

Welcome to PowerNet Software



Version 5.11

from



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Quick Start

The quickest way to get up and running in using PowerNet is to open the sample circuit files provided with the installation. These are normally located in the *Circuits* folder under your documents folder.

- Familiarize yourself with the function of the toolbar buttons by slowly mousing over them, noting the tool tips and watching the status bar messages. Do the same with the symbols on the [symbols panel](#).
- Open a sample circuit. Mouse over the symbols and note the tool tips and status bar messages.
- If the circuit is not active, click on the calculate button . The meter panel should appear. Mouse over the circuit diagram symbols and watch the data tips. Select a symbol and read the meter panels and status bar.
- Try moving individual lines and symbols by left clicking on them and dragging them to different screen positions. Try copying them by holding down the [Ctrl] key while dragging the symbols or lines to another position.
- Add a new symbol by selecting a symbol from the symbols panel and dragging it to an empty area on the screen.
- Add a new line by mousing over a snap grid position until the cursor turns to a crosshair icon. Left click and drag the cursor to the desired end point.
- Double click on a circuit diagram symbol to bring up the [properties panel](#). Modify the symbol data, calculate the circuit and observe the effect on the electrical data.

If you encounter any difficulties doing any of the above, please refer to the appropriate section of this help file.

Using PowerNet

The use of PowerNet consists of three basic steps:

1. Drawing the circuit diagram.
2. Entering data for all symbols in the diagram.
3. Calculating the circuit.

Drawing the Circuit Diagram.

The circuit can be any actual circuit consisting of standard electrical devices, cables and equipment such as loads, generators, motors, etc. The circuit is represented by drawing symbols and connecting lines on the screen circuit display area. The result is a single line diagram.

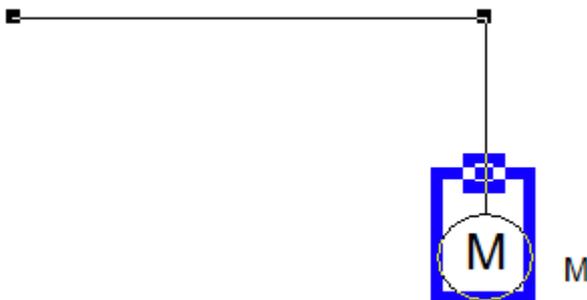
To draw a symbol, click on a symbol on the [symbols panel](#) and drag the mouse cursor to the desired position on the screen. Release the mouse button to draw the symbol.

Connecting lines are started by positioning the mouse cursor on a grid point where it turns into a cross-hair cursor. Click and hold the left mouse button and move to the desired endpoint. Note that lines may only be drawn between snap grid points. Snap grids may be displayed by clicking on the Snap Grid Button .

Connecting lines may only be drawn as vertical or horizontal lines. When crossing over other lines, the line being drawn automatically crosses over (no connection) the other line. To cross-connect, terminate the line on the other line.

Selecting Symbols and Lines

Left click on any symbol or connecting line to select. Markers are used to show selections on the circuit diagram. To select multiple lines and symbols, hold the [Shift] key while selecting each symbol and line in turn.



Motor symbol with a marker. Horizontal connecting line with end markers.

Entering Data.

Data for all the symbols must be entered before circuit analysis may be performed. To enter data for a symbol, double click on the symbol. This will activate the [Properties Panel](#). Most of the data entry fields in this form are required, although some, such as the Label and Description fields are not.

A helpful feature of PowerStar is the [Database](#). By clicking on the  button in the [Properties Panel](#), a Database Box is activated. By clicking on menu drop down lists and selecting from the main list, the data entry fields on the panel are automatically filled in. Of course, some fields such as cable lengths must still be filled in manually.

Another helpful feature is the  button. Clicking on this button will automatically fill in the data entry fields with values from the last form edited and saved as default using the  button.

Calculation.

Calculation is started by selecting *Circuit/Calculate* from the menu or clicking on the Calculate Button  on the Circuit Toolbar. This will start the analysis and error checking process.

When the calculation is completed, the [meter panel](#) is displayed. Mouse-over any symbol to show voltages, current kva, kw and power factor on a [data tooltip box](#), or select a symbol or connecting line to display data on the [meter panel](#).

Display Result.

Electrical data can be displayed using the [meter panel](#). Select any symbol by clicking it to show voltages, current kva, kw and power factor on the meter panel. Hover the mouse on any part of the circuit to show device info and electrical data in a [data tip window](#).

A [text report](#) on the circuit can be displayed on screen. The report can be saved in *rich text format (RTF)* or *Microsoft Word Format (DOC)* which can be read in Microsoft Word or most other word processing software for further formatting and editing.

Keyboard Shortcuts

Following are tables of keyboard shortcuts. Many of the shortcuts can speed up PowerNet operations like zooming the circuit display.

Edit Operations

| <i>Menu</i> | <i>Keyboard</i> | <i>Action</i> |
|-------------|-----------------|-------------------------------------|
| Copy | Ctrl+C | Copy object to clipboard |
| Cut | Ctrl+X | Delete object and save to clipboard |
| Paste | Ctrl+V | Paste object from clipboard |
| Undo | Alt+BkSp | Reverse the last operation |
| Delete | Del | Delete selected object |

Common Operations

| <i>Menu</i> | <i>Keyboard</i> | <i>Action</i> |
|-------------------|-----------------|----------------------|
| Circuit Report | Ctrl+R | View circuit report |
| Circuit Calculate | F8 | Calculate circuit. |
| Device Data | Enter | Show device data |
| View Grid | Ctrl+G | Toggle Grid display |
| Help | F1 | Display help |
| Close Window | Alt+F4 | Close current window |

Zoom Operations

| <i>View Command</i> | <i>Keyboard</i> | <i>Action</i> |
|---------------------|-----------------|------------------------|
| Zoom In | [+] | Increase magnification |
| Zoom Out | [-] | Decrease magnification |

Mouse Techniques

In addition to the standard functions of the mouse in Windows, there are several additional functions of the mouse in PowerNet.

Device Information - Mouse over a symbol to display a tool tip with information such as label, name, device class, connection. Clicking on a symbol will display information on the Status Bar. A double click on the symbol activates [Properties Panel](#) that displays more detailed information on the device.

Entering or Editing Device Data - A double click on the symbol activates [Properties Panel](#) for filling in or editing ratings and other properties.

Device Selection - A left click on a device symbol selects that device and draws a gray rectangle around it. A small rectangle is also drawn on the head connection end of the symbol to differentiate it from the tail end. To select a group of device symbols, hold the shift key while clicking each symbol in turn.

Drawing Symbols - Click on a symbol button on the [symbols panel](#) and drag the cursor to the desired position on the screen. Note that the cursor changes to indicate the final symbol position. Release the mouse button to add the symbol to the circuit diagram.

Drawing Connecting Lines - Mouse-over a grid position changes the cursor to cross-hairs. Clicking on the snap grid position and dragging the mouse cursor across the screen produces a rubber banding line. Releasing the mouse button draws a connecting line.

Group Selection - A selection box may be started by clicking on a space away from snap grid positions. Holding the left mouse button while dragging the mouse across produces a rubber banding selection box. Releasing the mouse button will select all devices, lines and graphics objects inside the box. Also, holding the [SHIFT] key while clicking on several symbols in turn will select the symbols.

Moving a Symbol or Group - Clicking on any selected symbol and dragging the mouse cursor across the screen before releasing the mouse button will move the symbol or group of symbols to the new position. Note that symbols may not be moved to a position that is already occupied by another symbol.

Duplicating a Symbol or Group - Pressing the [CONTROL] key while clicking on a selected symbol and dragging the mouse cursor across the screen before releasing the mouse button will copy the symbol or group of symbols to the new position. Note that symbols may not be copied to a position that is already occupied by another symbol or line.

Middle mouse button - Click the middle mouse button to toggle between select (arrow cursor) and pan mode(hand cursor). In pan mode, you can grab the circuit and move it around the screen.

Mouse Wheel - When in pan mode, the mouse wheel serves as zoom in/zoom out control. In select mode, the mouse wheel serves as vertical scroller.

File menu commands

The File menu offers the following commands:

| | |
|-------------------------------|---|
| New | Creates a new document. |
| Open | Opens an existing document. |
| Close | Closes an opened document. |
| Save | Saves an opened document using the same file name. |
| Save As | Saves an opened document to a specified file name. |
| Print | Prints a document. |
| Print Preview | Displays the document on the screen as it would appear printed. |
| Print Setup | Selects a printer and printer connection. |
| Send... | Sends the active circuit document through electronic mail. |
| Exit | Exits PowerNet. |

Edit menu commands

The Edit menu offers the following commands:

| | |
|----------------------------------|--|
| Undo | Reverse previous editing operation. |
| Cut | Deletes data from the document and moves it to the clipboard. |
| Copy | Copies data from the document to the clipboard. |
| Paste | Pastes data from the clipboard into the document. |
| Delete | Pastes from the clipboard a link to data in another application. |
| Select All | Selects all connecting lines, symbols and graphics. |
| Default Settings | Opens settings box for PowerNet default settings. |

View menu commands

The View menu offers the following commands:

| | |
|--------------------------------|---|
| Symbols | Shows or hides the symbols panel. |
| Meter Panel | Shows or hides the meter panel. |
| Properties | Shows or hides the properties panel. |
| Equipment List | Shows or hides the equipment, cables and devices list panel. |
| Status Bar | Shows or hides the status bar. |
| Toolbars | Shows or hides main , graphics and circuit toolbars |
| Grid | Shows or hides the snap grid.points |
| Zoom In | Increase screen magnification. |
| Zoom Out | Decrease screen magnification. |

Circuit menu commands

The Circuit menu offers the following commands:

| | |
|----------------------------|--|
| Fault | Simulate a fault on the circuit. |
| Calculate | Calculates the electrical circuit. |
| Report | Generates a text report or spreadsheet for this circuit. |
| Symbol Set | Select a symbol set file. |
| Properties | Opens a circuit properties dialog box. |

Symbols Menu

The Symbol menu offers the following commands and applies to the selected symbol in the circuit diagram:

| | |
|-------------------------|---|
| Disconnect | Connects/Disconnects the selected symbol. |
| Invert | Invert symbol.head to tail |
| Rotate Clockwise | Rotate clockwise pivoting on the head point |
| Rotate Counterclockwise | Rotate counterclockwise pivoting on the head point |
| Properties | Opens properties settings panel. |
| Edit Symbol Graphics | Edit symbol by modifying the graphical object components of the symbol. |

Graphics menu commands

The Graphics menu offers the following commands:

| | |
|-----------------|--|
| Select | Tool for selecting symbols, lines and graphics. |
| Grabber | Use for screen pan and zoom |
| Line | Draw line tool. |
| Rectangle | Draw rectangle tool. |
| Round Rectangle | Draw rounded rectangle tool. |
| Ellipse | Draw ellipse tool. |
| Pie | Draw elliptical pie tool. |
| Arc | Draw elliptical arc tool. |
| Chord | Draw elliptical chord tool. |
| Polygon | Draw polygon tool. |
| Polyline | Draw polyline tool. |
| Text | Draw text tool. |
| Arrange | Group/ungroup selections. Move selected graphics layer forward/backward. |

See also:

[Graphics Toolbar](#)

[Graphics Operations](#)

Window menu commands

The Window menu offers the following commands, which enable you to arrange multiple views of multiple documents in the application window:

| | |
|--|--|
| <u>New Window</u> | Creates a new window that views the same document. |
| <u>Cascade</u> | Arranges windows in an overlapped fashion. |
| <u>Tile Horizontally</u> | Arranges windows in horizontal non-overlapped tiles. |
| <u>Tile Vertically</u> | Arranges windows in vertical non-overlapped tile |

Help menu commands

The Help menu offers the following commands, which provide you assistance with this application:

| | |
|-------------------------------------|---|
| Help Contents | Offers you an index to topics on which you can get help. |
| Help Index | Offers you an index to topics on which you can get help. |
| Buy Now | Opens the default internet browser to the PowerNet products page. |
| Enter License Key | Opens an entry form for the activation key. |
| Check for updates/Check Now | Check for new versions of Powernet |
| Check for updates/Check on start-up | Check for new versions of Powernet on starting up. |
| About | Displays the current version number of the installed Powernet software. |

Toolbars

Use this command for instructions about using Help.

Main Toolbar



 Open File - open an existing circuit file.

 File Save - save the current circuit file.

 Edit Cut - cut the selected object and save to Windows clipboard.

 Edit Copy - copy the selected object and save to Windows clipboard.

 Edit Paste - copy the saved object in Windows clipboard to the current circuit.

 File Print - print the current circuit diagram.

 Help About - display PowerStar copyright and version information.

 Undo - undo the last operation.

 Delete - delete the current selection.

Circuit Toolbar



-  Meter panel- show/hide meter panel.
-  Properties panel - show/hide properties panel
-  Graphics toolbar - show/hide graphics toolbar.
-  Snap grids - show/hide snap grid points.
-  Zoom In - increase screen magnification.
-  Zoom out - decrease screen magnification.
-  Disconnect - disconnect the selected symbol from the circuit.
-  Invert - invert selected symbol head to tail.
-  Rotate clockwise - rotate selected symbol clockwise.
-  Rotate counter-clockwise - rotate selected symbol counter-clockwise.
-  Edit symbol - edit the component graphics of the selected symbol.
-  Fault - Simulate a fault condition on a selected circuit node.
-  Calculate - Activate the circuit to show/hide electrical data/load flow.
-  Report - Create and display text report for the current circuit.

Graphics Toolbar



 Selection tool

 Line

 Rectangle

 Rounded rectangle

 Ellipse

 Elliptical Arc

 Elliptical Pie

 Elliptic chord

 Filled polygon

 Polyline

 Text

 Move selection forward one layer

 Move selection backward one layer

 Move selection to front-most layer

 Move selection to rear-most layer

 Group selection - consolidates all selected graphics to one unit

 Un-group selection - breaks down graphics to original components

Circuits

Circuit as used in PowerNet is a single line diagram representing a physical circuit. There must be at least one source (either a generator or a source bus), and one or more power sink such as a load or a motor.

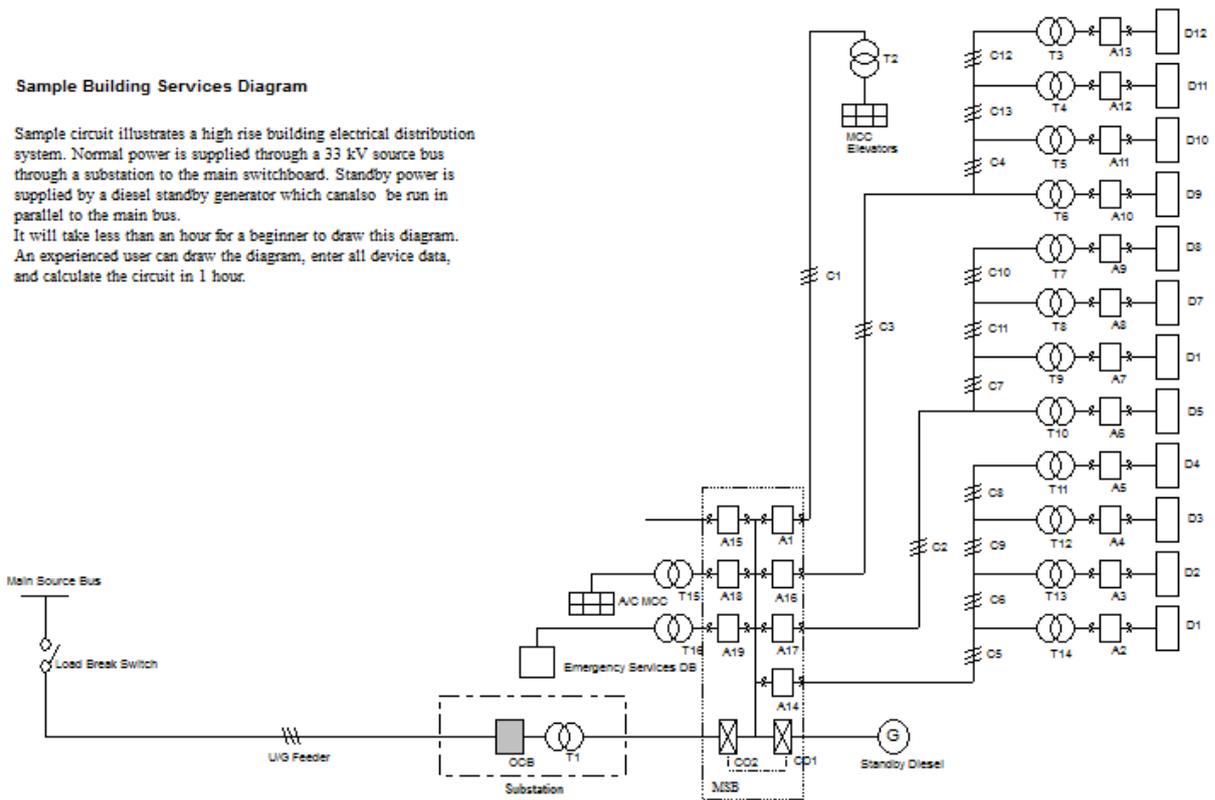
All branches should preferably be terminated through a load, although PowerNet will still correctly analyze the circuit as long as some of the branches are correctly terminated.

All symbols in the circuit must be interconnected into one circuit, either through other symbols or through connecting lines. Two or more independent (not interconnected) circuits are not allowed.

An example of a circuit:

Sample Building Services Diagram

Sample circuit illustrates a high rise building electrical distribution system. Normal power is supplied through a 33 kV source bus through a substation to the main switchboard. Standby power is supplied by a diesel standby generator which can also be run in parallel to the main bus. It will take less than an hour for a beginner to draw this diagram. An experienced user can draw the diagram, enter all device data, and calculate the circuit in 1 hour.



Symbols

Symbols represent any electrical equipment, cables or devices used as components in the circuit. They device be balanced, passive or active and must not be coupled either capacitively or inductively with other components in the circuit. The symbol may be single-ended (3 terminals for three phase) or double ended(6 terminals) excluding the neutral.

Component Class - indicates the classification of the electrical component.

GENERATOR
SOURCE BUS
CABLE
TRANSFORMER
TRANSMISSION LINE
SYNCHRONOUS MOTOR
INDUCTION MOTOR
POWER CAPACITOR
IMPEDANCE
LOAD
DISTRIBUTION BOARD
PANELBOARD
MOTOR CONTROL CENTER
PROTECTIVE DEVICE
CONNECTION DEVICE
NULL DEVICE

Connection Type - Whether the symbol is connected to the circuit on its head or head and tail. The connection is basically determined by the device class, for example, head-tail for cables and transformers and head only for motors, generators and loads.

Phase Connection - The phases connected may be 3-phase, **ABC**, or 3-phase plus neutral, **ABCN**. Single phase connections are not allowed in PowerNet.

Connection Status - The normal status of a symbol is *connected*. It may be *disconnected* or *connected* again by selecting it clicking the Disconnect Button . The symbol is grayed out if it is *disconnected*.

Label - A symbol has a label that is normally shown below and to the right of the symbol on the circuit display. This is also displayed on the Status Bar. When first inserted in the circuit, the label is only a pre-set prefix (such as "T" for a transformer). When you start the calculation process, PowerNet automatically numbers the symbols if the device auto-number option flag is checked. The numbering sequence is left to right, top to bottom. For example, the top leftmost transformer label will now be "T1". The device label may be repositioned by clicking on the label and dragging it to the desired position . The label text may be edited in the [Properties Panel](#).Equipment, cables, devices list panel

Position and Orientation - The symbol head is positioned on a snap grid point. It can be rotated around this point using the rotate buttons  so that it points up, right, down or left. The symbol may be inverted using the invert button  .

Grids and Lines

Grids - All connecting lines and symbols are drawn between snap grids. The position of these grids may be shown or hidden by toggling the Snap Grid Button .

Lines - Connecting lines are drawn by dragging the mouse cursor across the screen while pressing the mouse left button. The line must be started by clicking the left mouse button on a snap grid position.

Note that graphical lines and other graphical elements are ignored by PowerNet when analyzing and calculating the circuit.

Abbreviations

I - Current, amps

I_{pri} - Current, Primary Winding

I_{sec} - Current, Secondary Winding

I₁ - Current at symbol head

I₂ - Current at symbol tail

I_a, I_b, I_c - Line current

I_{fa}, I_{fb}, I_{fc} - Fault current

I_{rated} - Rated Current

I_{st}/I_{fl} - Starting to Full Load Current Ratio

kA - Current, amps X 1000

kA_{sc} - Short Circuit Current X 1000 amps

kW - kilowatt

kVA - kilo-voltamps

kVA_r - kilo-voltamps reactive

MVA_{sc} - Short Circuit MVA

R - resistance, ohms

R/km - unit resistance per km

R/kft - unit resistance per 1000 ft

V₁ - voltage at symbol head

V₂ - voltage at symbol tail

V_d - voltage drop, volts

V_{pri} - voltage, primary winding

V_{sec} - voltage, secondary winding

V_{an}, V_{bn}, V_{cn} - Line to neutral voltage

V_{ab}, V_{bc}, V_{ca} - Line to line voltage

% Load - loading in percent

% R - Percent resistance referred to base impedance

% Tap - percent tap referred to the winding where the tap is located.

% VR - Voltage regulation in percent

% X - percent reactance referred to base impedance

% X₀ - percent zero sequence reactance referred to base impedance

% X₂ - percent negative sequence reactance referred to base impedance

% X' - percent transient reactance referred to base impedance

% X'' - percent sub-transient reactance referred to base impedance

% X_s - percent synchronous reactance referred to base impedance

X - Reactance, ohms

X/km - unit reactance, ohms per kilometre

X/kft - unit reactance, ohms per kilofeet

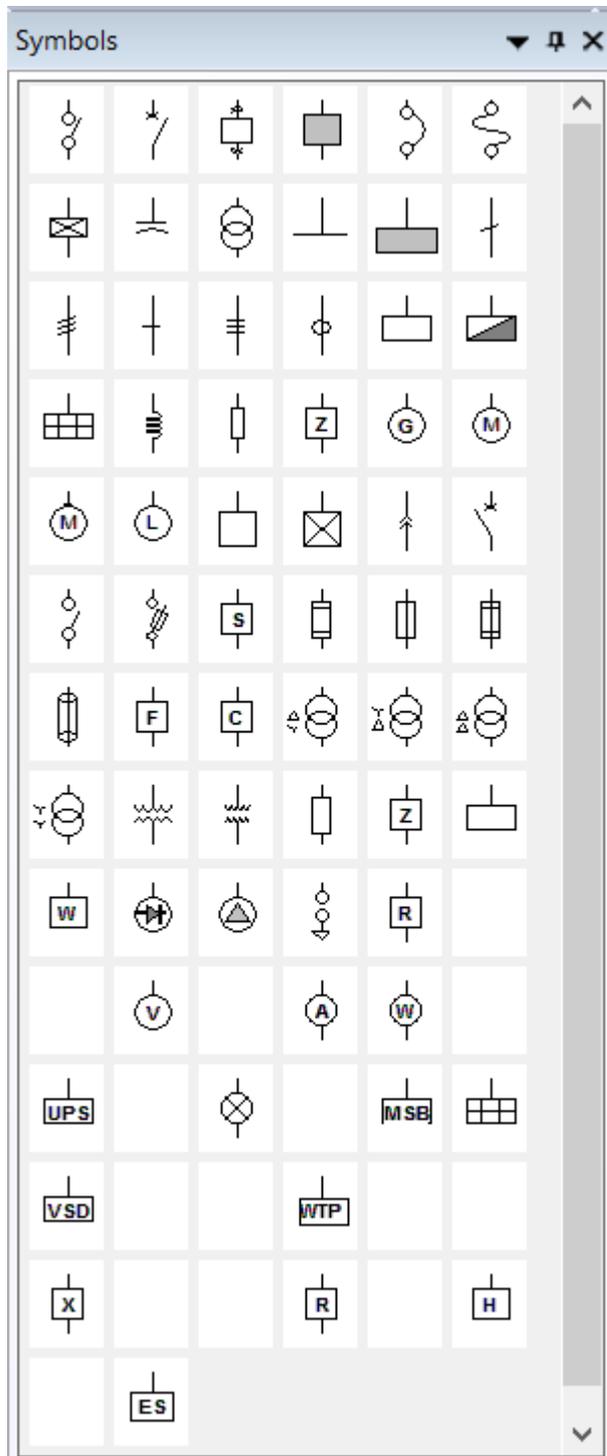
P.F. - power factor

Sets - number of conductor sets in parallel

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Using the symbols panel

The Symbols Panel displays the symbols from a symbol set file which is opened by PowerNet when it starts. You can set the default symbol set file by selecting *Edit / Default Settings...* from the main menu.



Displaying the Panel - Use the symbols button  to show or hide the symbols panel.

Symbol Information - Mouse over any of the symbols to display a tool tip information on the symbol component class or type.

Adding Symbol to Circuit - To add a symbol to the circuit diagram, click on the symbol and drag the cursor to the desired grid location on the screen. Note that the cursor shape changes to indicate the symbol orientation depending on the position of the cursor relative to the snap grid point. Release the mouse button to add the symbol to the circuit diagram.

Adding Symbol from Circuit - To copy a symbol from a circuit to the symbols panel, right click on the symbol and select *Copy to Symbol Set* on the menu. The copied symbol will be added to the end of the symbol set. This function is useful for reusing a symbol that has been edited from within PowerNet.

Editing the Symbols Panel - Right click on any symbol to display a menu which lets you *Cut*, *Copy*, or *Delete* any symbol on the panel. Right click on any symbol position to display a menu to *Paste* from the clipboard or *Insert Blank* on that position.

Move, Duplicate Symbols - To rearrange the symbols, click on any symbol and drag it to its new position. To duplicate a symbol, press and hold the [CTRL] key while dragging a symbol to its new position. A copy of the symbol will be left at the original position.

Saving the Symbol Set - If the symbol set was modified, PowerStar will give you the option of saving it when you close PowerStar. You can save it under the original filename or under another filename.

Manipulating the symbols

To move a symbol on the screen simply click on the symbol and drag it to the new position while holding the left mouse button. Release the button to position the symbol on the closest snap grid point.

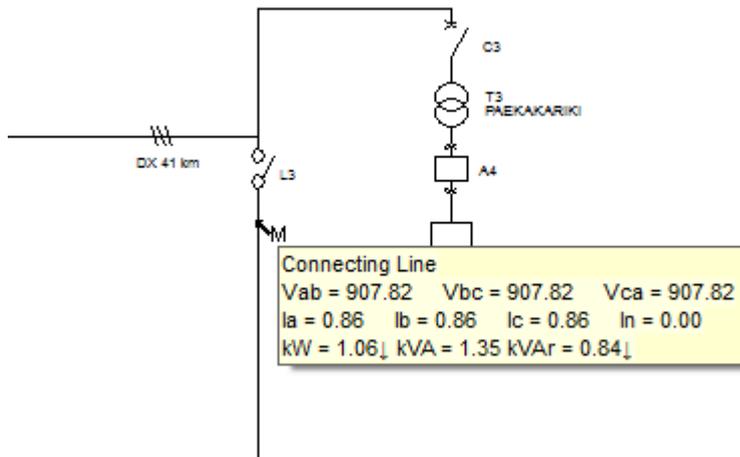
To move a group of symbols, connecting lines and graphics objects, select the group. Left click and hold the mouse button on the upper left corner of the desired area. Drag the cursor to the opposite corner until the desired block size is shown. Releasing the mouse button will select all the symbols, connecting lines and graphics inside the selection area. Group of symbols may also be selected by holding the [SHIFT] button and selecting each symbol in turn.

Next, left click on any selected object and drag the mouse cursor across the screen until the symbols are positioned over the desired area. Release the mouse button.

Each symbol can be individually rotated around its head point using the clockwise button  or the counter-clockwise button . It can also be inverted head to tail using the invert button .

Drawing connecting lines

Connecting lines are used to connect symbols to form a circuit. If the circuit is active, selecting a line by clicking on it will display the electrical data for that line on the meter panel. Hover the mouse over a connecting line to show a data tip window as shown below.



To draw connecting lines, position the mouse cursor over a snap grid point. The mouse cursor will turn to cross-hair when positioned properly over a snap grid point. To show the grid points, click on the snap grid button  on the [Circuit Toolbar](#).

Press and hold the left mouse button and drag the cursor across the screen. A rubber banding line will show where the line will be drawn. Release the mouse button when the desired direction and length of the line are shown.

When adding new connecting lines, the lines will automatically cross over intersected lines without connecting to those lines. To cross connect lines, one line must terminate on the other.

Copying and pasting symbols and blocks of symbols

To duplicate a device symbol, hold the [Ctrl] key, left click the center of the symbol and drag the cursor to the desired position before releasing the mouse button.

To duplicate a group of symbols, the symbols must first be selected. To do this, click and hold the mouse button on the upper left corner of the desired area. Drag the cursor to the opposite corner until the desired block size is shown. Releasing the mouse button will select all the symbols, connecting lines and graphics inside the selection area. Alternatively, select a group of symbols by holding the [SHIFT] key while clicking on the symbols to be selected.

Next, press and hold the [Ctrl] key, left click on any selected object and drag the mouse cursor across the screen until the symbols are positioned over the desired area. Release the mouse button.

Note that when copying or duplicating symbols or group of symbols, the electrical data are copied over to the new symbols.

To copy the selected symbols, lines and graphics objects to Windows clipboard, click on the Copy Button on the main toolbar. or choose Edit|Copy from the menu bar.

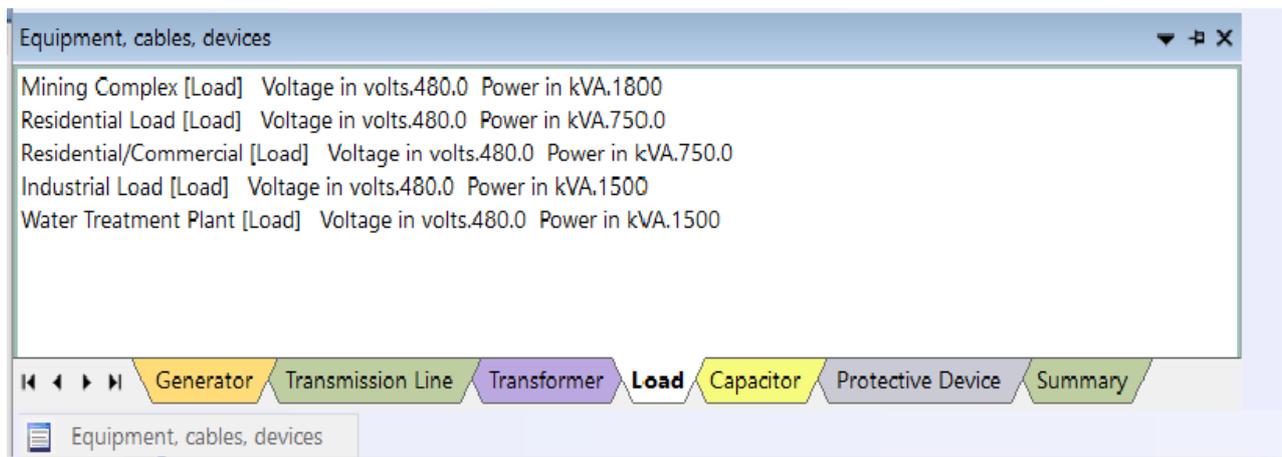
Symbols previously saved to Windows clipboard may be pasted in any vacant area on the screen. To start paste operation, click on the Paste Button. The cursor changes to a paste cursor. Position the cursor over the insertion point (top left corner of the block to be pasted) and click the mouse left button.

Note that the symbol or symbols to be pasted must not overwrite any existing connecting line or symbol. Otherwise, the paste operation will fail.

Positioning Symbol Labels

To position a symbol label, click on the label and drag the cursor to the desired position before releasing the mouse button. Note that the label text may not be modified by double clicking. To edit the symbol label, select the symbol by double clicking to open the properties panel. Edit the *Label* field under *Basic Properties* heading.

Equipment, Cables and Devices List Panel



Select *View/Equipment List* from the menu to display this panel which lists all circuit components classified according to type.

- Click tab to display list of equipment, cables or devices of this type .
- Click on an item on the list to highlight the corresponding symbol on the diagram with a [symbol marker](#).
- Double click an item on the list to display the [properties panel](#) for that item.

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Properties Panel

The Properties Panel is mainly a form for displaying and editing various properties of circuit components such as symbols and connecting lines, graphical objects, circuit defaults and PowerNet settings.

The screenshot shows the Properties Panel for a Transformer component. The panel is titled "Properties" and has a "Transformer" tab. It contains several sections of properties, each with a yellow circle and a line pointing to it:

- 1: Points to the top toolbar icons (Save, Undo, Redo, Refresh, Help).
- 2: Points to the "Basic Properties" section header.
- 3: Points to the "Label" property, which is set to "T1".
- 4: Points to the "ID" property.
- 5: Points to the "Description" property.
- 6: Points to the "Connection" section header.
- 7: Points to the "Option settings" section header.
- 8: Points to the "Transformer Data" section header.
- 9: Points to a callout box for the "Phase Connection" dropdown, which is currently set to "3-Phase + Neutral". The callout box contains the text: "Phase Connection" and "Select the type of connection for this device".

| Basic Properties | |
|------------------|----|
| Label | T1 |
| ID | |
| Description | |

| Connection | |
|------------------|-------------------|
| Phase Connection | 3-Phase + Neutral |
| Disconnected | False |
| Winding Type | Delta-Wye |

| Option settings | |
|------------------|---------------------------|
| Show label. | True |
| Show Device Name | False |
| Primary | Primary voltage, volts. |
| Secondary | Secondary voltage, vol... |
| Power units | Power in kVA. |

| Transformer Data | |
|------------------------|----------------|
| Rated Capacity in k... | 6250.000000 |
| Primary voltage, vo... | 3300.000000 |
| Secondary voltage,... | 22000.000000 |
| Winding tap | Tapped primary |
| Winding Tap % | -3.000000 |

| Impedances | |
|-------------|----------|
| Resistance% | 1.000000 |
| Reactance % | 5.000000 |

Phase Connection
Select the type of connection for this device

Legend:

- | | | |
|----------|--------------------------|--|
| 1 | <i>Save Button</i> | Save any changes to the properties form. |
| 2 | <i>Database</i> | Opens the Database for help in filling up data form. |
| 3 | <i>Copy Default</i> | Copies stored data from the last saved default form into the current form. |
| 4 | <i>Save To Default</i> | Saves data from the current form as default for future use. |
| 5 | <i>Basic Properties</i> | Common to all circuit components - Label, ID, Description fields. |
| 6 | <i>Connection</i> | Phase or line or three-phase connection, connection status, transformer winding configuration. |
| 7 | <i>Option Properties</i> | Show/hide options and other options such as data units. |
| 8 | <i>Data</i> | Depending on component class, displays ratings and other properties. |
| 9 | <i>Description</i> | Displays a summary or short description of the field being edited. |

Equipment, Cables and Devices Database

| Size | Rated Current | R, ohms | X, ohms | R0 |
|------------|---------------|-----------|----------|-----|
| 1.0 sq.mm. | 14 | 19.400000 | 0.172000 | N/A |
| 1.5 sq.mm. | 18 | 13.100000 | 0.161000 | N/A |
| 2.5 sq.mm. | 25 | 7.840000 | 0.148000 | N/A |
| 4 sq.mm. | 34 | 4.960000 | 0.140000 | N/A |
| 6 sq.mm. | 43 | 3.320000 | 0.131000 | N/A |
| 10 sq.mm. | 60 | 1.960000 | 0.122000 | N/A |
| 16 sq.mm. | 87 | 1.240000 | 0.114000 | N/A |
| 25 sq.mm. | 125 | 0.725000 | 0.105000 | N/A |
| 35 sq.mm. | 145 | 0.564000 | 0.101000 | N/A |
| 50 sq.mm. | 175 | 0.416000 | 0.098700 | N/A |
| 70 sq.mm. | 225 | 0.289000 | 0.094000 | N/A |
| 95 sq.mm. | 270 | 0.215000 | 0.091800 | N/A |
| 120 sq.mm. | 320 | 0.166000 | 0.088900 | N/A |
| 150 sq.mm. | 370 | 0.136000 | 0.088700 | N/A |
| 185 sq.mm. | 425 | 0.109000 | 0.088000 | N/A |
| 240 sq.mm. | 510 | 0.084300 | 0.086400 | N/A |
| 300 sq.mm. | 590 | 0.067600 | 0.085600 | N/A |
| 400 sq.mm. | 690 | 0.055300 | 0.085200 | N/A |
| 500 sq.mm. | 800 | 0.046000 | 0.084100 | N/A |
| 630 sq.mm. | 950 | 0.038700 | 0.081900 | N/A |

The equipment, cables and device database can be used to fill in the [properties panel](#) data form with typical values. Click [*Copy Data*] button to fill the form with values from the database.

Database Buttons:

Copy Type - Check this to copy the data record type into the properties description field.

Clone- Create a new record using the the current selected record data values. Record type will be "New Data Record".

Edit Type- Edit the data record Type/Size field.

Delete - Delete the selected data record. This action can not be undone.

Copy Data- Use the record values to fill in the properties panel data form.

Source Bus

About Source Bus - These are power sources, or power take-off points, not to be mistaken with bus bars. In many cases a source bus is used instead of a generator when only a section of a larger system is the scope of the project.

Voltage rating - the no load voltage of this bus source.

Short circuit MVA - the estimated or calculated short circuit capacity of this bus.

R/X ratio - the internal resistance to reactance ratio.

Fixed Loading - Set TRUE to force real and reactive power to preset values. Only possible when there are other floating sources with variable loading in the circuit.

Kilowatt Out - Enter preset real power output.

Kilovar Out - Enter preset reactive power output. Negative value to sink kilovars.

Zero Sequence Reactance X0, % - Enter percent reactance for zero sequence. Used for fault calculations if neutral is earthed..

Neutral is earthed - Set TRUE if neutral is connected to earth.

See Also:

[Basic Properties](#)

Generator Data

About Generators - PowerNet treats generators as constant voltage sources (infinite bus) with a series impedance in series with values consistent with r/x ratio and voltage regulation.

Generator Data

Voltage in volts - No-load voltage of the generator.

Rated capacity in MVA - rated capacity of the generator.

R/X Ratio - Resistance to reactance ratio of the generator internal impedance.

Torque Angle, degrees - Angle between internal generated voltage and terminal voltage. Use to adjust kilowatt loading share for circuits with multiple sources. Typical values of between 1 and 5 degrees.

Voltage Regulation % - the difference between no load and full load voltage divided by full load voltage in percent.

Earthed Neutral - TRUE if generator neutral is connected to earth.

Generator Impedances - used in fault calculations.

Synchronous Resistance % - machine resistance in percent base. Ignored in calculations.

Synchronous Reactance % - machine reactance in percent base. Ignored in calculations.

Transient X', % - transient reactance in percent base.

Subtransient X'', % - subtransient reactance in percent base.

Negative Sequence X2, % - negative sequence reactance in percent base.

ZeroSequence X0, % - zero sequence reactance in percent base.

Earth resistance, ohms - value of resistance between neutral and earth.

Earth reactance, ohms - value of reactance between neutral and earth.

See Also:

[Basic Properties](#)

Cable Data

About Cables - All conductors with non-negligible impedances should be included in the circuit. This includes all types of cables, bus bars, bus ducts, distribution lines.

R, ohms/linear unit - the cable resistance per 1000 linear unit for each phase. Note that this value is temperature dependent.

X, ohms/linear unit - the cable reactance per 1000 linear unit for each phase. The neutral impedance is assumed to be zero. *Temperature rise* - the temperature above the reference temperature where the conductor impedance was measured.

Length in linear unit - the cable length.

Rated current in amps - the rated ampacity of the cable. Note that this dependent on temperature and installation configuration.

Sets in parallel - number of cable sets in parallel. Cable sizes and installation configuration must be identical.

R0, ohms/1000 meters - zero sequence resistance per unit length.

X0, ohms/1000 meters - zero sequence reactance per unit length.

The zero sequence impedance is used in fault calculations. The impedance of the neutral conductor should not be included

in this impedance as the neutral is assumed to be earthed at the source and at the fault. If the fault is between a line and the

neutral conductor, this may be simulated by using the neutral impedance as the source earthing impedance, e.g., at the generator or transformer neutral earth impedance..

See Also:

[Basic Properties](#)

Impedance Device Data

About Impedance Devices - These devices are included as a general purpose substitute for any other electrical component not covered by the other classification.

Resistance, ohms - the actual device resistance in ohms.

Reactance, ohms - the actual device reactance in ohms.

See Also:

[Basic Properties](#)

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Capacitor Data

About Capacitors - Capacitors refer to power factor correction capacitors or capacitor banks which are connected across phases or between phases and neutral. For series capacitors, use impedance device class with a negative reactance and zero resistance.

Voltage in volts - Operating voltage of the capacitor bank/assembly.

Rated capacity in kVAR - rated kilovar capacity of the capacitor bank/assembly.

See Also:

[Basic Properties](#)

Load Data

About Loads - Loads generally represent all equipment and devices that are power sinks or power consuming. They are passive, linear and balanced three phase impedances with or without neutral connections. Non-linear loads such as rectifiers and converters may also be modelled provided that the power factor is accurate and the harmonics effects are neglected.

Voltage rating - Operating voltage of the load.

Load power rating - Specify the operating kVA/MVA of this load.

Load power factor - Enter the load operating power factor.

See Also:

[Basic Properties](#)

Induction Motor Data

About Induction Motors - Induction motor class includes all squirrel cage and wound rotor motors but not synchronous motors and series motors. Induction motors are treated as constant impedance load instead of the more realistic constant kVA. This means the current draw decreases with lower voltages instead of increasing to maintain power as in actual motors.

Induction motor data

Voltage rating - Operating voltage of the motor.

Rated power - Enter the motor shaft output rating.

Motor P.F. - Enter the actual motor operating power factor.

Efficiency, percent - the mechanical efficiency of the motor. As a guide, about 80% at 3.75kW(5HP) and 90% at 37.5(50HP).

Start-Full Load Ratio - the ratio of starting current to the full loads current. Between 1.5-15, typically 6.5.

Running/Starting - Select operating mode of motor.

Loading % - Specify the percent loading for the motor. Normally 100 or less, more for simulating overload.

Subtransient X", % - subtransient reactance in % of base impedance. Required for fault calculations. Typically, 20-25%.

See Also:

[Basic Properties](#)

Synchronous Motor

About Synchronous Motors - Like induction motors, synchronous motors are modeled as constant impedances. They may be used to improve power factors by supplying reactive power using over-excitation.

Synchronous Motor Data

Voltage in volts - Operating voltage of the motor.

Motor Power in kW - Specify the rated power output of this motor.

Motor P.F. - Enter the actual motor operating power factor. Negative values to supply reactive power.

Efficiency, % - the mechanical efficiency of the motor.

Motor Load, % - loading in percent of motor rating.

Impedance Data

Resistance % - machine resistance in percent base. Used for positive sequence calculations.

Reactance % - machine reactance in percent base. Used for positive sequence calculations.

Negative Sequence X2, % - negative sequence reactance in percent base.

Zero Sequence X0, % - zero sequence reactance in percent base.

Transient X', % - transient reactance in percent base.

Sub-transient X'', % - sub-transient reactance in percent base.

Earthed Neutral - select TRUE if motor neutral is connected to earth.

Earth resistance, ohms - value of resistance between neutral and earth.

Earth reactance, ohms - value of resistance between neutral and earth.

See Also:

[Basic Properties](#)

Transformers

About transformers - PowerNet includes voltage transformation and phase shift in calculating circuits. Delta-Wye windings shifts the secondary voltage by -60 degrees(delayed) while Wye-Delta shifts the secondary 60 degrees(advanced). Zigzag windings are treated as Wye. For example, a Wye-Zigzag winding is the same as a Wye-Wye winding. In PowerNet, winding types only affect the phase shift between windings.

Transformer Data

Winding Type - Select primary and secondary winding type.

Rated Capacity in kVA - Enter transformer capacity in kVA.

Primary voltage, volts - Operating voltage, primary.

Secondary voltage, volts - Operating voltage, secondary.

Winding Tap - Selects which winding, primary or secondary, is tapped.

Tap % - Percentage tap on the winding.

Impedance Data

Percent R - Percent of base impedance, resistance.

Percent X - Percent of base impedance, reactance.

Zero Sequence X, % - Zero sequence reactance of transformer windings.

Earthing

Primary Earthed - Neutral connection of primary winding is earthed.

Secondary Earthed - Neutral connection of secondary winding is earthed.

R, ohms - Earthing resistance between neutral and earth.

X, ohms - Earthing reactance between neutral and earth.

See Also:

[Basic Properties](#)

[Three-winding transformers](#)

Transmission Line

About Transmission Lines - PowerNet calculates transmission lines as a pi network with half capacitive reactance to ground on each leg and a series impedance for corresponding sequences.

Transmission Line Data

Length - the line total line length in km or miles.

Rated current in amps - current rating. Ignored in calculations.

Positive sequence resistance R, per unit length - the line resistance per unit length for each phase.

Positive sequence reactance X, per unit length - the line reactance per unit length for each phase.

Zero sequence resistance R0, per unit length - the line resistance per unit length for each phase.

Zero sequence reactance X0 per unit length - the line reactance per unit length for each phase.

Capacitance C, nanofarads per unit length - mutual capacitance.

Capacitance C0, nanofarads per unit length-capacitance to earth.

See Also:

[Basic Properties](#)

Motor Control Center

About Motor Control Centers - Similar to distribution boards and panelboards, motor control centers are special types of loads consisting of several sub-loads connected together by a bus bar. They are included here for compatibility with PowerStar.

Voltage rating - Operating voltage of the MCC.

Rated Power - The total load kVA of this MCC.

Load P.F. - The net load power factor of this MCC.

See Also:

[Basic Properties](#)

Distribution Board

About Distribution Boards - Similar to panelboards and motor control centers, distribution boards are special types of loads consisting of several sub-loads connected together by a bus bar. They are included here for compatibility with PowerStar.

Voltage rating - Operating voltage of the DB.

Rated Power - The total load kVA of this DB.

Load P.F. - The net load power factor of this DB.

See Also:

[Basic Properties](#)

Panelboard

About Panelboards - Similar to distribution boards and motor control centers, panelboards are special types of loads consisting of several sub-loads connected together by a bus bar.

Voltage rating - Operating voltage of the PB.

Rated Power - The total load kVA of this PB.

Load P.F. - The net load power factor of this PB.

See Also:

[Basic Properties](#)

Protective Device Data

About Protective Devices - These devices have zero impedances. They include all devices that act on the magnitude of current flowing through it. Examples include fuses, circuit breakers, re closers, relays. These devices do not affect circuit calculation as they have zero impedance but serves the purpose of indicating that the rated current has been exceeded.

Type - Select fuse, air circuit breaker or oil circuit breaker.

Voltage rating - rated voltage of the device.

Frame Size - the frame size in amps.

Trip Current - the current setting of the trip element of the device.

Interrupting Rating - the maximum current the device can safely break.

Momentary Rating - the maximum current the device can safely withstand.

See Also:

[Basic Properties](#)

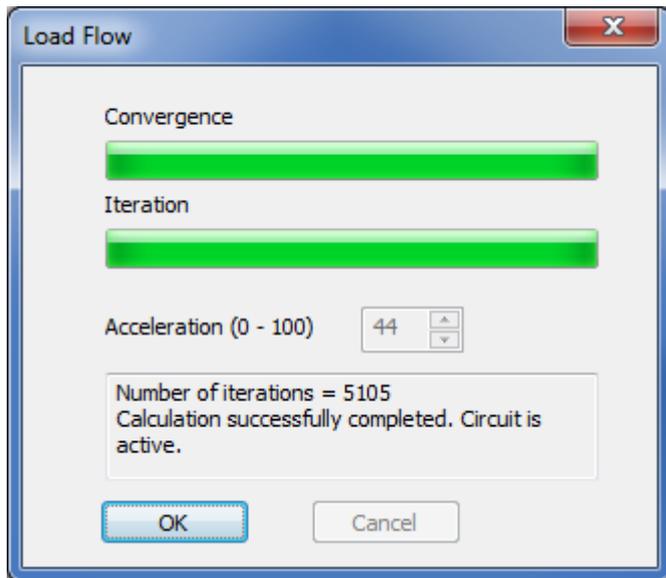
Connection Device

Connecting device is a general purpose class to represent any zero impedance electrical component in the circuit such as instrument current transformers and switches. They are not taken into account during circuit calculations and no data is required except for [basic properties](#).

Null Device

Null device is a general purpose class to represent any infinite impedance electrical component in the circuit such as lightning arresters, PTs and voltmeters.. They are not taken into account during circuit calculations and no data is required except for [basic properties](#).

Calculation



Overview

After drawing the circuit and entering data for each circuit symbol, click on the calculate button . The circuit is analyzed for correctness and completeness of data for all symbols. If there are no errors, the circuit is calculated. After calculation, all electrical information on each symbol and connecting lines can be displayed. The circuit is then said to be active.

Math

The circuit is simulated as an admittance matrix. The matrix is solved by iteration using accelerated Gauss-Siedl method. The speed of calculation convergence can be influenced to a limited extent by adjusting the acceleration factor. The number of iterations can also be adjusted to cater for slowly converging circuits.

Fault

For faults, the circuit is first calculated for load flow. All power sources are then short-circuited and the voltage at the fault point is used as the sole power source. The circuit is then configured and calculated as positive sequence, negative sequence and zero sequence. The sequence components are combined with the load flow to determine the voltages and current throughout the circuit during fault conditions.

Tips

Most real life circuits will calculate, converging rapidly. Failure to converge may be due to one of the following:

- *Resonance* - perfect or near perfect resonance can not be calculated. A non-negligible resistance between inductance and capacitance elements must be included.
- *Extremely small or extremely large impedances*- solving a large bus-bar with negligible impedance in series with a long transmission line may not converge. Simulate bus bar as connecting line instead.
- If the calculation fails to converge, try calculating up to 4 more tries. PowerNet will increase the iteration limit each time. If this still fails, review all data for "unrealistic" values. You can also email the circuit file to support@megasysoftware.com.

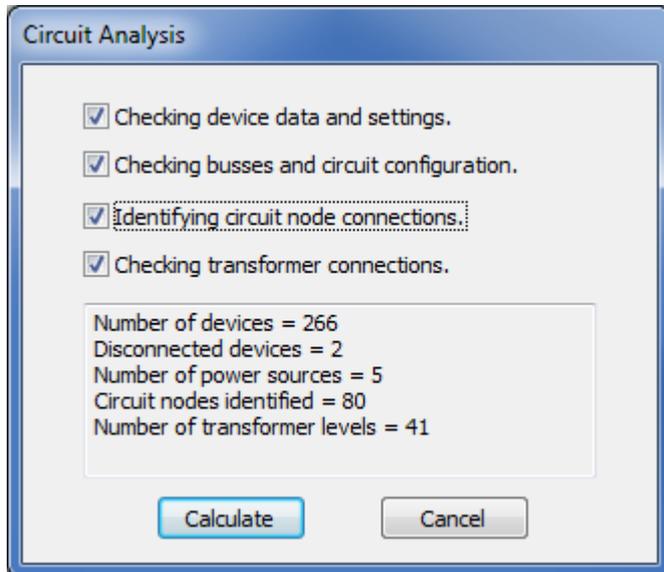
See Also:

[Circuit Analysis](#)

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Circuit Analysis

Circuit analysis is performed before the circuit is calculated.



Analysis Procedure

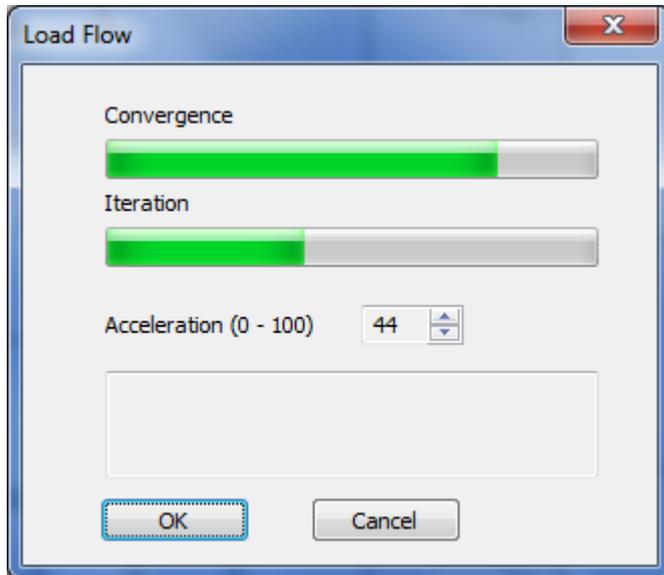
- *Auto-number* - Symbols are numbered in sequence unless flagged otherwise.
- *Check device data* - All symbols are checked for correct and complete data. If no fault is simulated (load flow only), sequence impedance data are not required.
- *Check configuration* - the circuit must connect all symbols and checks that there are no isolated symbols or groups.
- *Check source bus* - At least one generator or source bus must be included.
- *Identify nodes* - Each node (junction) in the circuit is identified and numbered in preparation for calculation.
- *Identify transformer groups* - This procedure makes sure that there are no connecting path between primary and secondary windings for all transformers and parallel transformers have the same voltage ratio and phase and phase shift.

See also:

[Calculation](#)

Load Flow

The following dialog box shows the calculation in progress. If there is a circuit fault, the process is repeated for the positive, negative, and zero sequence calculation.



Convergence - shows progress of calculation converging to a solution.

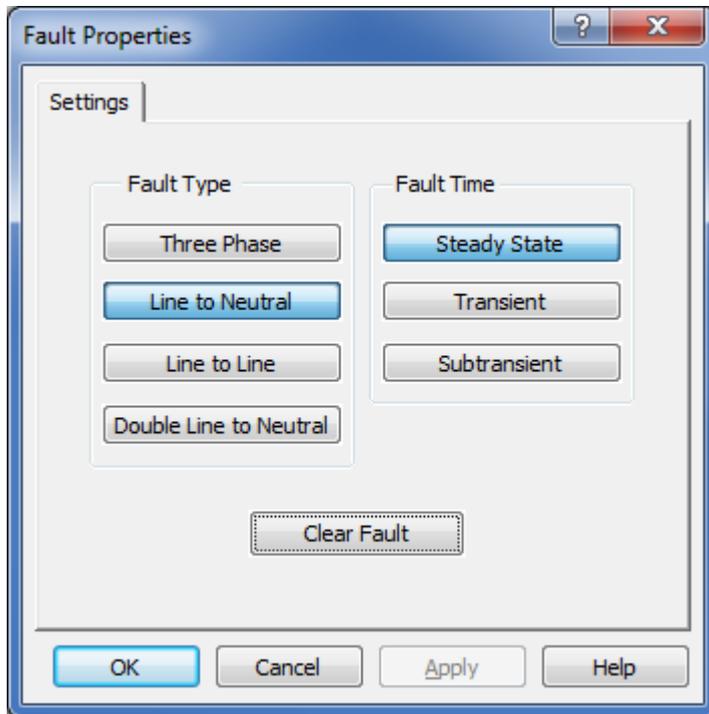
Iteration- Number of iteration done. Iteration limit can be set in the [circuit properties panel](#).

Acceleration- Speed up solution convergence. Start with a value of 25 and increase or decrease if it takes too long for the solution to converge.

Message Box - Displays error or successful result of calculation.

Fault Simulation

Click on the fault simulation button  to position a fault on the circuit. The cursor changes to a fault cursor. Click on any grid point on the circuit diagram to position the fault. The fault properties dialog box comes up.



Select the type and time of fault calculation required and click OK. If there is an existing fault, click the clear fault button, then OK to remove the fault.

After circuit calculation fault data is displayed in the [properties panel](#). This data is also included in circuit reports, right after the report header.

The following abbreviations are used for fault types:

FAE - line A to earth fault.

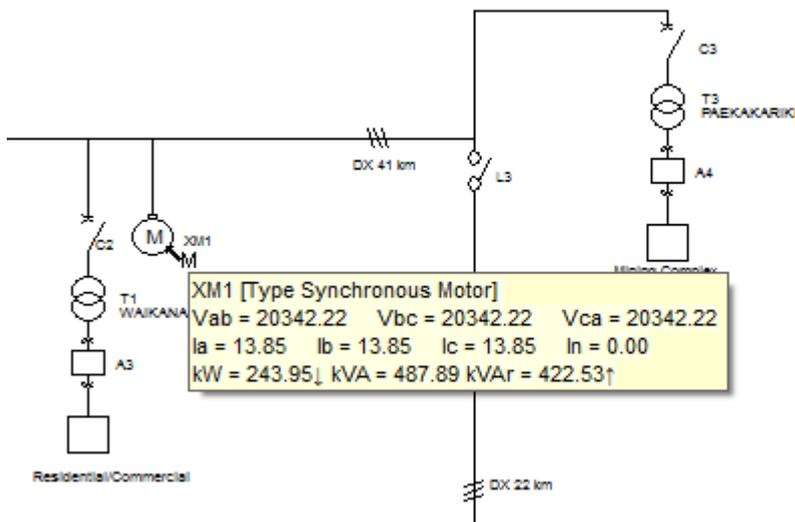
FBC - line to line fault between phase B and C

FBCN - line to line fault between phase B and C and earth

FABC - 3-phase bolted fault

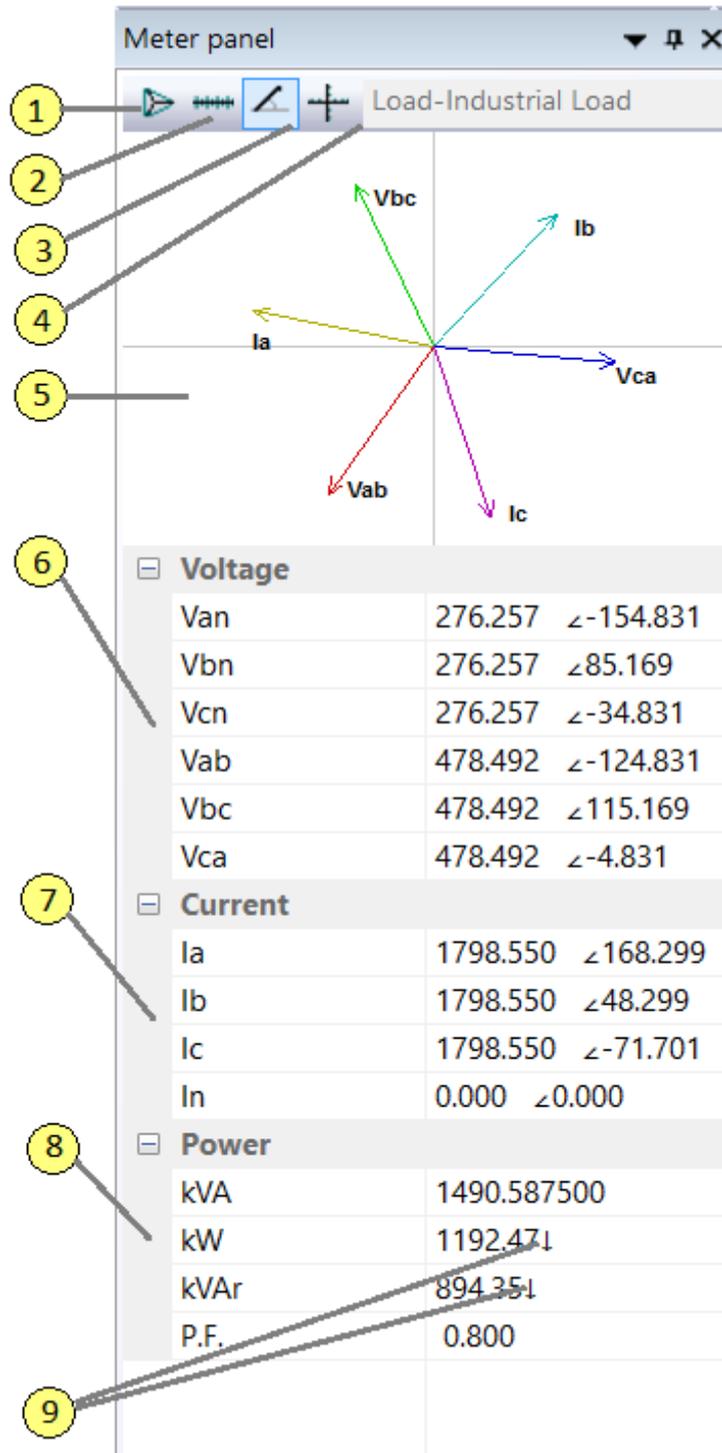
Data Tip Box

The data tip box is similar to the tool tip that appears when the mouse hovers over a toolbar button. Hover the mouse over any symbol or connecting line on an active circuit to display information and electrical data, such as symbol label, name, voltages, current, kVA, kilowatt and kilovar flow.



Meter Panel

The meter panel displays the electrical data of any part of the electrical circuit. Click on any symbol to select it and display the calculated electrical data on that part of the single line diagram.



Legend:

1 Vector Button

Toggles voltage vector display between line to line and line to neutral

(if neutral is available).

2 *Scalar Button* Displays voltage and current values in magnitude only, example 276.257.

3 *Polar Format Button* Displays voltage and current values in polar coordinates with angles in degrees, example 276.257 <85.169.

4 *Rectangular Format* Displays voltage and current values in rectangular format, example 236.257 +j145.67.

5 *Vector Display* Draws the voltage and current vectors. Angle is zero for horizontal line to the right. Counterclockwise is positive.

6 *Voltage Data* Displays line to line voltage and line to neutral voltage (if neutral is available).

7 *Current Data* Displays line currents and neutral if available.

8 *Power Data* Displays apparent, real, reactive power and power factor as calculated at the head end of the symbol.

9 *Arrows* Arrows shows the direction of real and reactive power flows in reference to the symbol orientation.

Circuit Text Report

Circuit Report

Project : Megasys Software Sample Project

Prepared by : John Smith

Circuit Fault Type -Line to earth fault (FAE) - Steady state

Fault on node connected to the following circuit elements:

| | | | |
|---------------------------|---------------|---------------|-----------------------------|
| Transformer - <i>TXF1</i> | Vfa = 0.00 | Vfb = 2139.39 | Vfc = 2049.33 |
| Transformer - <i>TXF2</i> | Ifa = 7707.19 | Ifb = 0.00 | Ifc = 0.00 Ifn = 7707.19 |

SB1 Bus

| | | | | |
|---------------------|--------|----------------|----------------|-----------------------------|
| Voltage in volts. | 11500 | Van = 6225.19 | Vbn = 6482.20 | Vcn = 6505.15 |
| Short circuit kVA. | 552000 | Vab = 10920.69 | Vbc = 11397.97 | Vca = 10958.63 |
| Kilowatt out | 2000 | Ia = 2571.77 | Ib = 397.15 | Ic = 398.11 In = 2369.96 |
| Neutral is earthed | Yes | kW = 7785.38↓ | kVA = 20083.30 | kVAr = 18512.88↓ |
| Zero Sequence X0, % | 0.5000 | | | |

Gen1 Generator(disconnected)

| | | | | |
|-------------------------|-------|------------|------------|------------------------|
| Voltage in kV | 11.20 | Vab = 0.00 | Vbc = 0.00 | Vca = 0.00 |
| Rated Capacity in MVA. | 12.50 | Ia = 0.00 | Ib = 0.00 | Ic = 0.00 In = 0.00 |
| Voltage Regulation, % | 2.000 | kW = 0.00↑ | kVA = 0.00 | kVAr = 0.00↑ |
| Resistance% | 0 | | | |
| Reactance % | 159.0 | | | |
| Negative Sequence X2, % | 11.00 | | | |
| Zero Sequence X0, % | 66.00 | | | |
| Transient X', % | 22.00 | | | |
| Subtransient X'', % | 10.50 | | | |
| Neutral is earthed | No | | | |

CB1 Protective Device

| | | | | |
|----------------------|-------|---------------|---------------|---------------------------|
| Voltage in volts. | 3300 | Van = 0.00 | Vbn = 2139.39 | Vcn = 2049.33 |
| Trip setting, amps | 250.0 | Vab = 2139.39 | Vbc = 3206.01 | Vca = 2049.33 |
| Interrupt rating, kA | 0 | Ia = 7707.19 | Ib = 0.00 | Ic = 0.00 In = 7707.19 |
| Momentary Rating, kA | 0 | kW = 1627.00 | kVA = 2027.05 | kVAr = 1227.24 |

Close Save As

A text report on the circuit can be displayed on screen. The report is in *rich text format (RTF)* which can be read in Microsoft WordPad, Word or most other word processing software for further formatting and editing.

For large circuits, PowerNet automatically opens WordPad if it is available to display the circuit report.

The electrical data format can be set in the calculation and data tab of the [default settings](#) properties page.

Circuit Spreadsheet Report

| | | Vab | Vbc | Vca | Van | Vb | Vcn |
|----|---|------------------|-----------------|-----------------|-----------------|---------------|----------------|
| 1 | Megasys Software | | | | | | |
| 2 | | | | | | | |
| 3 | Prepared by: John Smith | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | Circuit Fault Line to earth fault (FAE) - Steady state | 2103.97∠-117.01 | 3076.71∠104.87 | 2062.58∠-32.20 | 0.00∠0.00 | 2103.97∠62.99 | 2062.58∠-32.20 |
| 7 | Peak fault current, kA | 17.14 | | | | | |
| 8 | Fault RX ratio | 0.2316 | | | | | |
| 9 | Short circuit MVA | 14.67 | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | SB1 Source Bus | 10921.17∠-129.67 | 11348.30∠109.32 | 10969.34∠-12.12 | 6239.64∠-160.96 | 6460.93∠80.44 | 6489.79∠-4.44 |
| 13 | Voltage in volts | 11500 | | | | | |
| 14 | Short circuit kVA | 552000 | | | | | |
| 15 | Kilowatt out | 2000 | | | | | |
| 16 | Neutral is earthed | Yes | | | | | |
| 17 | Zero Sequence X0, % | 0.5000 | | | | | |
| 18 | | | | | | | |
| 19 | Gen1 Generator | | 0.00∠0.00 | 0.00∠0.00 | 0.00∠0.00 | | |
| 20 | Voltage in kV | 11.20 | | | | | |
| 21 | Voltage Regulation, % | 2.000 | | | | | |
| 22 | Resistance% | 0 | | | | | |
| 23 | Reactance % | 159.0 | | | | | |
| 24 | Negative Sequence X2, % | 11.00 | | | | | |

A spreadsheet report on the circuit is generated and saved as *report.xls* in the circuits folder. The report is in *XLS format* which can be read by Microsoft Excel, or most other spreadsheet software for further formatting and editing. If Excel is available, it will open this file and display it on screen. You may save this into a different filename so it will not be overwritten the next time a report is generated.

The electrical data format can be set in the calculation and data tab of the [default settings](#) properties page.

The initial cell formats are set in the spreadsheet *header.xls* located in the program files folder. You may edit the cell formatting to change the default format for the circuit report.

Graphics Elements

Graphics elements do not affect the circuit calculation but are useful for complementing the presentation of the circuit diagram.

Graphics elements can be used to:

- annotate the circuit diagram
- graphically modify individual symbols
- add captions
- create nameplates
- show borders
- delineate circuit sections

The following graphical elements are provided:

- line
- rectangle
- rounded rectangle
- ellipse
- elliptical arc
- elliptical pie
- elliptical chord
- polygon
- polyline
- text

Graphics Operations

Before creating or manipulating any graphics, click on the  toolbar button to hide the snap grids, unless you want the graphics to be sized and located on the snap grid points.

To create a graphics object, select the desired shape from the toolbar buttons, left click on the top left corner and drag the cursor to the bottom right to the approximate size. For polygons and polylines, left click each vertex and double click the last vertex to complete the polyline/polygon.

Graphics objects, like symbols and connecting lines can be moved, deleted, duplicated and used with Windows clipboard operations. They can also be sized. To select a graphics object, click on the inside if it is solidly filled or on the outline if not. Selecting a graphics object creates grab handles for that object, which can be clicked and dragged to resize the graphics object.

All graphics objects will be layered such that the newer objects will display on top of older objects. A selected object can be moved towards the front or back by using the following toolbar buttons,    .

To select several objects, press and hold the [Shift] key and left click on individual objects. To select objects within an area, left click on the top left of the area and drag the rubber banding selection rectangle to the bottom right.

Several graphics object can be grouped together as single object. To do this, select the objects as above, then click the  toolbar button. To ungroup the objects, click the  button.

Graphics Properties

The following properties are displayed on the [properties panel](#) for the selected graphics object:

Basic Properties - All graphics objects have the following basic properties:

- *Line Type* - May be solid, none, or a combination of dots and dashes.
- *Line Width* - Normal line width is zero which is 1 pixel wide.
- *Line color* - Click on the data entry field to show the button used to activate the color selection box.
- *Fill Type* - May be solid, none, or a combination of patterns.
- *Fill Color* - Click on the data entry field to show the button used to activate the color selection box.

Text - For text graphics, font, justify and text content may be edited by clicking the button at the end of the entry field..

Elliptical Objects - For elliptical graphics, zero degrees is +x axis (3:00 o'clock), positive is counter-clockwise. The graphics starts at the start angle and moves counter-clockwise towards the end angle.

Rounded Rectangles - For rounded corner rectangles, the X and Y axis roundness refers to the relevant radii of the ellipse quadrant used to form the rounded corners of the rectangle.

Default Settings

The default settings for PowerNet can be set in the properties panel by selecting *Edit/Default Settings...* from the menu.

Properties X

Default Settings

- [-] **Files**

| | |
|------------|-------------------------------------|
| Symbol set | C:\ProgramData\Megasys Software\... |
| Database | C:\ProgramData\Megasys Software\... |
- [-] **Color settings**

| | |
|-------------------------|--|
| Incomplete data warning | ■ 00ffff |
| Circuit config error | ■ ff0000 |
| Incompatible connection | ■ 00ff00 |
| Overload warning | ■ ffff00 |
| Screen background | ■ fffffff |
| Marker Color | ■ 0000ff |
| PowerNet Theme | Office 2007 Aqua |
- [-] **Fonts**

| | |
|-------------------------------|-----------|
| Default font for text grap... | Arial(-7) |
| Label font | Arial(-7) |
| Printer caption | Arial(-7) |
- [-] **Printer settings**

| | |
|-------------------------|------|
| Left margin | 0 |
| Top margin | 0 |
| Right margin | 0 |
| Bottom margin | 0 |
| Line thickness | 1 |
| Zoom to media size | True |
| Draw bounding rectangle | True |
| Print project caption | True |
- [-] **Units**

| | |
|---------------------------|--------------------|
| Frequency | 50 Hz |
| Motor power nameplate ... | Motor power in kW. |
| Linear units | Length in metres. |
| Data Format | Show Magnitude |
- [-] **Calculation**

| | |
|---------------------|------|
| Iteration limit | 6750 |
| Acceleration factor | 25 |
| Decimal digits V/kW | 2 |

The default settings properties panel has the following groupings:

[Files](#)- locations of symbol and database files.

[Color Settings](#) - warning and error display color settings.

[Fonts](#) - settings for labels, printer and default fonts.

[Printer settings](#)- margins, borders and captions.

[Units](#) - frequency, metric or imperial units and data format.

[Calculation](#) - Iteration limit, acceleration and decimal precision for electrical data.

[Multipliers](#) - multiplication factor for over capacity, under-voltage, over-voltage and over-current condition.

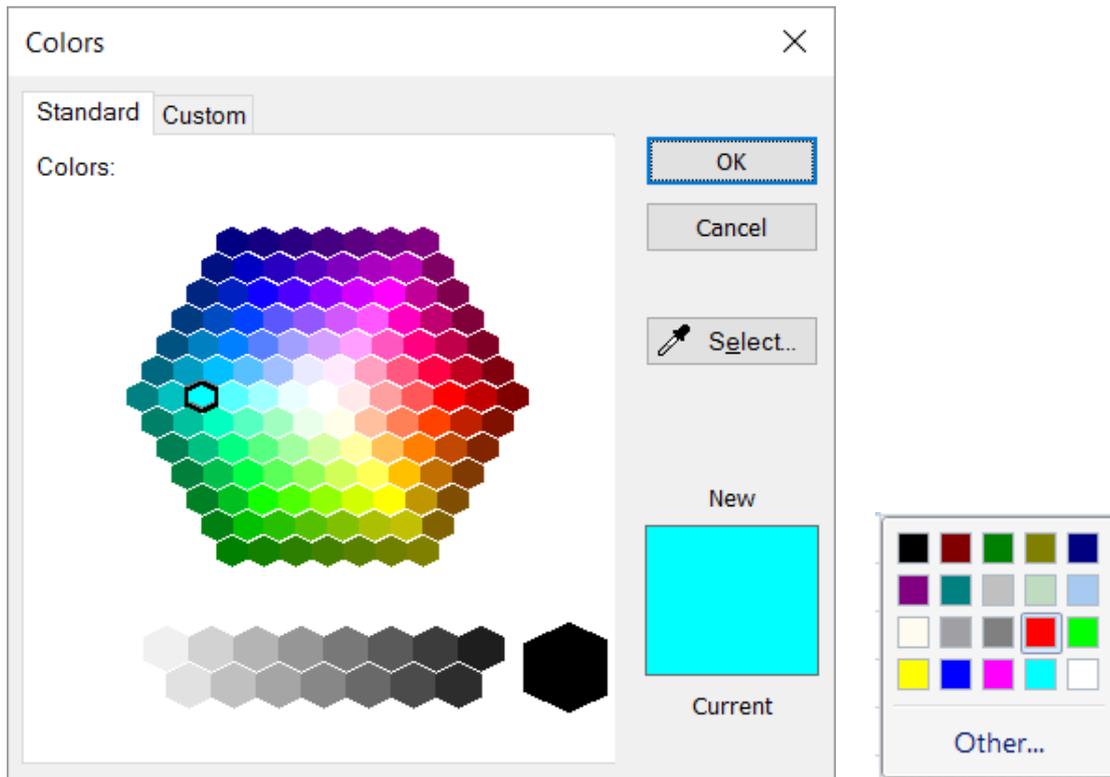
Files Settings

The Files section of the default settings properties panel contains two entries. To modify, select the entry field and click on the [...] button to display a Windows file selection box.

Symbol Set - normally located in the *C:\ProgramData\Megasys Software\Symbols* folder. The default file is *powernet.sym*.

Database - normally located in the *C:\ProgramData\Megasys Software\database* folder. The default file is *powerbase.mdb*. Note that the database consist of a pair of files. One is the database file *powerbase.mdb* and menu file *powerbase.dbm*.

Colour Settings



This properties group displays the above color selection boxes when you click on a field button to change the color.

Incomplete Data - a symbol with incomplete data will be marked with an X of this color when starting calculation.

Circuit Configuration Error - symbols in a circuit section that is not correctly configured will be marked with an X of this color when starting calculation.

Incompatible Connection - incompatible connections such as parallel transformers with different voltage ratios will be marked with an X of this color when starting calculation.

Overload Warning - overloaded symbols will be marked with an X of this color after calculation is completed.

Screen Background - select your preferred circuit background color.

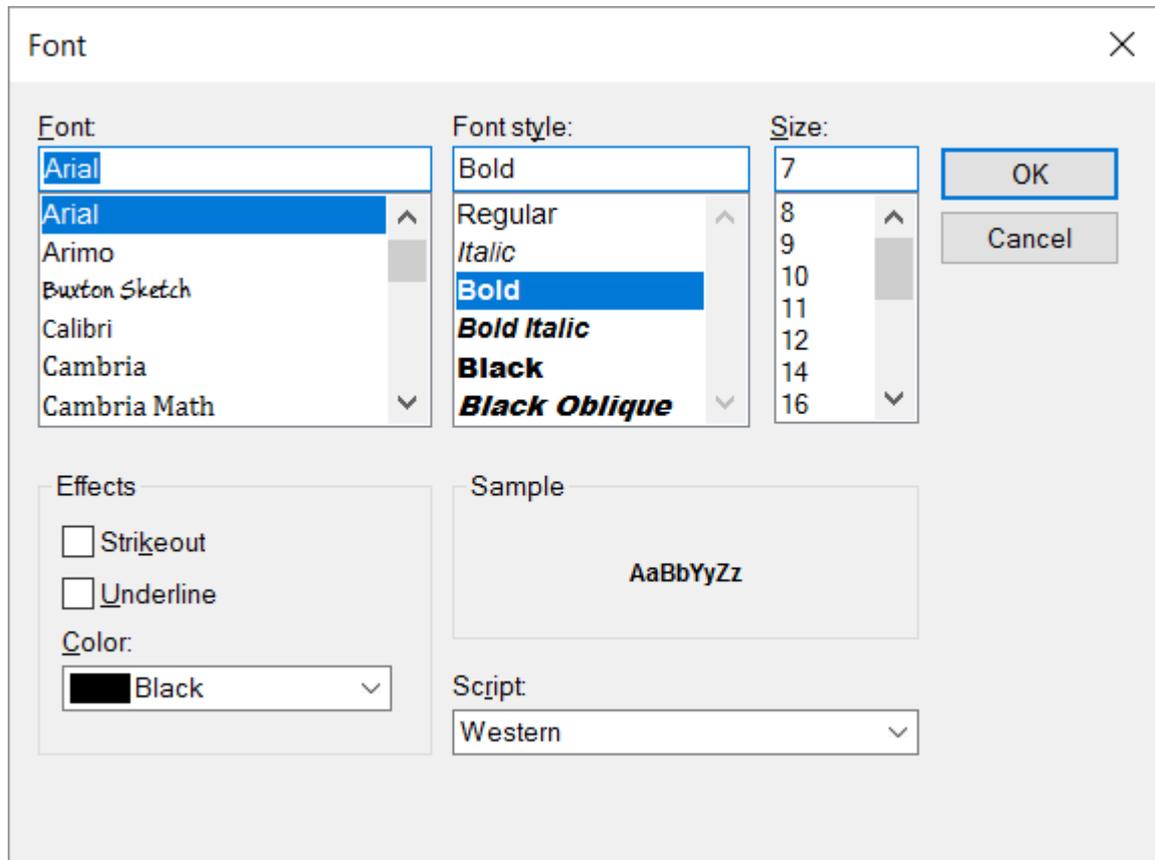
Marker Color - select the color of the [marker box](#) which indicates a selected symbol.

Disconnected - symbols that are disconnected will be displayed in this color.

PowerNet Theme - selection of standard Windows themes to apply to PowerNet.

Fonts Settings

The font settings box is used to select the default fonts.



Device Label Font - All symbol labels for all circuits will be drawn with this label.

Printer Caption Font - The circuit project name at the bottom of the page will be printed with this font.

Default Font - Used for all text graphics. Individual graphics font can be set by editing the [graphics properties](#).

Printer Settings

Margins - margins are in millimetre (or 0.04 inches).

Line thickness - adjust this to account for difference in line widths for different printers resolution.

Zoom to Media Size - the circuit magnification is adjusted to fill the whole page.

Draw Bounding Rectangle - Set this to draw a rectangular border inside the margins.

Print Project Caption - Set this to print the project file name, centered at the bottom of the page.

Units Settings

Frequency- default frequency used for all circuits. Frequency can be set for individual circuits. Used for transmission line calculations

Linear Units - default linear units for cables and transmission lines. Units can be set separately for each cable or transmission line.

Motor rating -default settings for all motors. Each motor rating can be set individually.

Data Format - Default format for voltage and current. Circuits formats can be set individually..

Calculation and Data Settings

Maximum Calculation Iteration - the calculation must complete before this limit is reached.

Calculation Acceleration- optimum value to speed-up calculation. Too high or too low slows down calculation .

V, I, kW Digit Precision - number of decimal digits for voltage, current, kW, kVA, kVAr .

R, X, PF Digit Precision - number of decimal digits for resistance, reactances, power factor and other data.

This settings page is available as default setting for PowerNet (Edit/Default settings menu) as well as individual circuit settings which can be set separately for each circuit file(Circuits/Properties menu).

Multiplier Settings

After circuit calculation, symbols will be marked based on electrical data exceeding normal values using the following multipliers.

Overload Multiplier - warning displayed for symbol kW, kVA, kVAr exceeding this value.

Overvoltage Multiplier - warning displayed for symbol voltage exceeding this value.

Undervoltage Multiplier - warning displayed for symbol voltage below this value.

Overcurrent Multiplier - warning displayed for symbol current exceeding this value.

Feedback

For any questions, comments, or suggestions, please contact our technical support service at:

support@megasysoftware.com

While describing the problems you have found in PowerNet, please provide us with the following information:

- PowerNet Build Number. Preferred - screen capture of Help/About Box.
- Your Windows version.
- Sequence of your actions that caused the problem.
- As many details related to the problem as possible.

Before requesting technical support, please make sure you are using the latest version of PowerNet . Information on the latest releases can be found on the Web site at:

www.megasysoftware.com

Upgrades

If you are a legally [registered user](#) of PowerNet, you have the right for free upgrades to any newer minor version (for example, from 1.0 to any 1.x version). Or, you have the right for free upgrades to any newer major version (for example, from 1.x to 2.x, 3.x, 4.x, and so on) in case if the period of one year since your order date has not yet elapsed.

In other cases, you have the right for a 50% discount from our current price for an upgrade to any newer major version of PowerNet.

For more information about recent releases, please visit our Web site at:

www.megasyssoftware.com

How To Order

You can order PowerNet online through our secure website. Your payment will be processed by payment service provider PayPal. You do not need to be a member of PayPal, they will process Visa or Mastercard and accept payments in different currencies (US Dollar, Australian Dollar, Euro, Pound Sterling, Canadian Dollar, etc).

Once your order is complete, your [license key](#) will be immediately sent via email to unlock the software for use.

The final cost for PowerNet depends on what type of [license](#) and how many copies of that license you are ordering. The latest pricing information is available on our [Web site](#).

The quickest way to order is by selecting *Help/Buy Now* from the PowerNet menu. Or you can simply visit the Megasys Software web page and place your order:

<https://www.megasyssoftware.com/products.php>

License Key

As soon as your order for PowerNet is complete, you will receive a license key, which should be entered into the program to unlock it for use.

To apply your license key:

1. Select the license key in your order confirmation e-mail, and press Ctrl+C to copy it to the Clipboard.
2. Run PowerNet.
3. Choose Help|Enter License Key from the menu.
4. In the dialog-box, click the Paste button to insert your license key.
5. Click the OK button and then restart PowerNet.

You are strongly advised to save your order confirmation e-mail for future reference.

Please do not distribute your license key and do not let anybody copy it. Otherwise, as stated in the license agreement, if your key is published anywhere, your license for using PowerNet will be terminated.

Lost your key?

If, for any reason, you have lost your license key, just contact us and we will resend it to the e-mail address you used when registering.

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