GRIDSIGHT MANUAL

ELECTRIC POWER ENGINEERS, INC.

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TABLE OF CONTENTS

1 INSTALLING AND OPENING GRIDSIGHT

This section dictates what software and hardware is needed for using GridSight and also instructs the user how to open GridSight.

1.1 HARDWARE REQUIREMENTS

If the user hosts their modeling on-site, the following are the recommended hardware requirements:

- Server:
  - Processor: Intel Xeon 3500 series or above or Intel Core i7-3770 or above,
  - Memory: 8 GB Minimum, 16 GB recommended,
  - Storage: Size 500 GB minimum, 1 TB recommended; Technology: SSD recommended.
  - Network: 100BASE-TX Ethernet minimum, 1000BASE-TX recommended
- Advanced User:
  - Processor: Intel Core i5 or above,
  - Memory: 3 GB or above
- Field personnel access:
  - Most tablets and phone devices

1.2 OPENING GRIDSIGHT

The typical user only needs to install a web browser and connect to the local virtual private network (VPN) where the model is stored. It is recommended to use Google Chrome or Firefox by Mozilla. The user then needs to navigate to the following address: http://gsdev.epeconsulting.local/. The user will then need to enter the correct username and password.

2 NAVIGATING GRIDSIGHT

The following tools will allow the user to explore the model in GridSight and look up information needed for operations and engineering purposes.

2.1 ZOOMING AND PANNING

Use the mouse wheel or the + and – signs on the right to zoom in and out of the model. To pan, click and drag the map in the desired location.

2.2 RETURNING TO HOME SCREEN

Use the Home symbol on the right side of the screen to return to the original view of the model at any time.

2.3 Restore Session

In order to continue from the exact same session in which the user was exploring before closing the software, GridSight has the ability to restore that session by checking Restore Session in Tool > Settings.

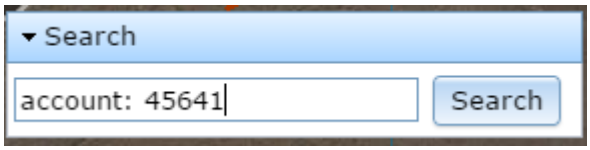
2.4 Search For a Location / Element

There are various different ways within GridSight to search for a particular location or device. Listed below are the different command prefixes for the search bar as well as specific instructions on how to use them.

Note: all command prefixes are case sensitive

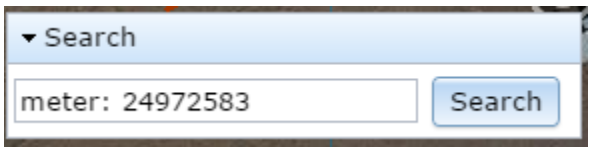
2.4.1 Search by member account number

- account: ##### (5)



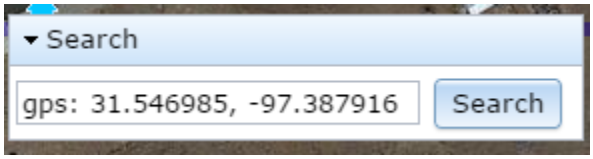
2.4.2 Search by meter number

- meter: ######## (8)

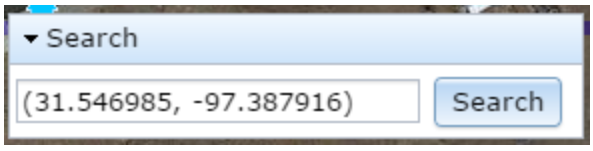


2.4.3 Search by GPS coordinates

- gps: latitude#, longitude#

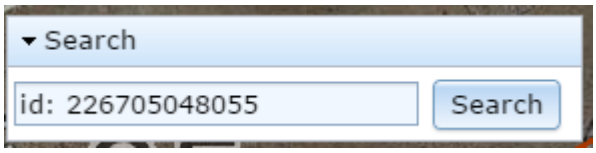


- (latitude#, longitude#)



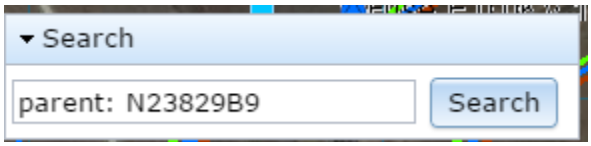
2.4.4 Search by object ID

- For consumers, this is the map location (grid) number. It is recommended to use this search method for finding members considering that some of the members are GPS corrected upon import into GridSight.
- id: objectID#



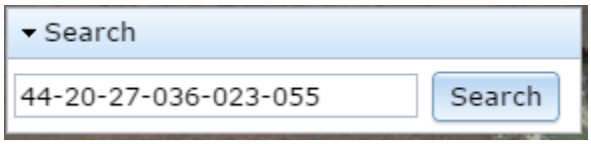
2.4.5 Search by parent

- This search will return all of the objects connected to the parent.
- parent: objectID#



2.4.6 Search by map location (grid number)

- There are two formats for this search. For the North you can search with and without the major grid number: 44-XX-XX-XXX-XXX-XXX or XX-XX-XX-XXX-XXX. The dashes do not have to be included. The South maplocs can be searched similar to the first search function including the major grid number.



2.4.7 Search by address

- One an address is entered into the search bar, GridSight will attempt to find the nearest location to what is currently being viewed which has the same address as what is entered.

2.5 Zooming to a Substation/Feeder

Go to Legend> Feeders for choosing to see only an entire substation or feeder. Click on the feeder's name and GridSight will highlight the area of interest. Bay highlights, issue highlights and the overall network can be dimmed or toggled in the legend tab by editing one of the three sliders at the top of the legend dialog.

2.6 Changing Base Map View

If the user is interested in seeing a particular view behind the mapping diagram, the user can change the base map to show the background in which they are interested, including topographical, satellite images, roads and rivers. This can be done by going to Tools>View and clicking on the desired base map. Note that some base maps have a higher zoom capability than

others. Those with lesser zoom capabilities will disappear from view when the max zoom for that base map is exceeded.

2.7 Street View

In areas where Google Maps™ has street view enabled, the user can see a ground level view of the desired area. To do this, first enable one of the Google™ base maps, then click and drag the orange person symbol located in the left of the screen (sometimes it is hidden behind the legends tab) to the street at the desired location. If the symbol cannot be clicked and moved, then street view is not available in that area.

Note: Street View is typically limited to heavily populated areas (Dallas, Waco, Austin, etc.)

2.8 Using the Legend

Under the Legend window, the user can check or uncheck specific parts of the legend, including Loads, Equipment, Lines and Grid to choose what is shown in the users view. As the zoom level is increased, new elements will appear both on the map and in the legend.

2.9 The Analysis Window

In the Analysis menu, the user can see the Voltage or Thermal violations that result when the Voltage Deviation Threshold or Thermal Threshold value is exceeded. The threshold values are set by the user. Also the results can be displayed in a chart by choosing Chart. The user can choose between Voltage issues and Thermal issues to be displayed in the chart. The chart is linked with the model and the user can easily find the location of the issue by just clicking on that issue in the chart. By clicking on Refresh Results, both Chart results and Report results can be refreshed if checked.

2.10 The Info Window

The info window appears once the user has clicked on an item in the model. Here, all the information about the selected object is available, including the object type, ID, parent ID, and many others. Items that are underlined can be clicked in order to locate the respective item. By clicking parent for example, the object's electrically connected parent is then selected and its info screen will then appear. If the user selects the intersection point between two objects, then both will be highlighted however only one item's info will appear. The user can select which item's info will appear by clicking on the arrows in the upper section of the info window. Many of the properties shown in the info window can be changed when editing mode is enabled (see section 3).

Note: Items do not have to be touching visually in the model in order to be electrically connected

Note: In Power Factor section of the INFO window, parenthesis around the value indicates that the power factor is negative.

3 USEFUL TOOLS

The following are several tools in GridSight that the user may need on a daily basis:

3.1 MEASURING DISTANCE

Go to Measurement and choose which of the following buttons the user needs:

These tools are Area, Length and Coordinates, respectively.

Use the measuring tool by clicking the area you want to begin with and then click the end point of the line you want to measure.

An area can also be selected to see how many acres the selected area is.

3.2 COUNTING CUSTOMERS

Select the line section that the user is interested in number of its consumers or loads. In the Info window, the user will see the Load Count and Distance from Bay tool. Click this and the Messages window will display the number of customers past this line section, in addition to listing the customer numbers and highlighting in purple all downline elements.

> Note: This would give the user some clues in cases that a sudden change in voltage or current appears.

4 TOPOLOGY EDITING

The following tools will enable the user to edit the models in GridSight, provided the user has editing access. The user should select Tools>Topology Editing and check the button Enable Editing in order to begin.

> Note: Objects are electrically connected through their parent/child properties. Moving an object visually away from its electrical parent or child will not change its electrical connection to that object. Changing an object's electrical connection to other elements must be done manually by changing the parent ID field in the edit window.

4.1 EDITING PROPERTIES OF AN EXISTING SINGLE LINE

After the user enables editing, the user should select the line of interest. A dialog box will pop up and allow the user to edit the properties of that line section, which will be highlighted. This includes changing the conductor size, voltage or phasing of a line.

Selecting Lines

Lines can be selected by clicking anywhere along the desired line. To **highlight multiple lines**, click on a vertex connecting any two or more line objects. All lines connected to the vertex will be highlighted, however the selected line will show its other vertices. The user may switch between selected lines by clicking on the arrow in the edit window.

> Note: For points containing equipment/customer objects and line objects in the same location, use the arrows at the top of the edit window to select the desired object.

4.2 MOVING LINES

Lines can be moved by selecting the desired line then clicking anywhere that is not a vertex or midpoint (grey and white dots) on the line and dragging the line to the new desired location. Click save in the edit window to complete the move or select dismiss to undo any changes before a save.

4.2.1 Vertex Editing

A vertex can be identified by the grey dots located on either side of a straight line segment. By clicking and dragging the grey dot the user can move the line while keeping the line segment's other vertex in place. A vertex may **snap** to any other line's vertex or midpoint as well as poles and other objects by holding **control** and releasing the mouse button once a red X appears on the desired snap location.

4.2.2 Midpoints

Midpoints can be identified by the white dot located between two vertices. These are very useful for adding more detail to lines. Midpoints can be moved just like vertices. Once moved, a midpoint becomes a vertex and two new midpoints are generated. To undo a midpoint move, **right click** on the newly created vertex and select delete.

> Note: These are useful for creating curved lines or snapping long line segments to poles.

4.2.3 Join and Split

Joining two lines takes two connected line objects and creates one combined object. To join two lines, select their shared vertex (connection point) and click Join in the edit window. By joining two lines, the child line inherits the properties of the parent line. To undo a join or split a line, **right click** on a vertex and click split. The properties of the two lines will be the same. Split is necessary for inserting equipment on a long line or creating a tap line off of a main line at the split location.

> Note: Join cannot be executed on a vertex with more than two connecting lines.

> Note: Join and split do not change the physical appearance of the lines.

4.2.4 Flip

Flipping a line changes the direction of the line arrow. To flip a line, select the line and click flip in the edit window.

> Note: Flip does not change a line's electrical connection (parent / child properties).

4.3 Adding a New Line

To insert a new line, first select the line or equipment that is to be the parent of the new line (this copies all the necessary properties for the new line segment) then navigate to Tools>Topology Editing and check the Insert New Assets box. In the toolbox that appears, select any line icon then snap to the end vertex of the desired parent line by holding **ctrl** and clicking on the vertex. From here, the user may add as many vertices as desired by single clicking on the map at the desired vertex location. The distance between the last created vertex and the cursor is shown to the right of the cursor. To end the line, **double click** on the final vertex and click save after selecting the desired properties. By default, the new line will have the same properties as the parent line and point in the direction it was created. To undo a line creation before clicking save, click delete in the edit window.

> Note: A parent line is not necessary for line creation, however it is recommended for proper electrical connections.
>
> Note: To measure the length of the entire line while creating, go to the Measurement tab and click on the length measurement icon before creating the first vertex. This length will be displayed in the Measurement tab while the line is being created.

4.4 New Load

To insert a new load, select the correct load type in the toolbox under Tools>Topology Editing and click on the correct location in the map where the load is to be placed. In the New Asset window that appears, enter in all the correct properties for the load and click save.

> Note: This is mainly for loads that may have been missed or did not import correctly. Most loads will be inserted after completing a Member Sync.

4.5 Adding Other Equipment (Transformer, Regulator…)

To insert an equipment, first select the line that is to be the parent of the new element then navigate to Tools>Topology Editing and check the Insert New Assets box. In the toolbox that appears, select the appropriate equipment icon then snap to the end vertex of the desired parent line by holding **ctrl** and clicking on the vertex. The user should then make any necessary changes to the properties in the edit window and then click save.

> Note: A parent line is not necessary for equipment creation, however, it is recommended for sound electrical connections.
>
> Note: Specifically, for inserting Motors, usually more information is required. After defining its parameters, the user can click on the equipment Ref. that appears in the motor's info window and define the other related properties, including NEMA Code and horse power. It's worth to mention that if the value for KVA per HP is known, then there is no need for choosing a NEMA code. This code is overridden only if the KVA per HP is unknown for the user.

4.6 Checking Edits

This section is very important to ensure proper electrical connections throughout the model so that the simulator will run properly. There are two main methods that can be used to ensure proper connection.

4.6.1 Load Count Method

After completing a small section of edits, select a main parent line for that section and run a Load Count. Use the purple highlights to ensure every element that is supposed to be downline from the parent line is highlighted in purple. If there are non-highlighted lines that are supposed to be downline from where the load count was ran then there may be an issue in that element's parent field. For instructions on how to run a Load Count see sec 3.2.

> Note: This method only checks for errors in parent/child connections.

4.6.2 Simulator Method

This method is recommended to be used after completing edits on a large area such as an entire feeder or substation. To check for possible phase errors or issues in parent/child relationships, run a Voltage Drop on the feeder in question. If there are any errors in phasing or connections the Messages window will indicate these issues with a red X to the left of the message. Copy the ID of the error in the messages window and paste into an ID Search (sec 2.3.4) to navigate to the error. For instructions on how to run a Voltage Drop see sec 8.2.

> Note: This is not a complete system check. It is still possible that elements could be assigned to wrong sections or have wrong phasing. It is recommended that consumers be spot checked while editing to ensure a true, properly modeled system.

5 Equipment Catalog

GridSight has a catalog of equipment saved for default use. When additional equipment needs to be added to the catalog, the user must have the correct privileges to add equipment to the catalog.

5.1 Adding New Equipment to Catalog

Once the properties of the conductor, such as impedances, are available, go to Tools>Equipment Manager to add in the respective properties of the equipment. The user is responsible for verifying the accuracy of the data for any equipment that is added.

6 IMPORTING DATA

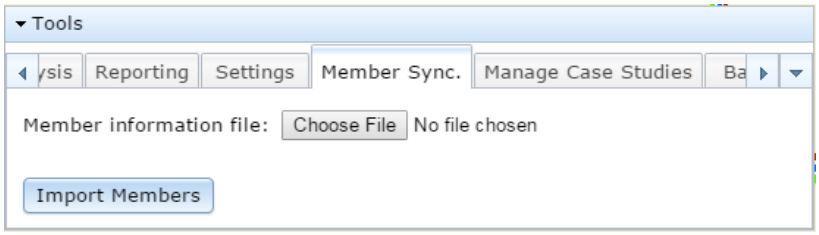
The following section will assist the user in importing new data, including new billing files or new customers.

6.1 IMPORTING A NEW BILLING FILE

Go to Tools>Demand Analytics and click Import Billing File. Browse to the location where the new file is saved and give it a correct time stamp to know what it represents. The time stamp given to the Billing File simply serves as a name to identify the Billing File that has been imported and does not factor in to calculations. Billing files are .txt files with consumer usage measured in Kilowatt Hours.

6.2 IMPORTING NEW CUSTOMERS

Go to Tools>Member Synch, click on Choose File and Browse to the location where the new files are saved that include the new customers information. This function will only add the new customers in the file and keep the existing customers as they are shown.

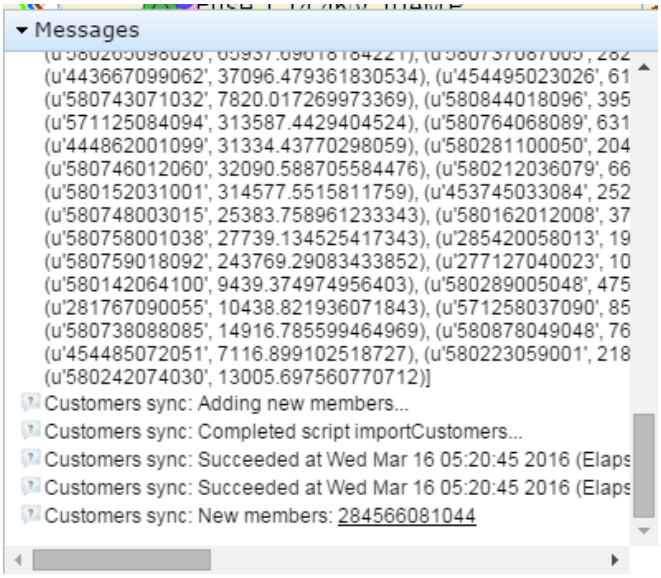


The member import file is a zip file that contains three csv files:

- ✓ Daffron customer information file, which should be called “epelocinfo.csv”
- ✓ Daffron transformer information file, which should be called “epexfmers.csv”
- ✓ Meter information from Landis+Gyr Command Center, which should be called “report.csv”

- ❖ Note that the first one is mandatory and the last two are optional. Also note that the file names should be exactly as noted.
- ❖ New members that are staked can be added into GridSight even before being assigned a meter.
- ❖ Once assigned a meter and the member is being supplied power, the meter data can be synced from L+G in order to be assigned a load based on consumption.

The new customers that have been added will be shown in the Messages window. Existing customer symbols that have been moved by the user will not be moved by a member import.



7 LOAD ALLOCATION

After importing a billing file, the load should be appropriately allocated before running any reports.

7.1 IMPORTING A LOAD ALLOCATION FILE

Go to Tools>Demand Analytics and click Import Bay Loading File. Browse to the location where the bay loading file is saved and select it. Bay Loading files are in Kilowatts and represent the total watt demand per bay in the model. Bay Loading Files usually include some historical data as well as projected load values. Importing a new Bay Loading file automatically overrides any existing data that contains an identical time stamp.

7.2 ADDING / UPDATING A LOAD PROFILE

To update or add a load profile, go to Tools>Demand Analytics and click Add/Update Load Profile. Enter the name of the load profile you would like to update or create a new name to create a new load profile. Be sure to name the new load profile something memorable or representative of the time stamp in order to easily reference the load profile when running the simulator.

8 VOLTAGE DROP

In order to run or select a previous voltage drop calculation, the user should go to Tools>Power Flow Study.

8.1 SELECTING A PREVIOUS VOLTAGE DROP STUDY

- Go to Tools>Power Flow Study.
- Under Case Study Name, Substations and Bays choose the case and the substations in which the user is interested.
- Click on Run Case Study.

8.2 RUNNING A NEW VOLTAGE DROP STUDY

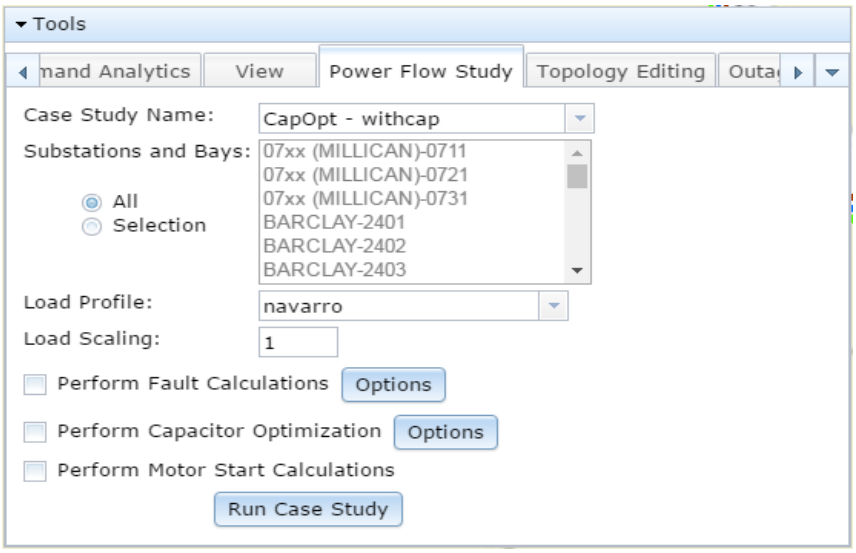
- Go to Tools>Power Flow Study.
- Under Case Study Name, type a name for the new study. Be sure to name the study something memorable or representative of the time and location of the study for future reference.
- Select All or make a selection of the feeders the user wishes to include.
- Next, select the Load Profile the user wishes to run.
- If the user wants to scale the load up or down, the user should enter an appropriate value in the Load Scaling Box. Otherwise, the value should be left at 1, where the load will be left as is.
- Click on Run Case Study.
- After running is complete, all the messages about the study will appear in the Messages dialog.

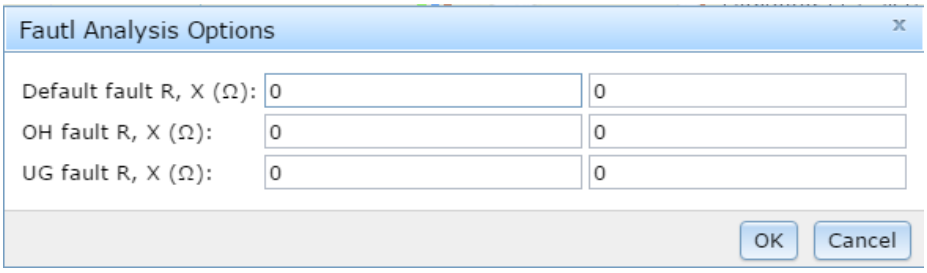
8.3 RUNNING A NEW SHORT CIRCUIT STUDY

- Go to Tools>Power Flow Study. As it can be seen in the picture below, there are three different studies that can be performed. Check Perform Fault Calculations (Short Circuit). Click on its Options tab and enter different properties that is asked for, such as:
  - Default fault: The default fault occurring on all the conductors.
  - OH fault: The fault occurring on an overhead conductor.
  - UG fault: The fault occurring on an underground conductor.
- Click on Run Case Study.

  Note: Please beware that this study requires a longer runtime.

- Click on Run Case Study. The information about the capacitors (phase and bank size) and the place in which they should be inserted will appear in the Messages dialog.

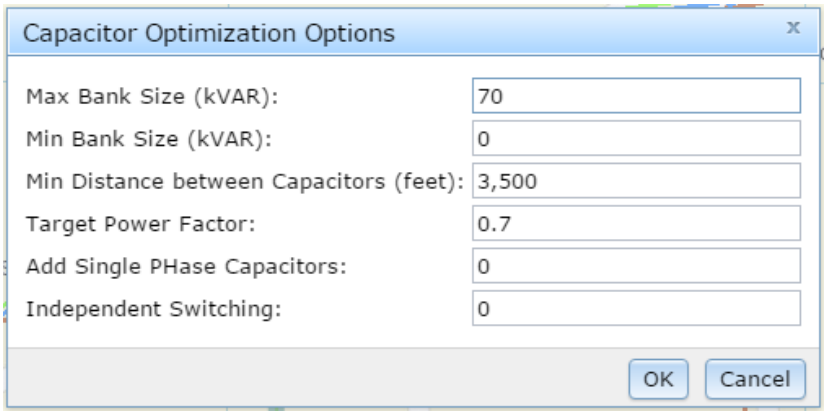




8.4 Running a New Capacitor Optimization Study

- Go to Tools>Power Flow Study. Check Perform Capacitor Optimization. Click on its Options tab and enter different properties that is asked for, such as:
  - Max Bank Size (KVAR): The maximum size of the capacitors bank,
  - Min Bank Size (KVAR): The maximum size of the capacitors bank,
  - Min Distance between Capacitors (feet): Although there might be multiple demands for capacitors in a circuit, there must be a minimum distance between them for capacitor optimization.
  - Target Power Factor: The power factor which is the target of adding the capacitor.
  - Add Single Phase Capacitors: Issues may happen in only one phase of a three phase line. For this reason, it's better to be able to add a single phase capacitor in location of the issue. (Set to 1 if capacitors can be allocated on a single phase basis.)
  - Independent Switching: Issues might be different and change differently. So they need different capacitors. For this reason, it's better to be able to switch them independently. (Set to 1 if the capacitors are to be inserted as switchable.)
- Then click on Run Case Study. The information about the capacitors (phase and bank size) and the place in which they should be inserted will appear in the Messages dialog.

Note: There are two cases for this study and there is a report for each of them. One Capacitor Optimization before capacitor placement, and one Capacitor Optimization after capacitor placement. By having both of the reports the user can compare the situations and check if the placement is good enough.



8.5 Running a New Motor Start Study

- Go to Tools>Power Flow Study.
- Check Perform Motor Start Calculations.
- Click on Run Case Study.

Motor impedance calculation:

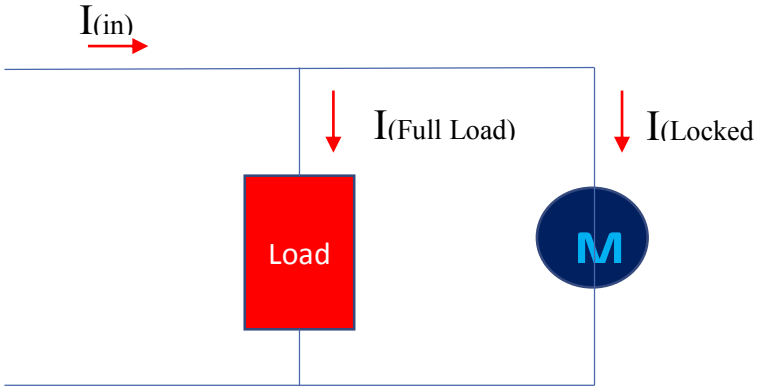
1) $V_{Bus\ (load)} = V_{Bus\ (motor)}$

2) $I_{Locked\ Rotor} = ((Hp \times KVA/Hp)/V_{Bus\ (motor)}) \times (Pf_{Motor} - jSin(arcCos(Pf_{Motor})))$

3) $I_{Full\ Load} = \frac{Kw_{Load}/Pf_{Load}}{V_{Bus\ Load}} \times (Pf_{Load} - jSin(arcCos(Pf_{Load})))$

4) $I_{in} = I_{Locked\ Rotor} + I_{Full\ Load}$

5) $Z_{total} = \frac{V_{Bus}}{I_{in}} \qquad (Z_{total} = Z_{Motor} || Z_{Load})$



8.6 Deleting a Previous Voltage Drop Study

In the user wishes to delete a previous voltage drop study, go to Tools>Manage Case Studies. Select the appropriate study that the user wishes to delete from the drop down study. Next click the Delete Case Study button to delete the study.

8.7 Checking Power Factor Correction on a Feeder

In addition, if any Large Loads are on the feeder, make sure their power factors are also correctly modeled. Any capacitor banks should also be correctly represented. To check the corrected power factor at the beginning of a feeder, run a voltage drop. Once the calculation has finished, the user can either check the conductor just out of the substation or the voltage drop report to determine the corrected power factor.

9 Analysis and Reporting

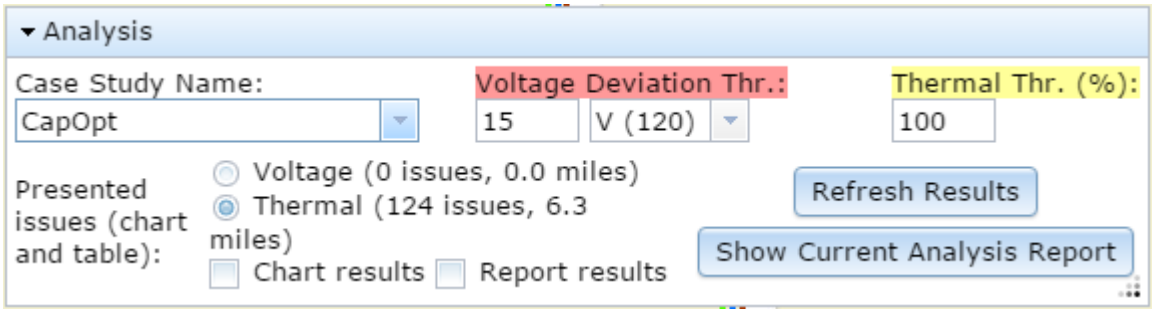
This section will allow displaying the analysis results and exporting the reports generated by studies performed by the user.

9.1 Displaying the Current Report

Go to Tools > Reporting. Next click the Generate Report File button. By Going to Messages window and clicking on a link that appears in the messages, the latest report for the latest study completed will open in a new tab in the user's browser.

9.2 Displaying the Results on the Mapping Diagram

Go to the Analysis window. Choose the latest study to see the results. Next enter the limits in Voltage Deviation Thr. And Thermal Thr. Boxes, based on which voltage deviations or thermal overloads are highlighted. In addition, the checkboxes can be chosen for charting or reporting results. The user should click Refresh Results to show the results on the diagram.



9.3 Clearing the Current Analysis Highlighting

If the user wishes to clear any analysis highlighting, the user should go to Tools>View. Next the user should choose the Clear Analysis Highlighting in order to clear the map of any highlighting.