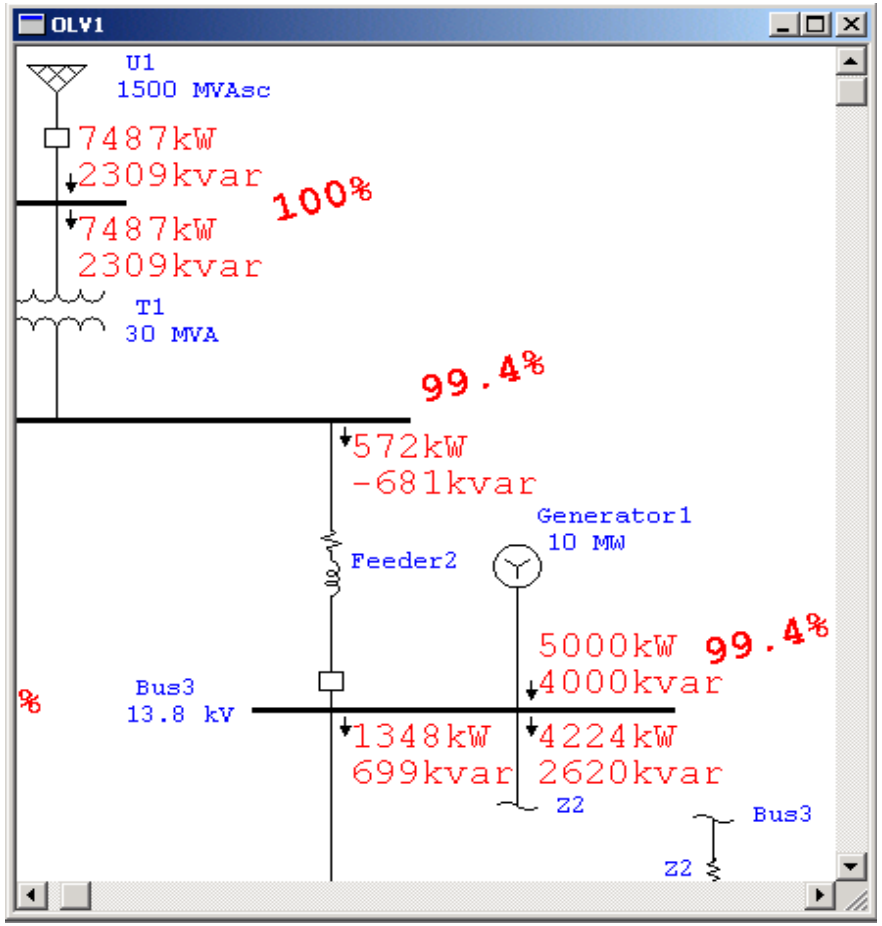
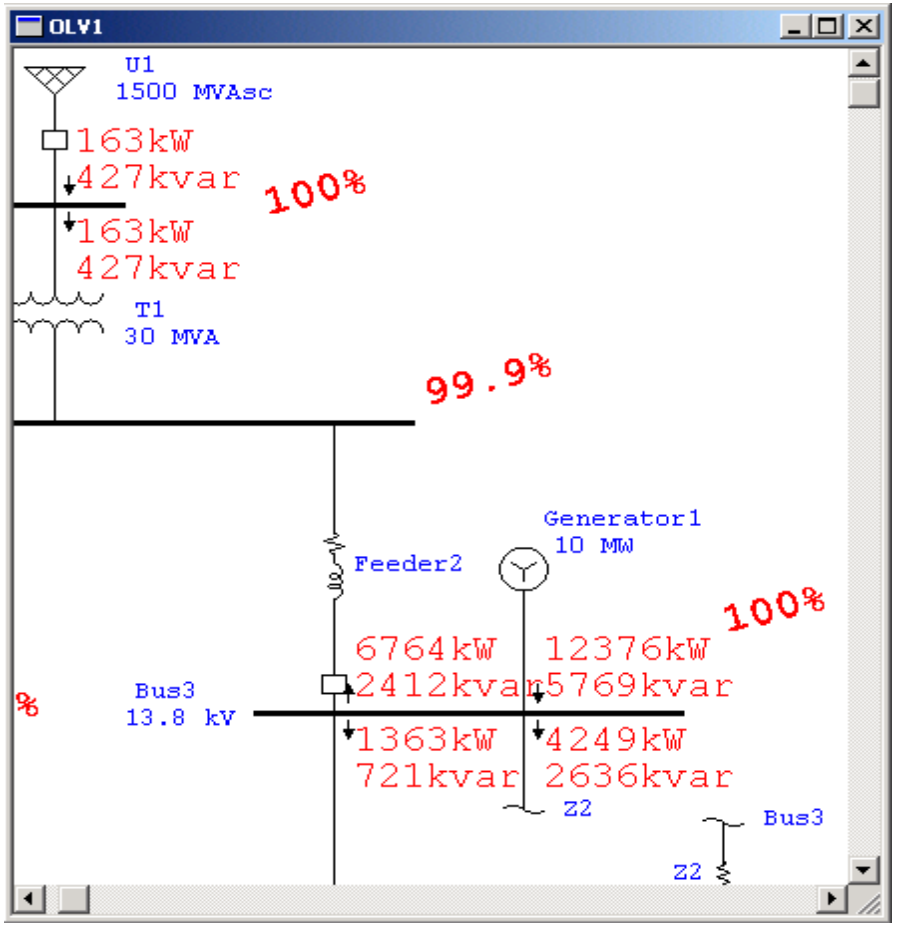
Study Conditions

- Different Operating Requirements



Generator 1 in Voltage Control Mode



Generator 1 in Swing Mode

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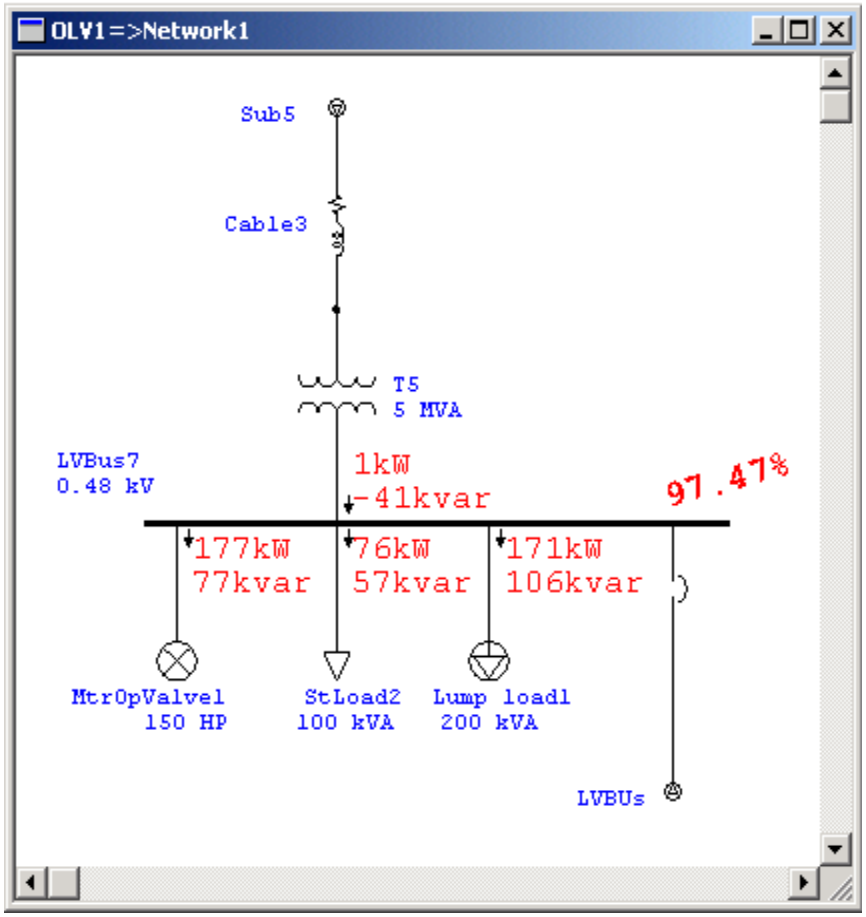
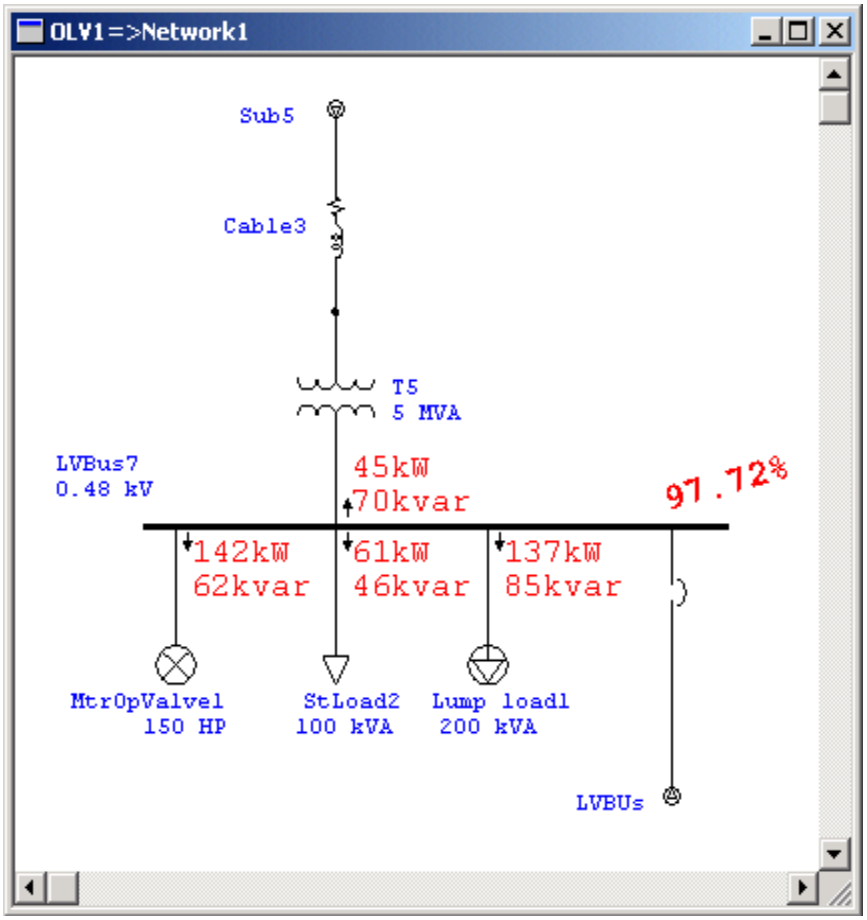
Study Conditions

- Different Loading Conditions



Summer Loading



Winter Loading

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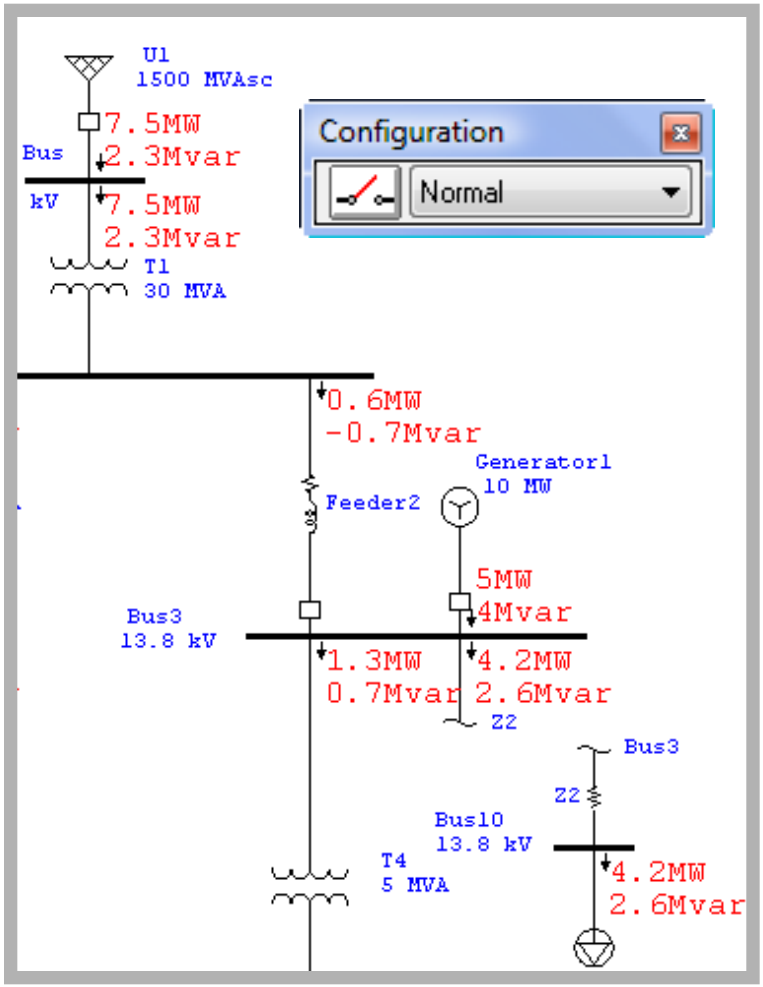
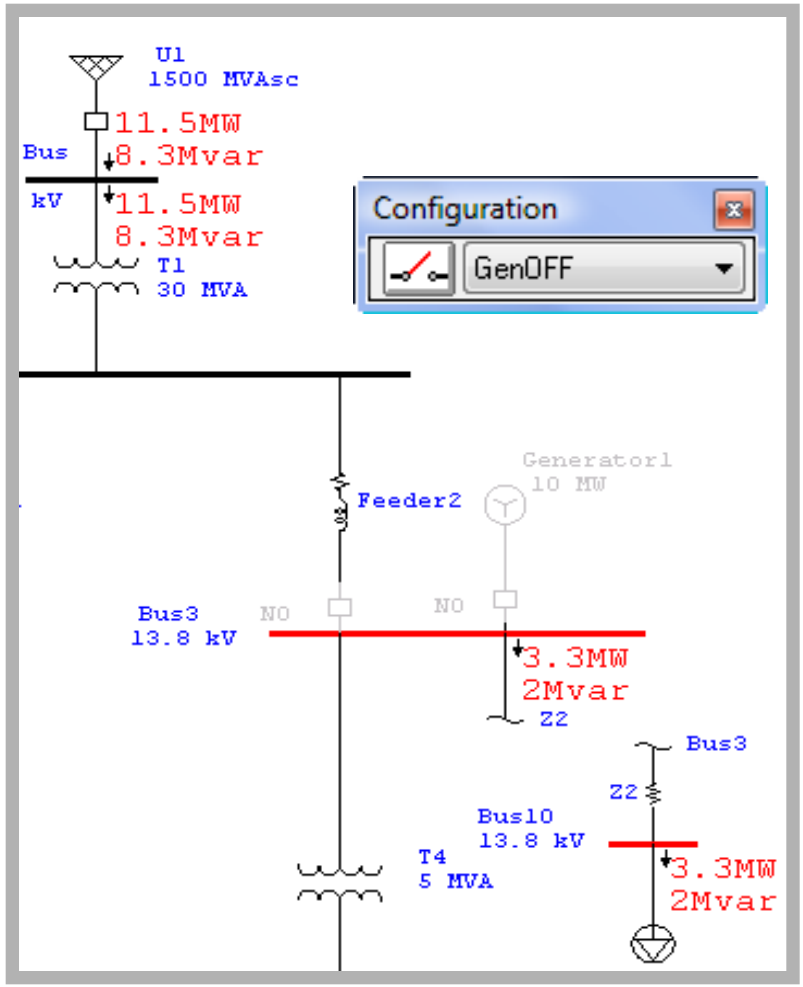
Study Conditions

- Different Configurations



Configuration Normal



Configuration GenOFF

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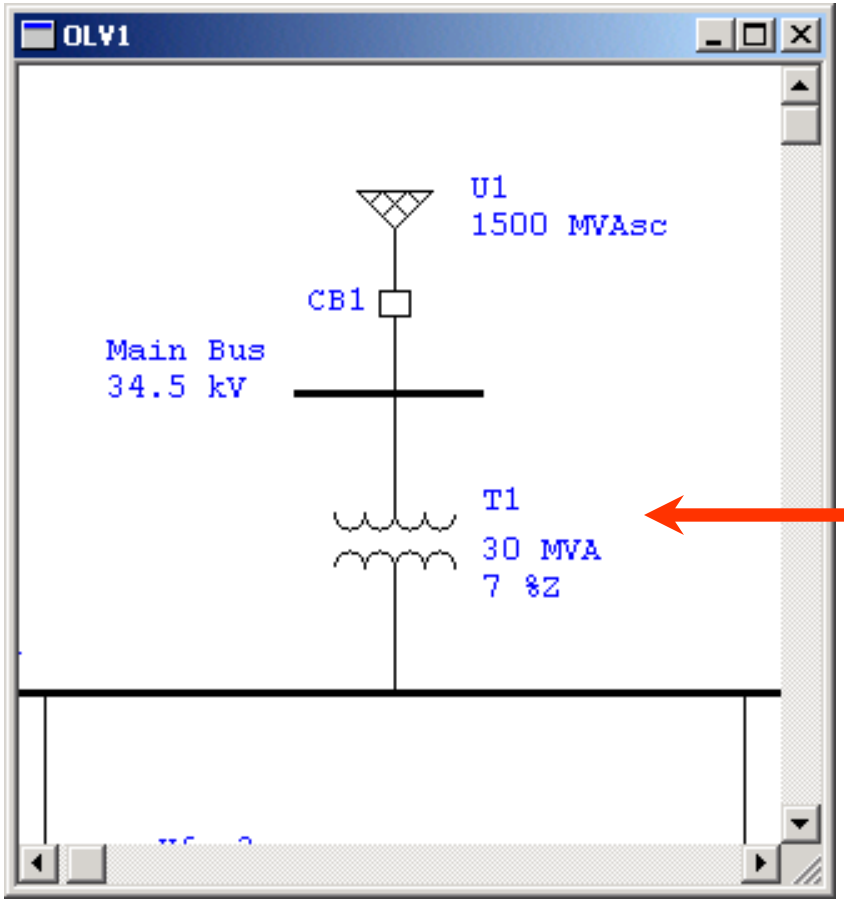
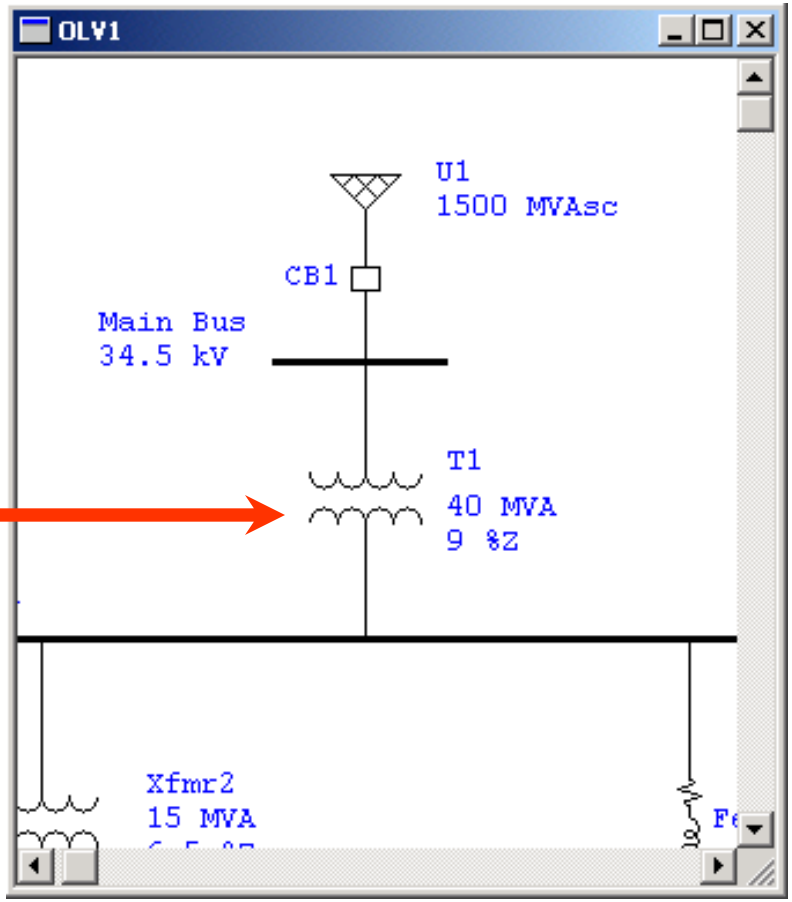
Study Conditions

- Different Engineering Data



Revision Base



Revision Sub2a Mod

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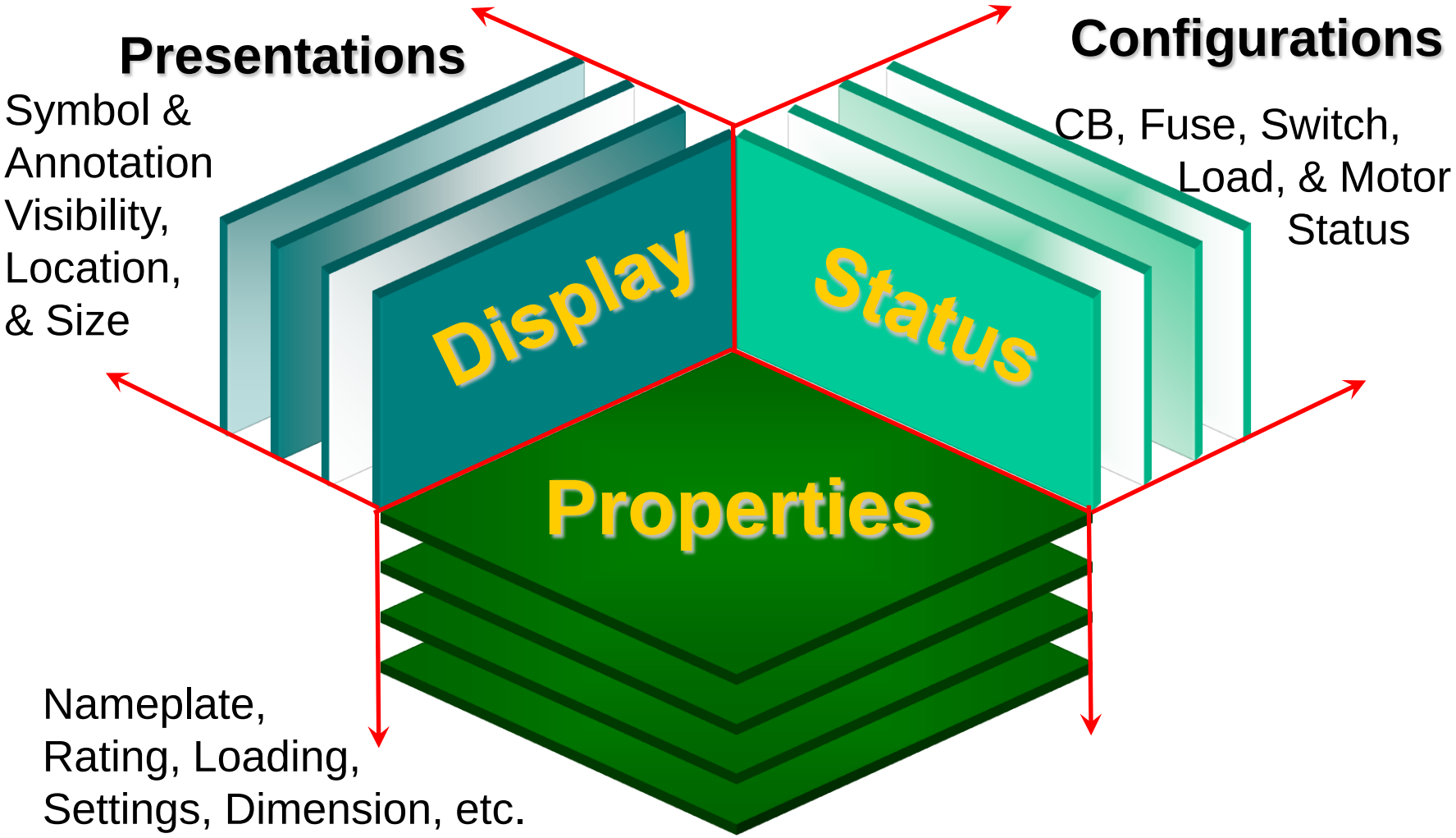
3-D Database



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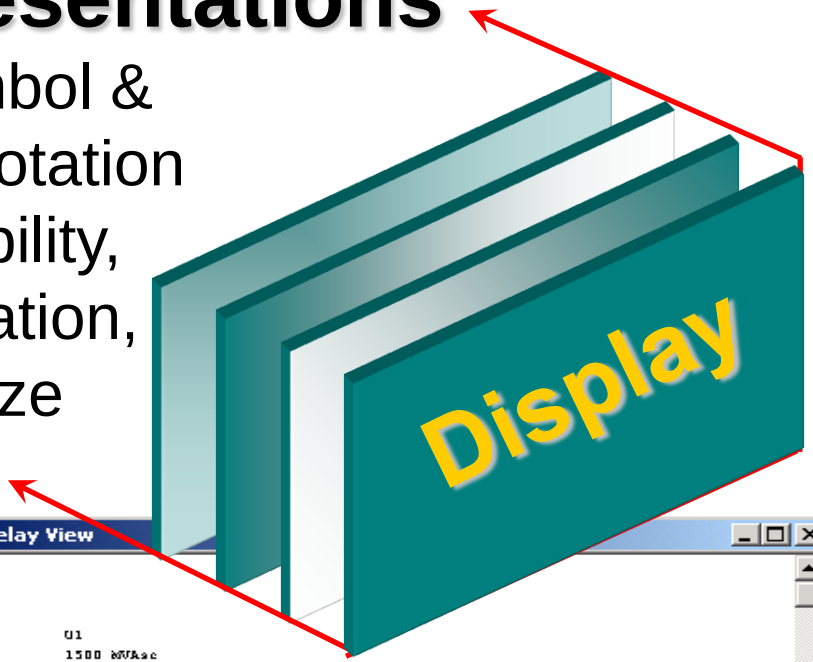
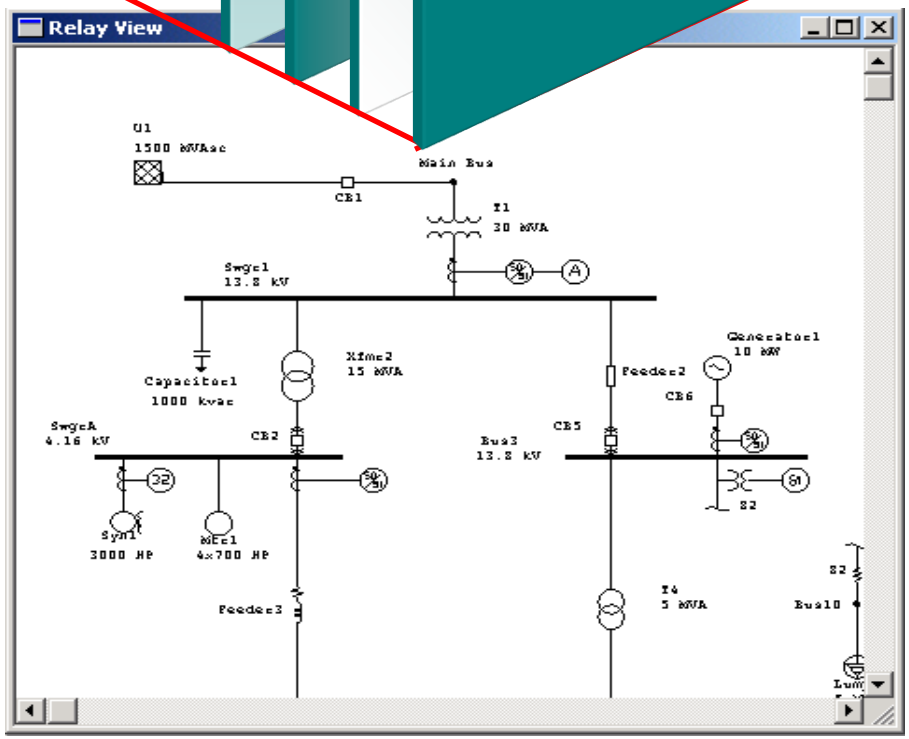
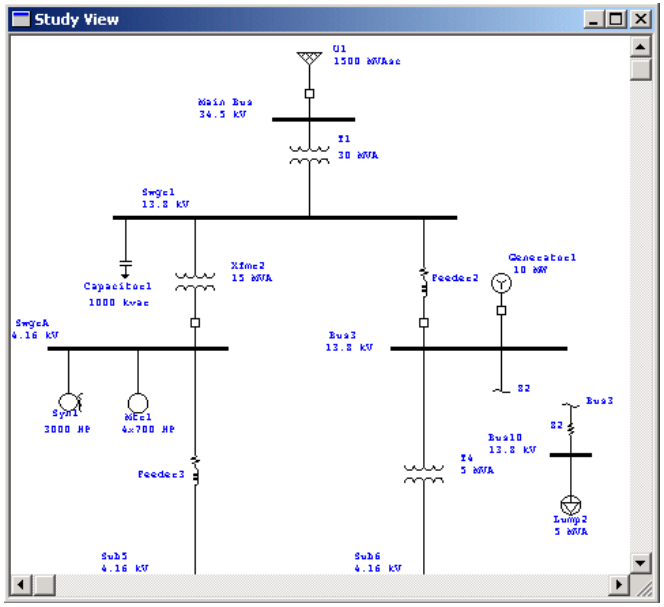
Presentations

Symbol &
Annotation
Visibility,
Location,
& Size







- One-Line Diagrams
- Impedance Diagrams
- Relay Diagrams
- Physical Diagrams
- Study Diagrams

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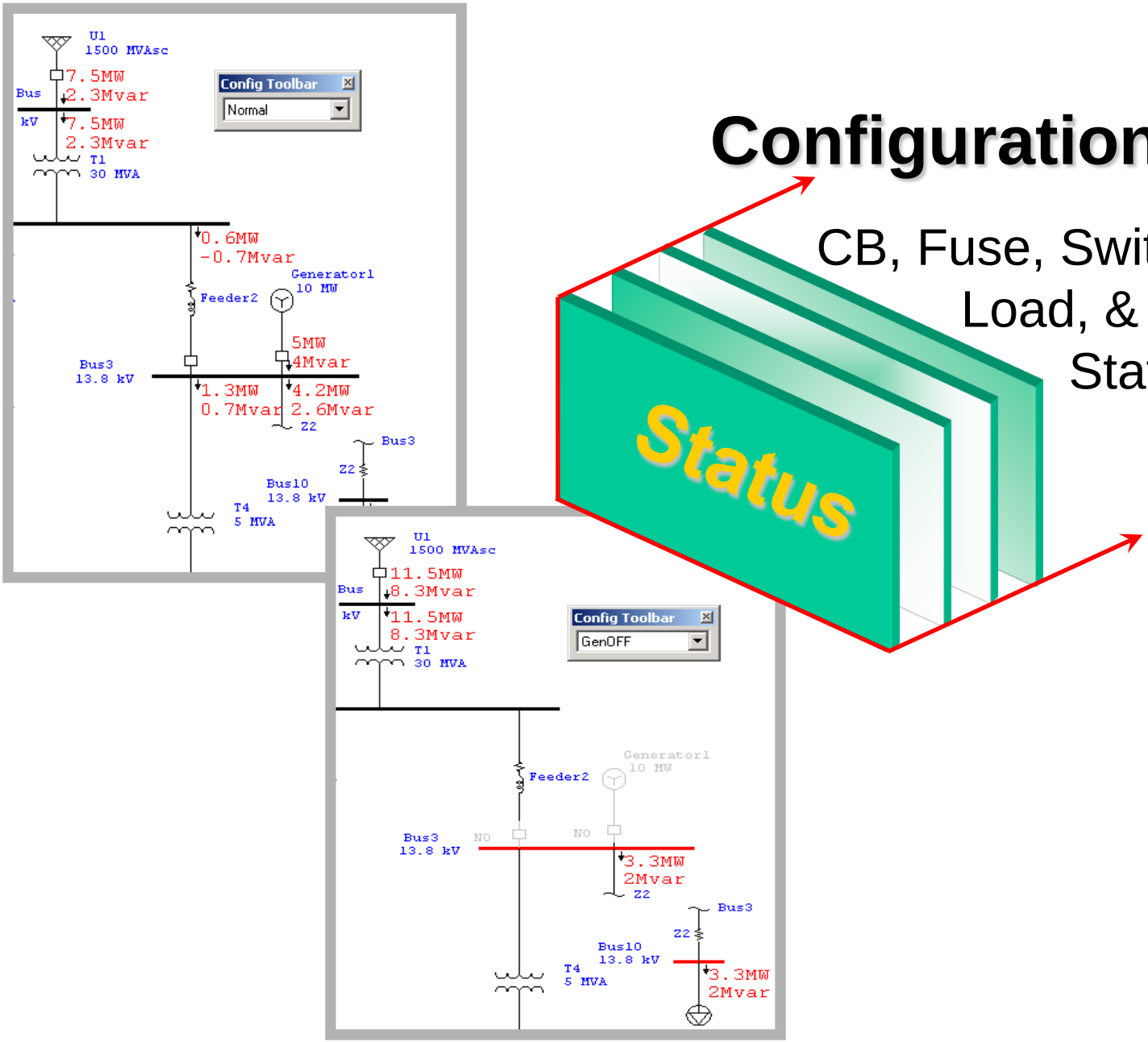
Configurations

CB, Fuse, Switch, Load, & Motor Status



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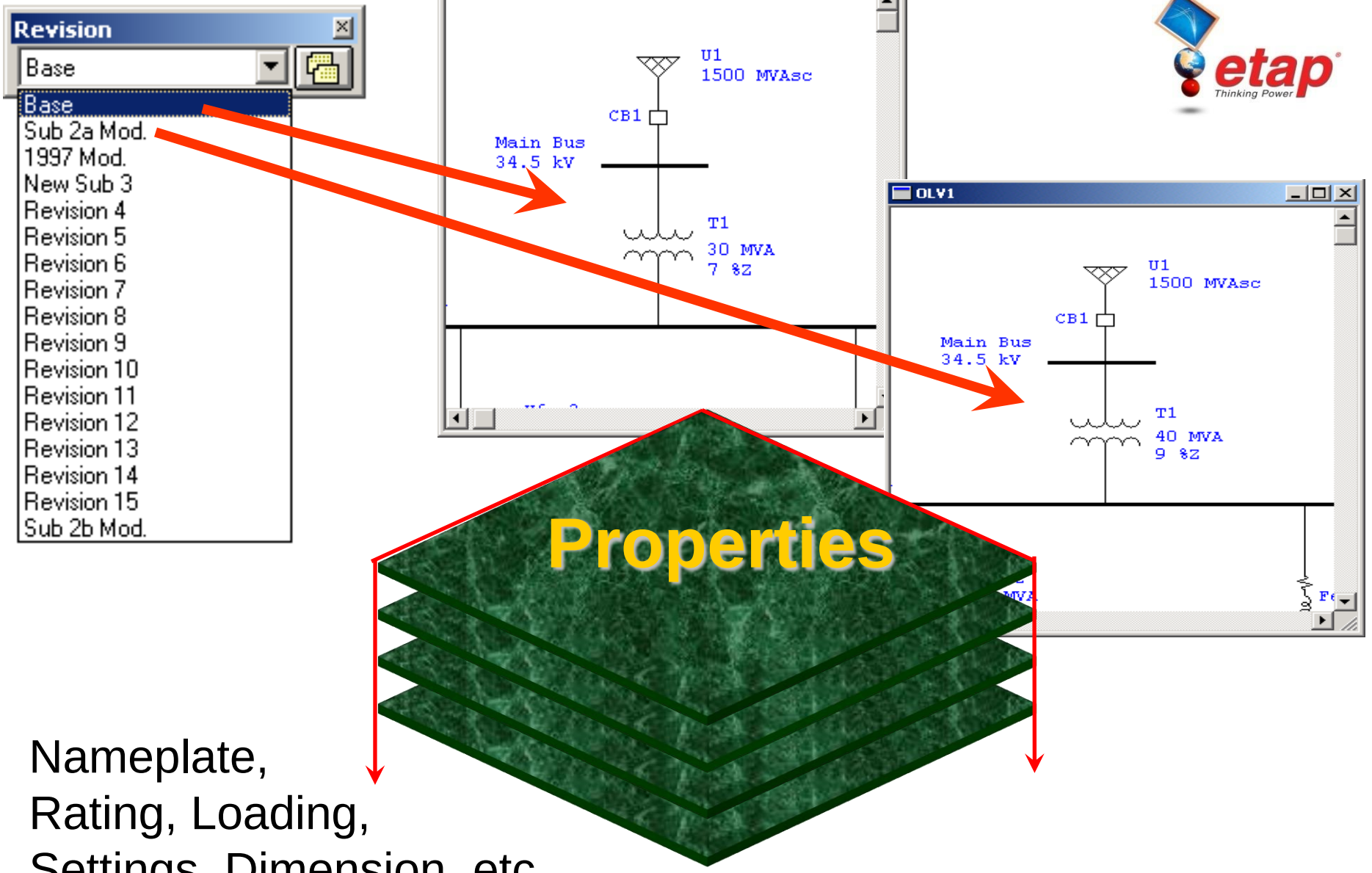

Nameplate,
Rating, Loading,
Settings, Dimension, etc.

Base & Revision Data

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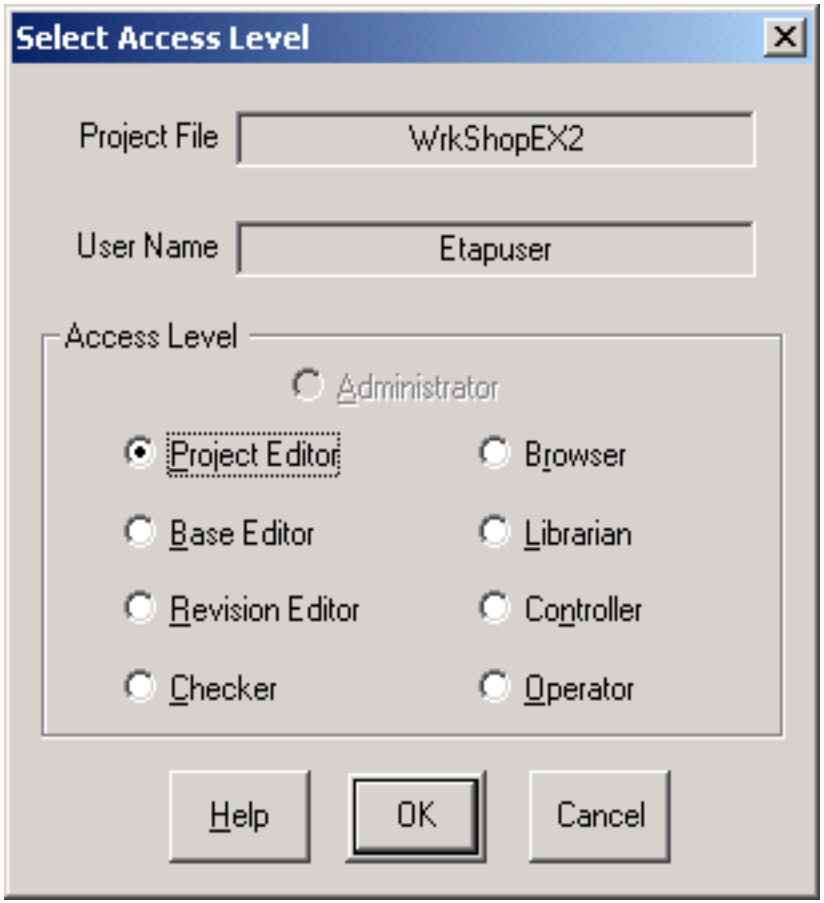
User Access Management

Group 1 Functions

- Move Elements
- Change Element Size
- Change Element Symbol
- Change Element Orientation
- Edit Engineering Properties
- Change Operating Status
- Hide or Show Protective Devices
- Autoroute Connections
- Change Bus to Node Symbols
- Purge Data Revisions
- Merge Data Revisions to Other Revisions



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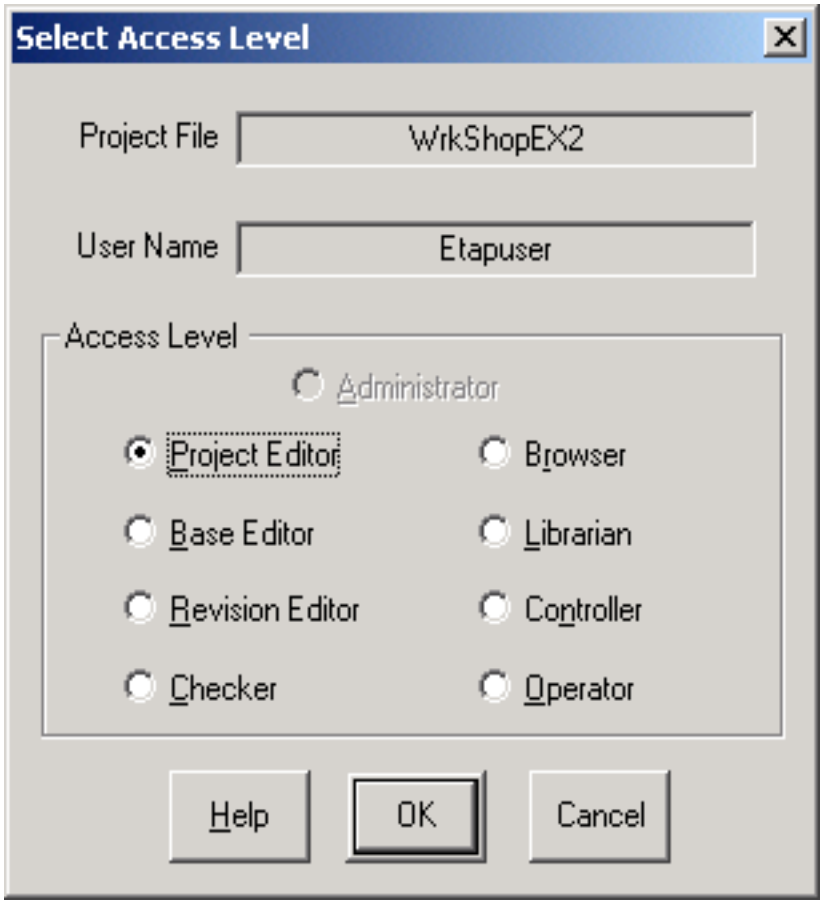
User Access Management



Group 2 Functions

Add (Drop) Elements

Cut (Delete) Elements to Dumpster

Copy Elements from Dumpster

Paste Elements from Dumpster

Move Elements from Dumpster

Connect Elements

Purge Elements from Dumpster

Re-sizing Elements (UGS)

Merge Data Revision to Base Data

Graphical Adjustment of STAR Views

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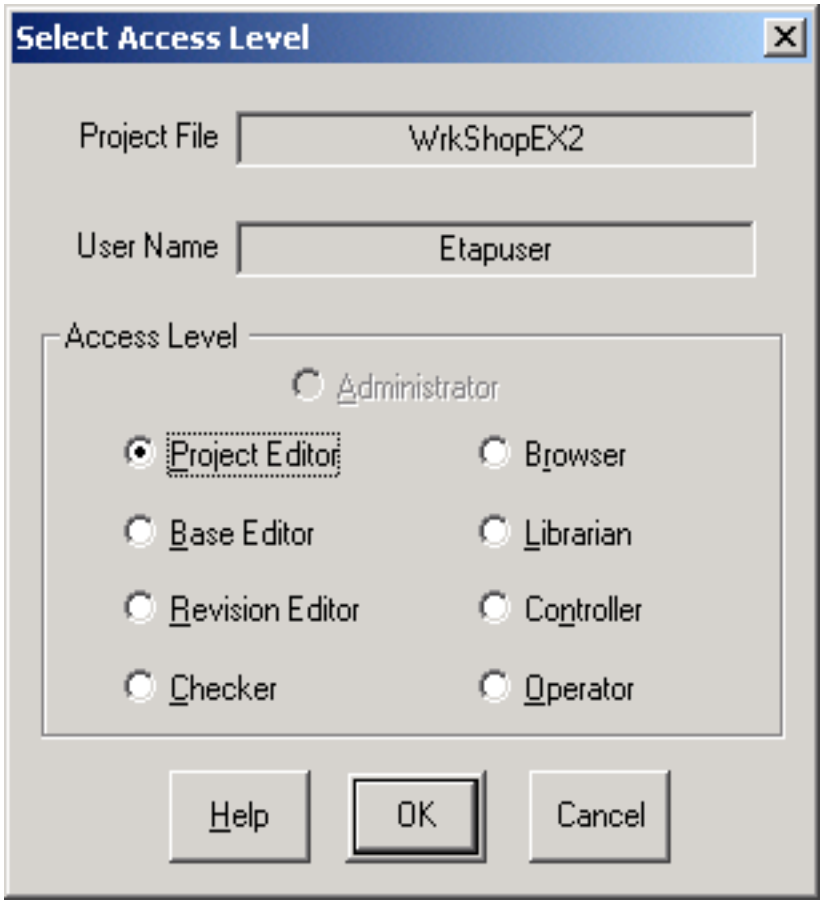
User Access Management



Group 3 Functions

Change Phase/Ground mode in Star View.

Compute Time Difference in Star View.

View Alerts.

View Device Setting Reports.

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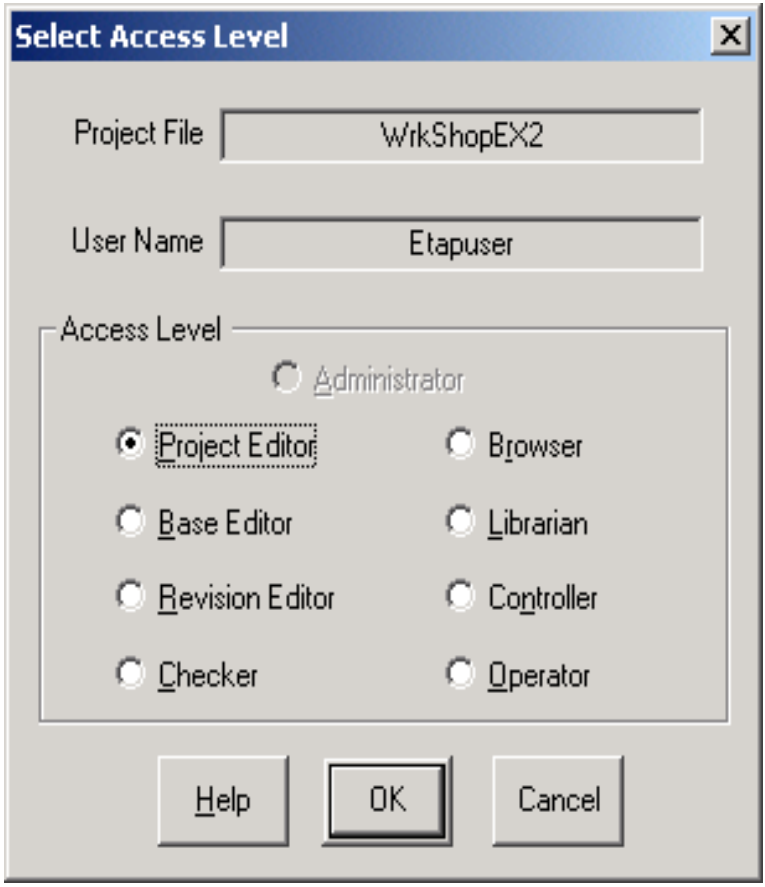
User Access Management

Project Editor

	Can Change	Cannot Change
User Access Management		X
Project Data / Defaults	X	
Base Data	X	
Revision Data	X	
Group 1 Changes	X	
Group 2 Changes	X	
Group 3 Changes	X	
Configuration Status	X	
Library Data	X	
Library Path	X	



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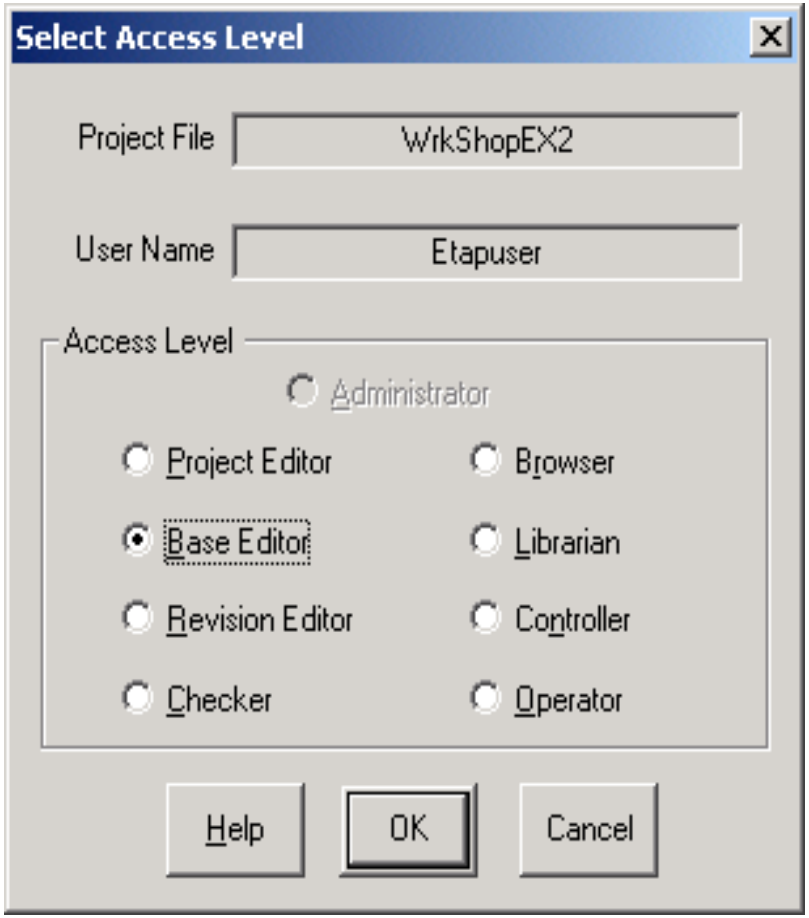
User Access Management

Base Editor

	Can Change	Cannot Change
User Access Management		X
Project Data / Defaults	X	
Base Data	X	
Revision Data	X	
Group 1 Changes	X	
Group 2 Changes	X	
Group 3 Changes	X	
Configuration Status	X	
Library Data		X
Library Path	X	



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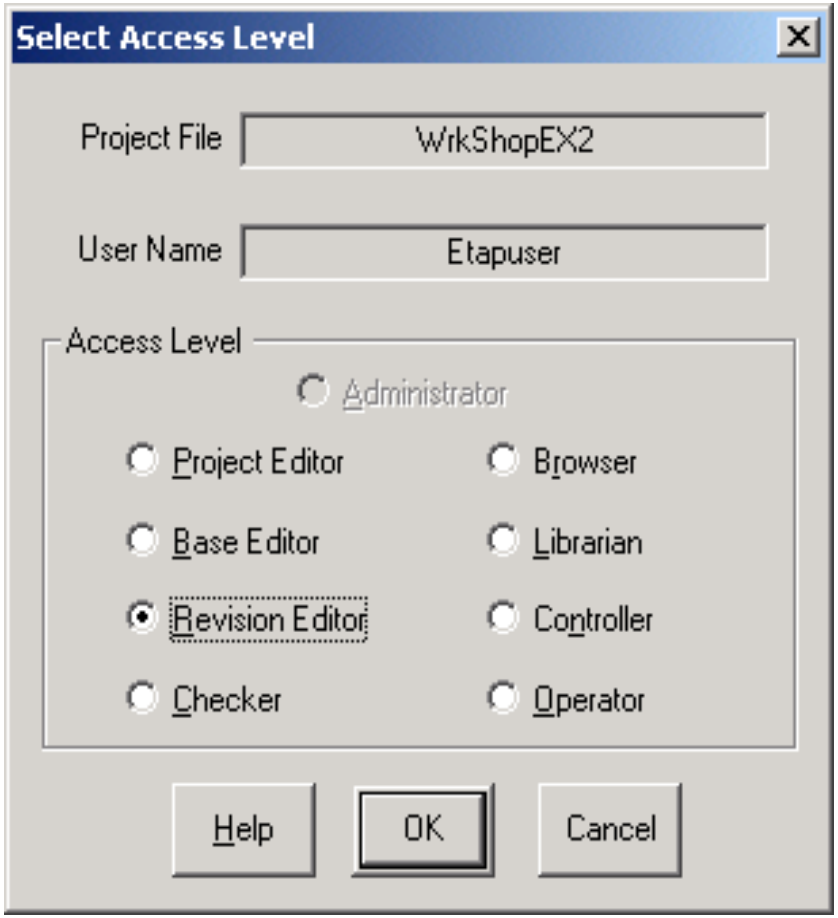
User Access Management

Revision Editor

	Can Change	Cannot Change
User Access Management		X
Project Data / Defaults		X
Base Data		X
Revision Data	X	
Group 1 Changes	X	
Group 2 Changes	X	
Group 3 Changes	X	
Configuration Status		X
Library Data	X	
Library Path		X



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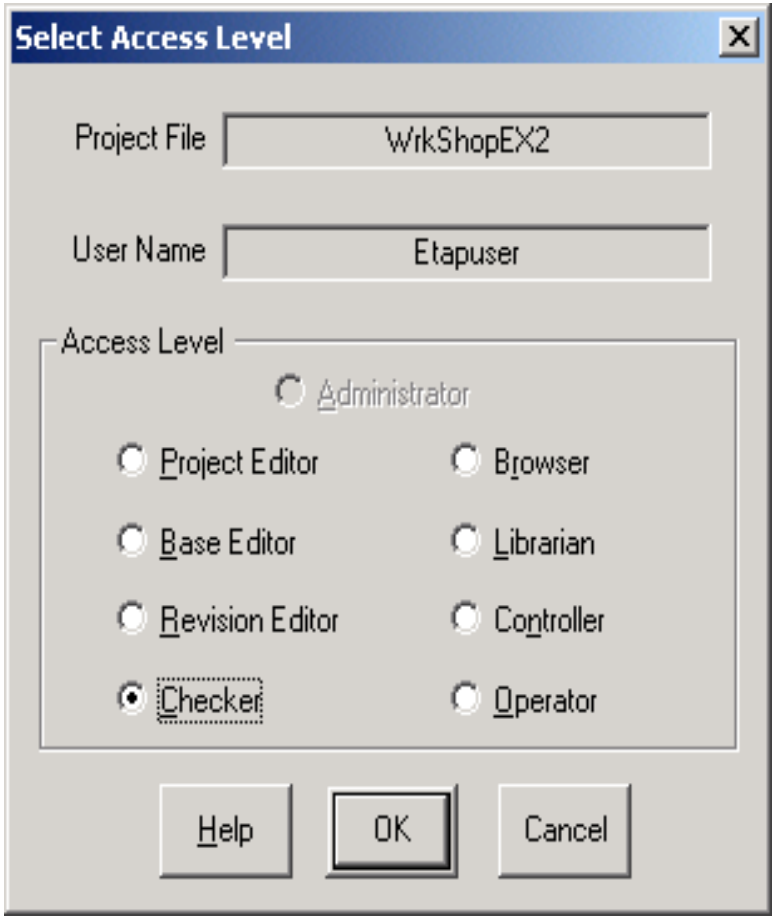
User Access Management

Checker

	Can Check	Cannot Change
User Access Management		X
Project Data / Defaults		X
Base Data	X	X
Revision Data	X	X
Group 1 Changes		X
Group 2 Changes		X
Group 3 Changes – Can Change		
Configuration Status		X
Library Data		X
Library Path		X



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Circuit Arrangements

- Radial System
- Loop System
- Primary Selective System
- Secondary Selective System

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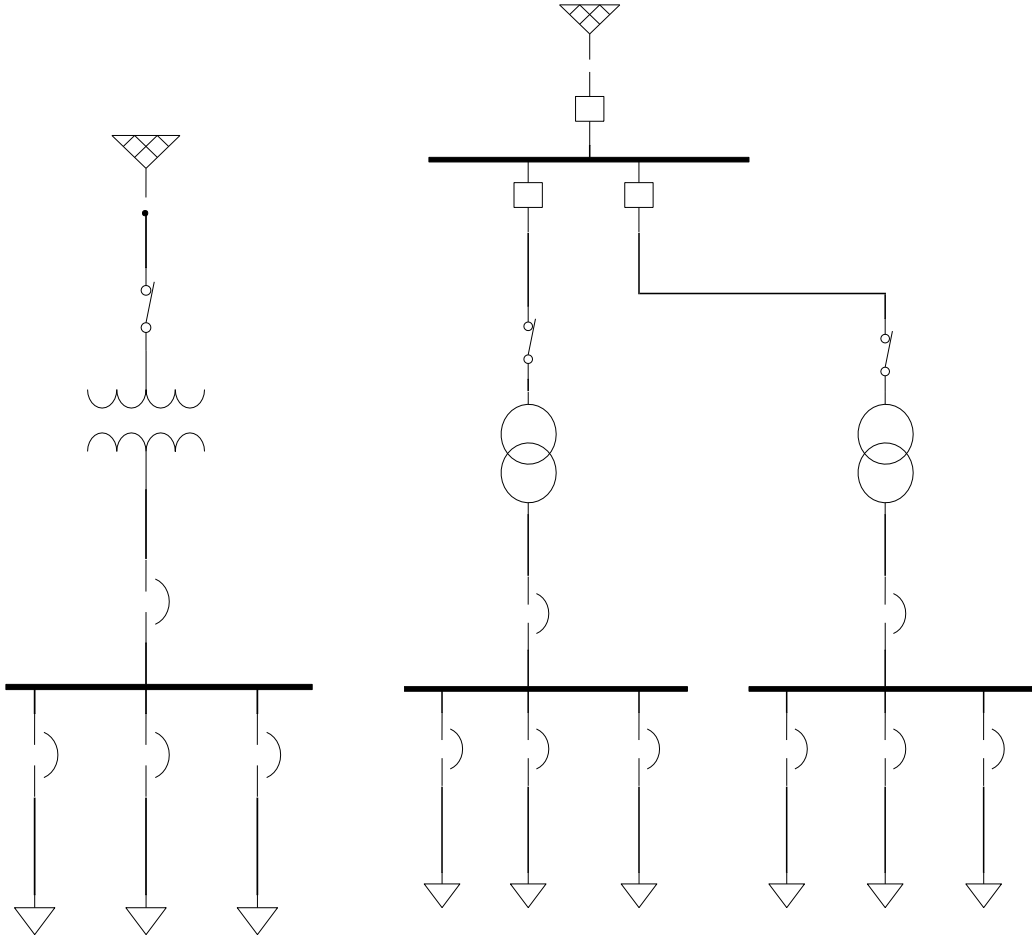
Radial System

- Simple or Expanded Radial
  - Inverted tree
  - No duplications
  - Least Expensive
  - Simple in operation
  - Easy to analyze



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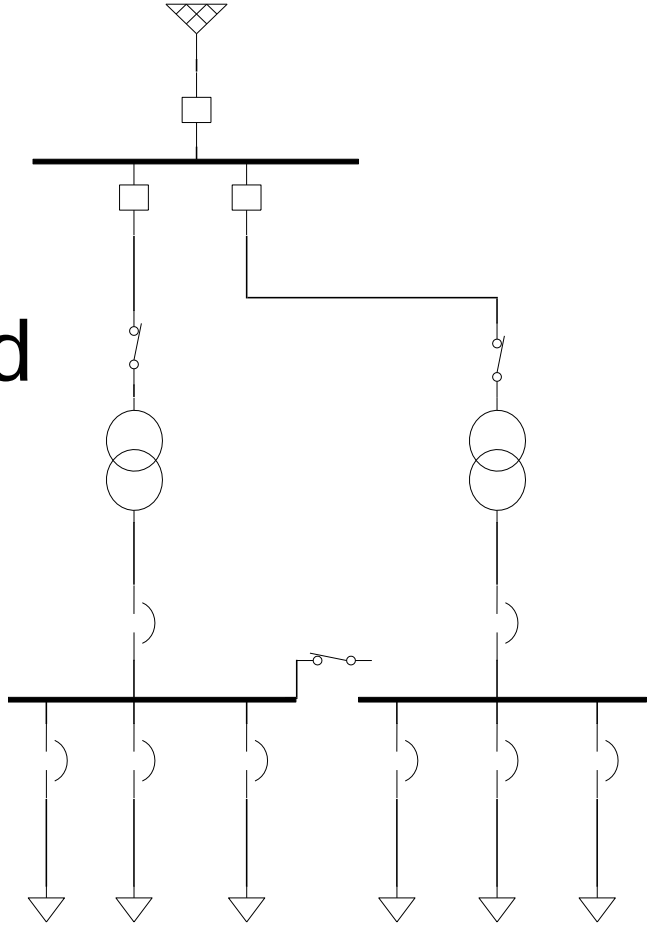
Loop System

- Interconnected / Open Point
- Loads are tapped of the loop
- Loop could be open or closed
- More difficult for analysis
- Reliable



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Primary Selective System

- Each transformer is supplied by two sources
- Normal operation is to supply half the load from one source
- Manual or Automatic transfer of load
- Recommended

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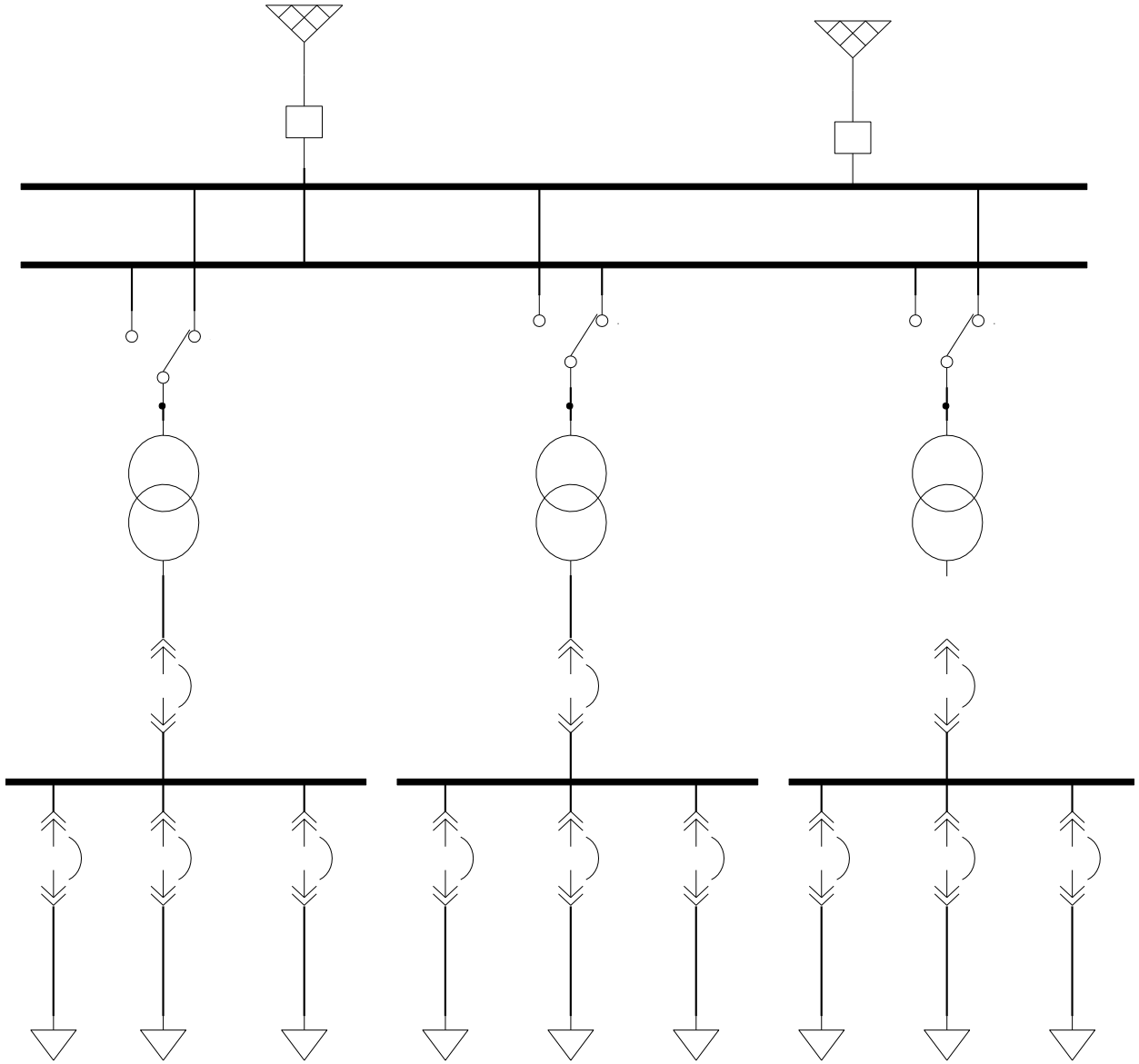

Primary Selective System

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Secondary Selective System

- Each load can be supplied from either one of the transformers
- The tie breaker is usually normally open
- If one of the transformers is out of service, the tie breaker is closed and the total load is supplied by the remaining transformer
- Very reliable system

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