

FineELEC

Quick Start Guide

1. Installation – Launching
2. CAD Environment
3. Calculation Environment

Preface

This Quick Start Guide provides a fast and friendly introduction on FineELEC, describing its concept and functionalities. All the features and functions of the program are presented and explained in detail within the complete User's Guide, along with informative examples.

FineELEC, the **F**ully **I**ntegrated **E**nvironment for **E**lectrical Building Installations combines both designing and calculations in a uniform, integrated environment, consisting of two main components, CAD and Calculations:

- Concerning the **CAD component**, it is based on an autonomous CAD embedding 4MCAD engine adopting the common cad functionality and open dwg drawing file format. The CAD component helps the user to design and then calculates and produces completely automatically the entire calculations issue for every Electrical Installation project, as well as all the drawings in their final form.
- Concerning the **Calculations component** (called also as ADAPT/FCALC), it has been designed according to the latest technological standards and stands out for its unique user - friendliness, its methodological thoroughness of calculations and its in-depth presentation of the results. The Calculation component of FineELEC acquires data directly from the drawings (automatically), thus resulting in significant time saving and maximum reliability of the project results. It can also be used independently, by typing data within the module spreadsheets.

Despite its numerous capabilities, FineELEC has been designed in order to be easy to learn. Indeed, the simplicity in the operation philosophy is realised very soon and all that the user has to do is to familiarise with the package.

This Guide is divided into 3 short parts:

- Part 1 describes the installation procedure and the main menu structure.
- Part 2 deals with the CAD component of FineELEC, showing its philosophy and main features.
- Part 3 describes the operations of the calculation environment of FineELEC.

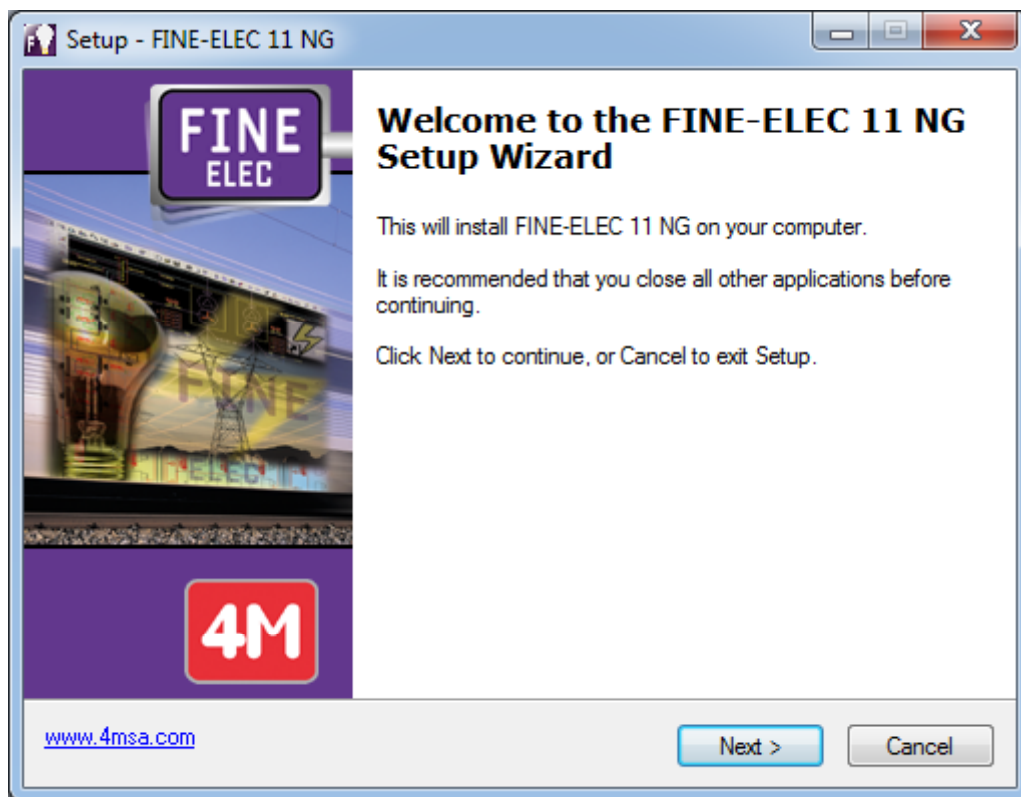
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1. Installation - Launching

1.1 Installing FineELEC

1. Insert the CD in your computer CD-ROM drive (e.g. D:, E:) or, if you received your software via Internet, run the installation application you downloaded.
2. When the Setup window appears, choose the language for the installation and click OK.
3. When the Welcome page appears (as shown below), click **Next**.



4. When the License Agreement appears, read it carefully. If you agree with the terms, check the respective "radio button" and then click **Next** (you must agree with the terms to proceed with the installation).
5. In the next screen enter your username and organization information and check if you want to create a desktop icon. Then click **Next** to see if the information is correct (see the following window) and finally click **Install** for the installation procedure to begin.
6. Upon completion of the installation procedure, the following last window appears on screen and all needed is to click **Finish**. In case that the "Run FineELEC" checkbox is selected, the program will start running.



7. After installation, the program is located within the programs list.

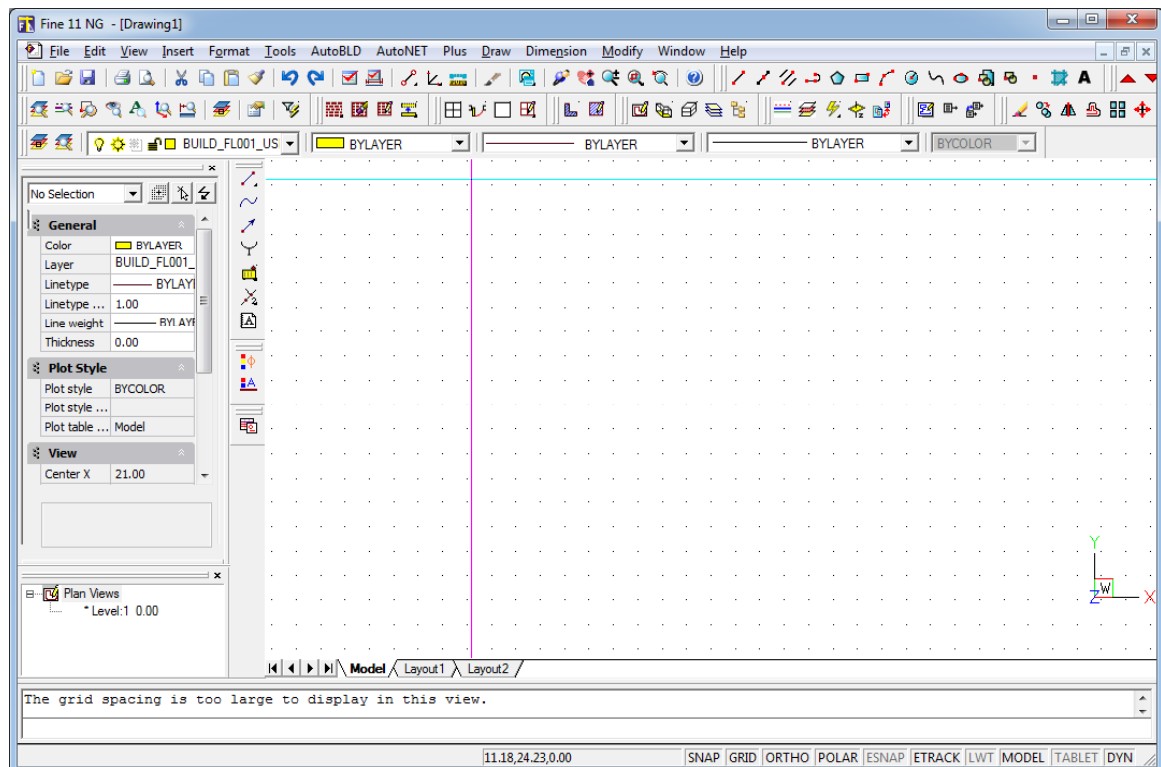
2. CAD Component

2.1 Overview

As mentioned above, FineELEC is a powerful workstation for electrical design of building installations. Based on HD384 regulations, the program performs automatically all the necessary calculations directly from the drawings, producing thus all the case study results (Calculation issue, technical descriptions, full-scale drawings properly updated, bills of materials etc). This chapter describes the operation of the CAD component of FineELEC, which operates on its own autonomous environment, embedding the 4MCAD engine. This CAD component considers the building and its Electrical installation as being composed of intelligent entities with their own attributes, consistently related to each other. More specifically, the CAD Component includes 2 main modules interacting between each other, giving the impression to the Designer that he/she virtually works on the building: It is about a) AutoBLD for the architectural design (3D building model), and b) AutoNET for the electrical network design.

2.2 Main menu

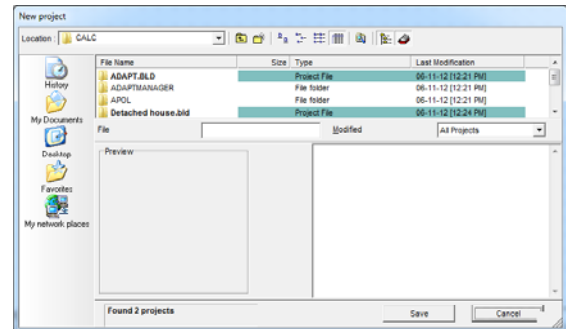
As soon as the program is loaded, the main menu screen appears for the first time:



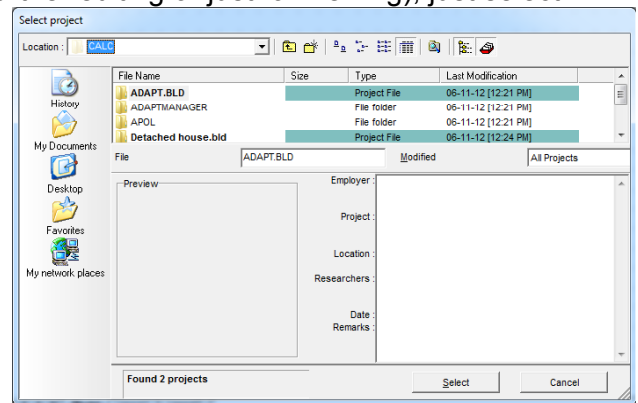
Among the commands of the designing environment, we notice the following main groups of commands:

1. **FILE** group of commands for the file management needs (New Project, Open Project and Project Information).
2. **AutoBLD** group of commands serving for the Architectural designing.
3. **AutoNET** group of commands, containing the instructions required for the designing and recognition of the electrical network.
4. **PLUS** menu including a series of designing facilities for the user.

To start drawing with FineELEC, a new project should be first defined by applying the “**New Project**” command, which is located at the “**FILE**” menu. Then a window appears on screen where the name of the Project must be filled. Then, click OK and you are now ready to start drawing and work on the project.

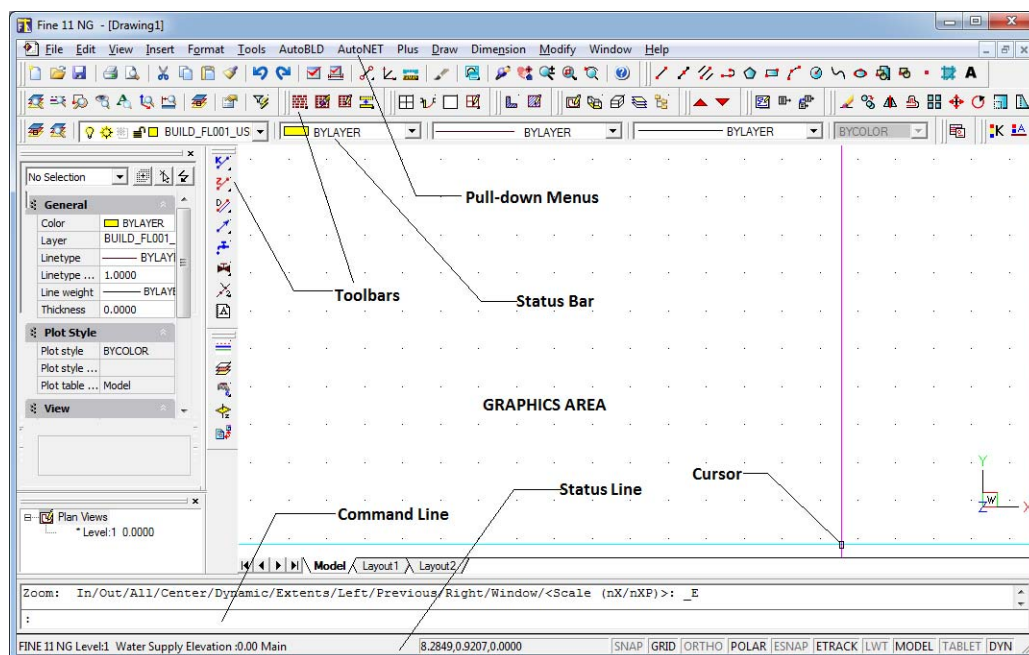


In order to “**Open**” an existing project (i.e. for further editing or just for viewing), just select “**Select Project**”, and a list with the existing projects in your disk will be displayed on the screen. The functionality of this window list follows the windows standards.



2.3 Drawing Principles & Basic Commands

A great advantage of the package is that the structure and the features of the drawing environment follow the standards of the CAD industry adopted by AutoCAD, 4MCAD etc. In particular, the available working space is as follows:



As shown in the above figure, the screen is divided into the following "areas":

- **Command line:** The command line is the area where commands are entered and the command messages appear.
- **Graphics area:** The largest area of the screen, where drawings are created and edited.
- **Graphics cursor:** The cursor is used for drawing, selecting objects and running commands from the menus or the dialog boxes. Depending on the current command or action, the cursor may appear as a graphics cursor (crosshairs), a selection box, a graphics cursor with a selection box etc.
- **Pull-down menus:** These menus appear by selecting them.
- **Status Line:** It is the line on the bottom of the screen where the current level, the drawing status and the current cursor coordinates are displayed.

2.3.1 Drawing aids

This section describes the basic drawing aids available to the user. These are the commands **Esnap** (object snap), **Ortho** (vertical/horizontal drawing), **Grid** and **Snap** (movement increment). More specifically:

ESNAP: The "Esnap" command forces the cursor to select a snap point of an object, which is within the Pick box outline. The snap points are characteristic geometric points of an object (i.e. endpoint of a line). If you have specified a snap point and move the cursor close to it, the program will identify it with a frame. The "Esnap" command can be activated either by holding down the "SHIFT" key and right clicking the mouse or by clicking the middle mouse button or through the additional toolbar.

ORTHO: The "Ortho" feature restricts the cursor to horizontal or vertical movement. The status bar shows whether the "Ortho" command is activated by displaying "ORTHO" in black characters. The command is activated or deactivated by clicking the corresponding button-icon or by pressing **F8**.

GRID: The screen grid is a pattern of vertical and horizontal dots, which are placed at the axes intersection points of an imaginary grid. The grid can be activated or deactivated by clicking the corresponding button-icon or by pressing **F7** (if the grid is active, it appears on the Status Bar).

SNAP: The graphics cursor position coordinates appear in the middle of the upper part of the graphics area. If "Snap" is selected, the graphics cursor movement may not be continuous but follow a specific increment (minimum movement distance).

2.3.2 Drawing Coordinates

When you need to determine a point, you can either use the mouse (by seeing the coordinates in the status bar or using the snap utilities), or enter the coordinates directly in the command line. Moreover, you can use either Cartesian or polar coordinates, either absolute or relative values, in each method (relative coordinates are usually more convenient).

Relative coordinates: Enter the @ symbol (which indicates relative coordinates) and then the x,y,z coordinates (Cartesian system) or the $r<\theta<\phi$ coordinates (polar system) in the command line. The system used (Cartesian or polar) is defined by the "," or "<" symbol. If you do not insert a value for z or ϕ , it will be automatically taken as zero. For example, if you are prompted to locate the second (right) endpoint of a 2m horizontal line, you should enter:

@2,0 if you use the Cartesian coordinates (which means that the distance of the second point from the first is 2 m on the x axis and 0 m on the y axis), or

@2<0 if you use the polar coordinates [which means that the second point is at a distance of 2m ($r=2$) and an angle of 0 degrees ($\theta=0$) from the first].

Absolute coordinates: These are specified like the relative coordinates, but without using the @ symbol. The absolute coordinates are specified in relation with the 0,0 point of the drawing.

The measurement system can be activated, deactivated or changed with the F6 key.

2.3.3 Drawing Basic Entities

Line: "Line" option is used for drawing segments. When you select "Line" from the menu or type "Line" in the command line, you will be prompted to specify a start point (by left clicking or by entering the point coordinates – relative or absolute – in the command line) and an endpoint (determined in the same way).

Arc: The "Arc" command is used for drawing arcs. An arc can be drawn in different ways: The default method is to specify three points of the arc ("3-Points"). Alternatively, you can specify the start point and endpoint of the arc as well as the center of the circle where it belongs (St, C, End). The user will not find it difficult to understand and become familiar with the various methods of drawing an arc.

Polyline: This command allows you to draw polylines, which are connected sequences of line or arc segments created as single objects. The command is executed by either using the menu or typing "pline" in the command line. You will be prompted to specify a start point and an endpoint (by right clicking the mouse or by entering the point coordinates – relative or absolute – in the command line). Then, the command options will appear (Arc, Close, Length etc). Select **A** to switch to Arc mode, **L** to return to Line mode and **C** to close the polyline.

2.3.4 Useful Commands

This section includes brief descriptions of the basic program commands, which will be very useful to the user. These are the commands "Zoom", "Pan", "Select", "Move", "Copy" and "Erase". In particular:

Zoom: "Zoom" increases or decreases the apparent size of the image displayed, allowing the user to have a "closer" or "further" view of the drawing. There are different zooming methods, the most functional of which is the real-time zooming ("lens / \pm " button). You can use the mouse to zoom in real time – that is to zoom in and out by moving the cursor. There are a number of zoom options as shown by typing "Zoom" in the command line: All/Center/Dynamic/Extents/Left/Previous/Vmax/window/<Scale(X/XP)>

Pan: "Pan" ("hand" icon) moves the position of the visible part of the drawing, so that you can view a new (previously not visible) part. The visible part of the screen moves towards the desired area and to the desired extent.

Select: This command selects one or more objects (or the whole drawing), in order to execute a specific task (erase, copy etc.). Select is also used by other CAD commands (for example, if you use the "Erase" command, "Select" will be automatically activated in order to select the area that will be erased).

Move: This command allows moving of objects from one location to another. When the "Move" command is activated, the "Select" command is also activated so that the object(s) the user wants to move (in the way described in the previous paragraph) can be selected.

After you have selected the desired object(s), you are prompted to specify the base point (using the snap options), which is a fixed point of the drawing. When you are prompted to specify the position where the base point will be moved, use either the mouse or the snap options. After you have completed this procedure, the selected object(s) will move to the new position. Please note that the base and the new location points can be also specified with the use of coordinates (absolute or relative, see related paragraph).

Copy: The "Copy" option allows the copying of objects from one location to another. The "Copy" procedure is similar to the "Move" procedure and the only difference is that the copied object remains at its original location in the drawing.

Erase: Choose this option to delete objects. The procedure is simple: Select the objects you wish to erase (as described above), type "E" in the command line and press <Enter>. Alternatively, you may first type "E" in the command line, then select the object(s) by left clicking and finally right click to erase the object(s).

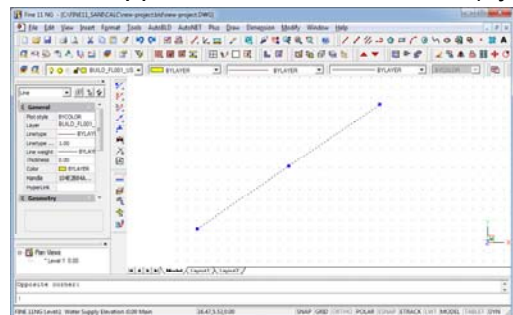
DDInsert (Insert Drawing): This command allows the user to insert another drawing (DWG file) or block in the drawing. When this command is selected, a window appears in which you should select block or file and then select the corresponding block or file from disk. Then you are prompted to specify the insertion point, the scale factor etc, so that the selected drawing is properly inserted.

Wblock: The "Wblock" command allows us to save part of a drawing or the entire drawing in a file, as a block. When this command is selected, you are prompted to enter the file name and then you should select the drawing or the part of the drawing you wish to save. The use of this command is similar to the "Screen Drawing" command, which will be described in a following section. In order to insert a block in a drawing, you should use the "ddinsert" command described above.

Explode: The "Explode" command converts a block in a number of lines so that you can edit it in that form. If it is selected, the program will prompt you to select the block ("Select object") you wish to explode.

2.3.5 Grips

Grips are some characteristic points of an object which appear after it is selected (by moving the cursor on the object and left clicking). Then object is displayed with grips (small squares), which mark control locations and are powerful editing tools. When you click a grip, it turns red and the following prompt appears in the command line: ****STRETCH**** <stretch to point> /Base point /copy/ undo/ exit. If you press <Enter> (or right click), the first characters of the corresponding word are entered, e.g. "sc and enter" for the "Scale" command).



When a command is executed, grips disappear and the objects are deselected. If the command is an editing command (correction or copy), which can be preselected, the objects take part in the execution of the command automatically. In this case, the command overrides the "Select objects" prompt and proceeds. To deselect grips and objects you should press <Esc> twice: Once to deselect the objects and twice to deactivate the grips.

In each object the positions of the grips are different. Namely, for a point the grip is the point itself, for a segment the grips are the midpoint and the two endpoints, for an arc the midpoint and the two endpoints, for a circle the center and the quadrants, for a polyline the endpoints of the line and arc segments and the midpoints points of the arc segments, for a spline the spline points, for a block the insertion point, for text the insertion point etc.

2.3.6 Print

This section may be read after the user has created a drawing and wants to print it. Any drawing can be printed using a printer or plotter or to a file. Printing is performed using "PRINT" (or "PLOT") command, selected either from the "FILE" menu or typing it in the command line, provided there is a drawing already loaded.

Viewing a drawing before printing gives you a preview of what your drawing will look like when it is printed. This helps you see if there are any changes you want to make before actually printing the drawing.

If you are using print style tables, the preview shows how your drawing will print with the assigned print styles. For example, the preview may display different colors or lineweights than those used in the drawing because of assigned print styles.

To preview a drawing before printing

1. If necessary, click the desired Layout tab or the Model tab.
2. Do one of the following:
 - Choose File > Print Preview.
 - On the Standard toolbar, click the Print Preview tool ().
 - Type ppreview and then press Enter.
3. After checking the preview image, do one of the following:
 - To print the drawing, click Print to display the Print dialog box.
 - To return to the drawing, click Close.

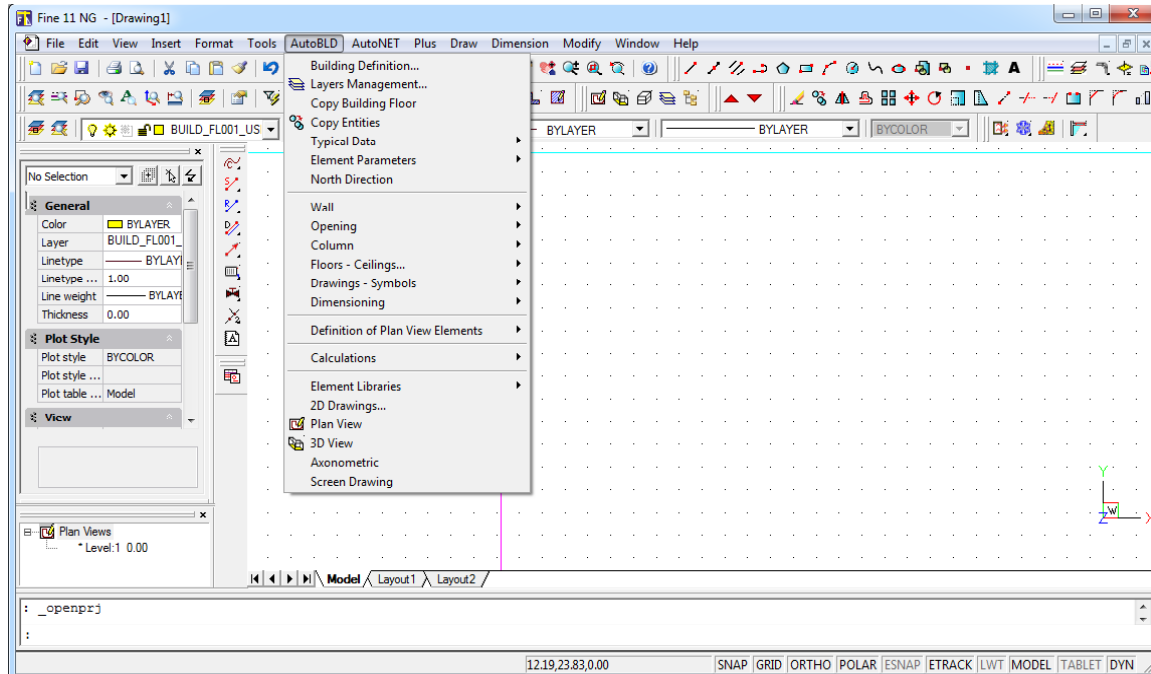
The Print dialog box is organized by tabs into two functional areas: scaling and viewing, and advanced printing options. For help defining print settings before you print, see Customizing print options.

To print a drawing

1. If necessary, click the desired Layout tab or the Model tab.
2. Do one of the following:
 - Choose File > Print.
 - On the Standard toolbar, click the Print tool (). If you click the Print tool, the Print dialog box does not display. Your drawing will be sent directly to the selected printer.
 - Type print and then press Enter.
3. From the Print dialog box, make any adjustments to the settings.
4. Click Print.

2.4 AutoBUILD: Architectural Design

As already mentioned, AutoBLD group of commands includes all the necessary tools to shape the 3D building model and therefore the Architectural drawings. Those tools are organized in sub-groups.

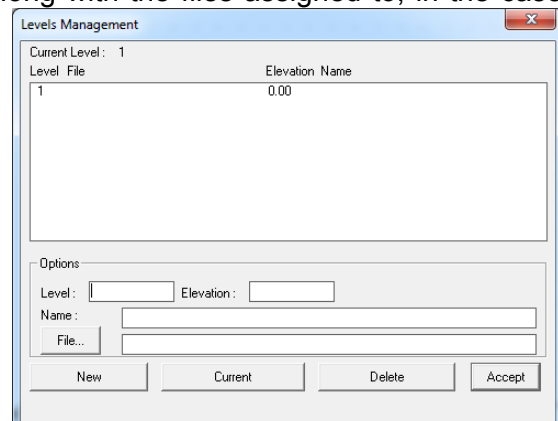


The first sub-group includes commands for the definition of the project parameters, the second sub-group includes drawing commands, the third sub-group commands related to the calculations, the fourth sub-group includes management options for the AutoBLD libraries and the fifth sub-group includes viewing commands of the building.

2.4.1 Building Definition

This window summarizes the building levels along with the files assigned to, in the case that the user wishes to import existing dwg drawings for the building levels (i.e. provided by the Architect). More specifically:

- In the "Level" field, the user must define the Level (floor) number.
- In the "Elevation" field, the height of the floor level (i.e. 3 meters).
- In the "File" field, the path and the name of the relevant DWG drawing-file, only if the user wants to refer to an already existing drawing, otherwise if he is intended to draw the architectural drawing from scratch he/she must leave this field blank.

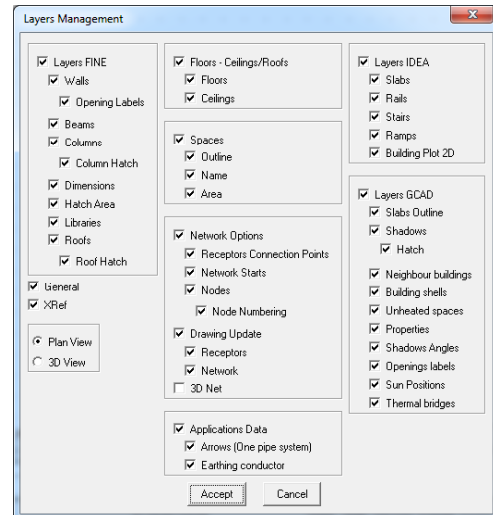


The insertion and the management of ground plans are performed with use of the xref command. At the bottom of the dialog box there are three functions available which are actually used to manage the floor files. More specifically:

- Press the "New" button to save a new floor or the changes in the data of a floor (e.g. level, DWG drawing).
- Use the "Current" option to select the ground plan/file you want to work on each time.
- Select the "Delete" option to delete the desired floor. The "Delete" command removes the ground plan of the relevant floor in the project without deleting the original architectural DWG file.

The "OK" command closes the dialog box (does not save the floor data). This can be managed with the "New" command). FineELEC enables also the insertion of a "scanned" ground plan, that is a bitmap file created by a scanner. In this particular situation the steps to follow are described in detail within the User's Guide.

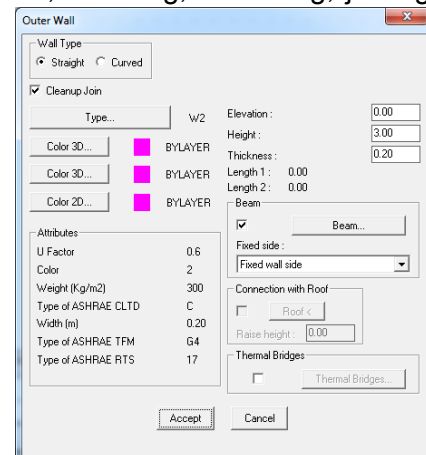
Through the "Layers Management" option the user can disable any element group, by simply clicking inside the check-box of the respective group.



2.4.2 Drawing Walls

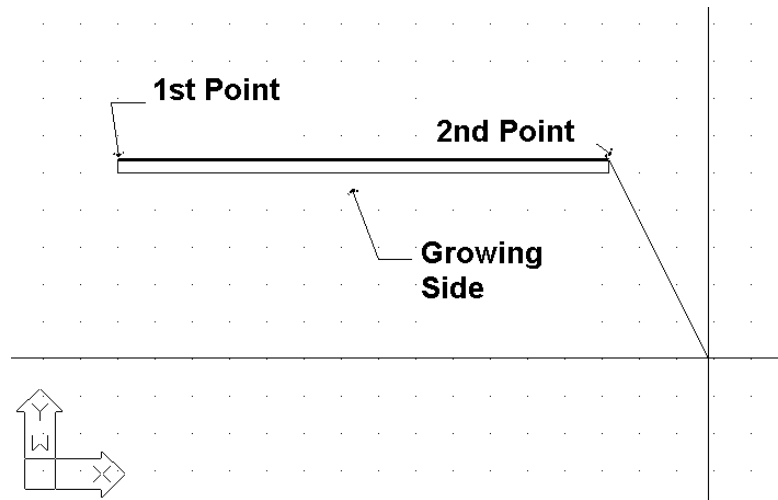
AutoBLD contains all the commands required for drawing and editing walls, such as parallel moving of walls, trimming, extending, joining and breaking walls as well as placing openings of any kind on them (windows, sliding doors, openings, arches). During the initial drawing, as well as during any modification at any stage, the drawing is automatically updated.

The **Wall** option, located at the second subgroup of the AutoBLD group of commands, includes the Outer, Inner, Outer wall from polyline, Inner wall from polyline and Outline options as well as the option subgroup Modify, Delete, Extend, Break, Join, Trim and Move. The first subgroup concerns the wall drawing, while the second with their further processing after being drawn. Finally, there is also the Elevation of Merge Intersection option, which affects the plan view drawing presentation. By selecting Outer Wall, first of all its attribute dialog appears with a series of parameters (type, dimensions, colors etc). In order to start drawing a wall, you should click OK and then follow the instructions shown below:



Outer wall (straight / arc): After activating the command (by pressing <Enter> in the menu), you are required to successively provide:

- i) the starting point of the wall (the application message in the command prompt is: *"Wall start \ Relative to wall \ Toggle shape <Linear>"*)
- ii) the ending point of the wall (the application message in the command prompt is *"Wall end \ Relative to wall \ Toggle shape <Linear>"*)
- iii) the direction towards which the wall shall grow, by providing any point on one of the two half-planes defined by the wall line (the application message in the command prompt is *"Enter Side Point"*).



After the above actions, you can see that the wall has been drawn and that you can continue to draw another wall starting from the ending point you defined earlier, unless you right click, which means that you want to stop. You can change the wall drawing from linear into circular, typing **T** in the following program prompts and pressing <Enter>. During drawing, one can come to the conclusion that the ability of drawing consecutive walls is very convenient, since it saves the user from making many movements. As mentioned further below, in the “Element Parameters” section, the thickness of the wall, its height and its level in relation to the floor level (when the level is 0, the wall starts from the floor), are stored within the “Element Parameters” for the wall. By providing proper values for the wall height and level, any possible case of walls of unequal height can be dealt with. The techniques and tools for creating walls are described in detail within the User’s Guide.

Further to the drawing functions, the program also provides the user with powerful editing tools, such as erase, modify (through the wall dialog box), multiple change etc. Within the User’s Guide there are complete instructions regarding the above commands plus also the applicable commands Copy, Stretch, Extend, Trim, Break, Unify, Mirror, Rotate, Scale, Base point. Two other commands that are widely used while drawing the walls are a) the Undo command, which enables the user to reverse the previous command executed and b) the Properties command, which enables the user to view (and change) the attributes of the selected wall.

2.4.3 Drawing Openings

Once the command "Opening" is activated, a second option menu is displayed, including a variety of opening types (window, sliding door, door etc) to draw, plus also a set of editing functions such as "Erase", "Modify" or "Move", applied to existing openings. Besides, at the bottom of this menu lies the option “Libraries”, which enables the user to define his/her own opening freely, to create various shapes of windows.

Window: The option "Window" demands that you select the wall on which the opening will be placed and then define the beginning and the end of the opening (all these actions are carried out using the mouse and pressing <Enter> each time). The window will automatically obtain the data that are predefined in the “Attributes”, namely the corresponding values for the height, the rize, the coefficient k etc). Of course, you can draw the window from the ground plan as well as in the three-dimensional (3D) view. During drawing a window, it is very helpful to the user the fact that, after the wall where the window will be automatically placed is selected, the distance from the wall edge is displayed in the coordinates position on the top of the screen, while the crosshair is transferred parallel to the wall for supervision reasons.

The measurement starting point (distance 0) as well as the side (internal or external) are defined by which one of the two edges is closer and which side was "grabbed" during the wall selection. Similar functionality exists for other types of openings, such as Sliding Doors, Doors, Openings etc. All the details are included within the User's Guide.

Besides walls and openings, AutoBLD provides tools for designing columns and other elements, as well as drawing libraries including drawings and symbols to place within the drawing (i.e. general symbols, furniture, plants etc). Details are shown within the User Guide of FineELEC.

The Building model of a FineELEC project can be viewed through the commands:

- Plan View (2D): The two-dimensional plan view of the respective building level is shown.
- 3D View: A three-dimensional supervision of the ground plan of the current floor (with given viewing angles) is shown.
- Axonometric: Provides three-dimensional supervision of the whole building (for all floors), with the given viewing angles as they have been selected in "Viewing Features".

2.5 AutoNET: Electrical Installation Design

2.5.1 General Philosophy

The option group AutoNET includes all those tools the designer needs in order to draw (and then calculate) the cabling network of the electrical installation. More specifically, the main AutoNET instructions are described below:

Drawing Definition: Layers for each installation are organized properly and the information is shown on the respective dialog. The command "Color" is used to assign the desired color to each network while the command "Linetype" is used to select the desirable line type.

Copy network of Level: AutoNET enables copying of typical (installation) plan views and pasting them on other floors through this command, which functions similarly to the "copy level" AutoBLD option.

Select Application: This option enables selection of the desired application of FineELEC, Electrical Installation or Nets. Depending on the selected application, the commands of the following AutoNET menu will be configured accordingly.

The basic principles and rules for drawing a network are described below:

The installation network drawing is carried out with a single line, by drawing lines and connecting them to each other, exactly as the network is connected in fact. The user should keep in mind some general principles regarding drawing and connecting between straight or curved, horizontal or vertical network segments.

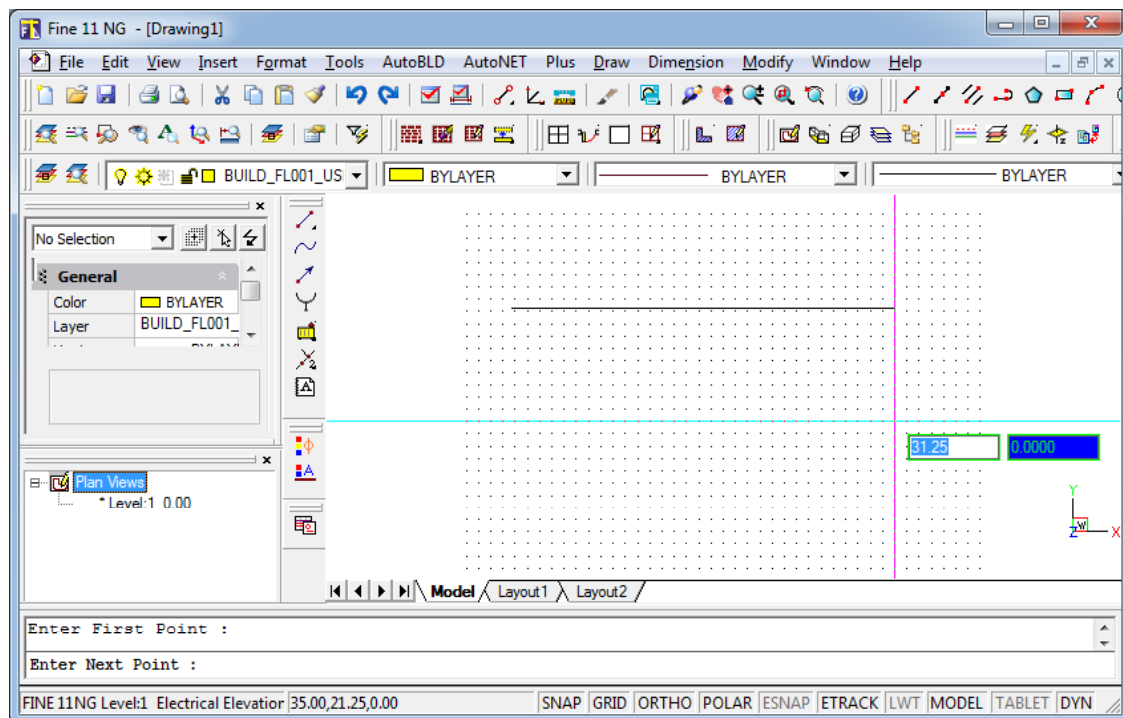
Horizontal Cabling: In any case, the cabling drawing is carried out exactly as the line drawing in AutoCAD (or 4MCAD). The user is able to draw horizontal network segments.

The cable installation thickness (thickness of the line) is the current thickness. Modification of the cable installation thickness is possible through the AutoCAD (or 4MCAD) command "elev". If you type "elev" (in the command line), you are prompted to determine the new current thickness after defining the new current elevation. Press <Enter> if it is 0 or type 0 if there is another value but 0. At this point it should be emphasised that, if a horizontal cabling which is found on a specific level is drawn and it is connected to another cabling or a contact point (receptor or appliance), the program automatically places the cable in such way so that connecting to the other cable or receptor, respectively, is possible. In this way, the program facilitates the drawing of cabling in three dimensions while the designer is actually working in a two-dimension environment.

<p>Caution! In case a horizontal segment is connected to a vertical one, "perpendicular" snap should be used so that there will be no more vertical segments created which would possibly complicate identification.</p>

While designing a network, all facilities provided by AutoCAD or 4MCAD can be used through relative co-ordinates.

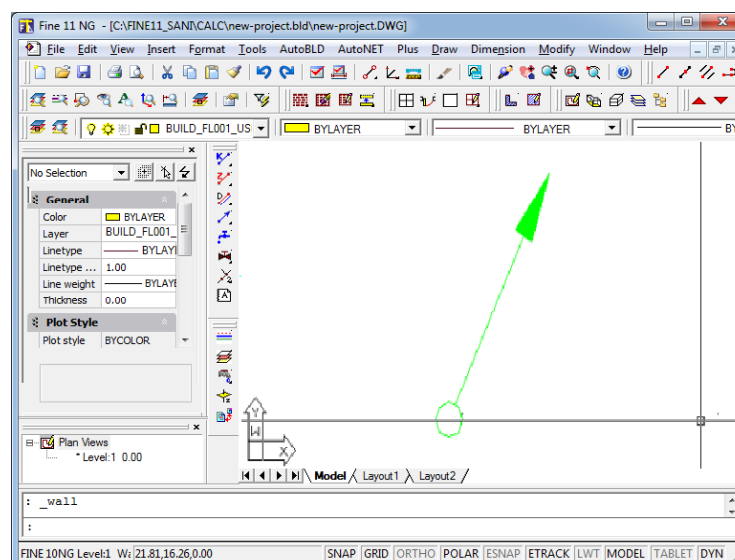
Example: Suppose you want to draw a horizontal network segment at the floor level which will be parallel to the wall (thickness 0). After selecting "Cabling", use the mouse to define the first endpoint. Activate AutoCAD "ortho" to enable horizontal movements, as this facilitates the drawing of this example.



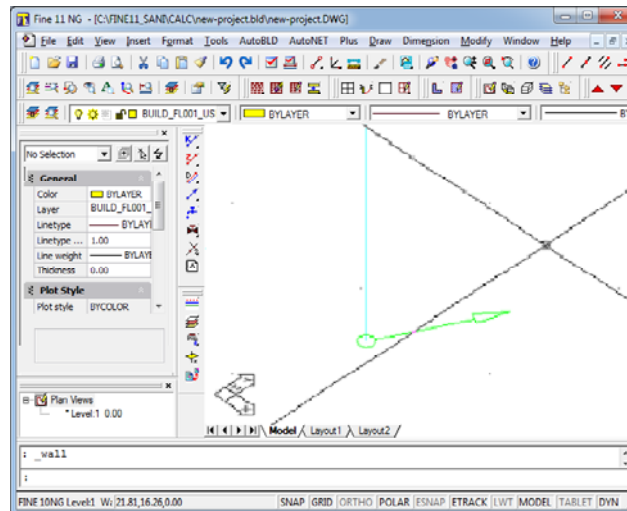
Move to the other side of the cable and left click to define the second endpoint. Right click to complete the function of this command.

Vertical Cabling: Drawing vertical segments that cross floors (one or more) is possible through the option "Vertical Cabling". When this option is selected from the menu, the program asks for the vertical cabling position ("Enter XY Location") and then for the height of the starting point ("Enter Height for First Point") as well as the height of the ending point ("Enter Height for Second Point").

Example: Assume that you want to draw a vertical segment (cabling) from 0 to 3. If you insert the location point (XY) and then the numbers 0 and 3 successively, the arrow of direction change appears on the ground plan.



If "3D View" is selected, the column is displayed in 3 dimensions, exactly as drawn:



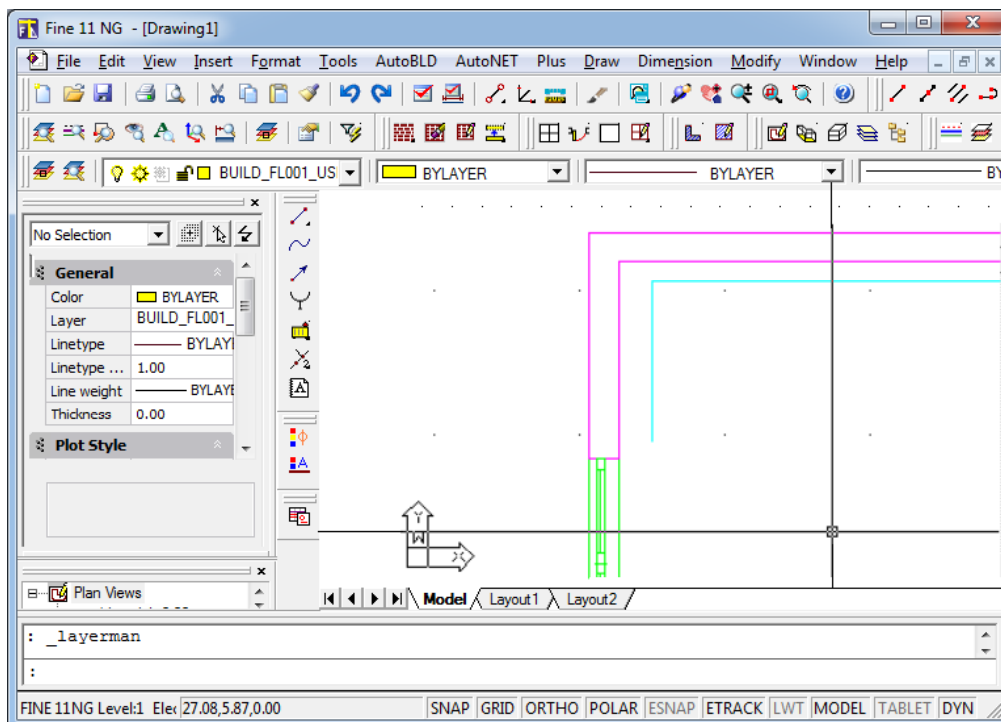
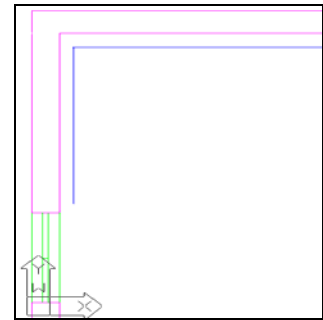
The program automatically draws the symbol for a vertical cabling, as shown in the image.

Note: This symbol is a block with the name Mark1. After the symbol is placed, the user can modify it, draw any other symbol he wishes or "Replace Block".

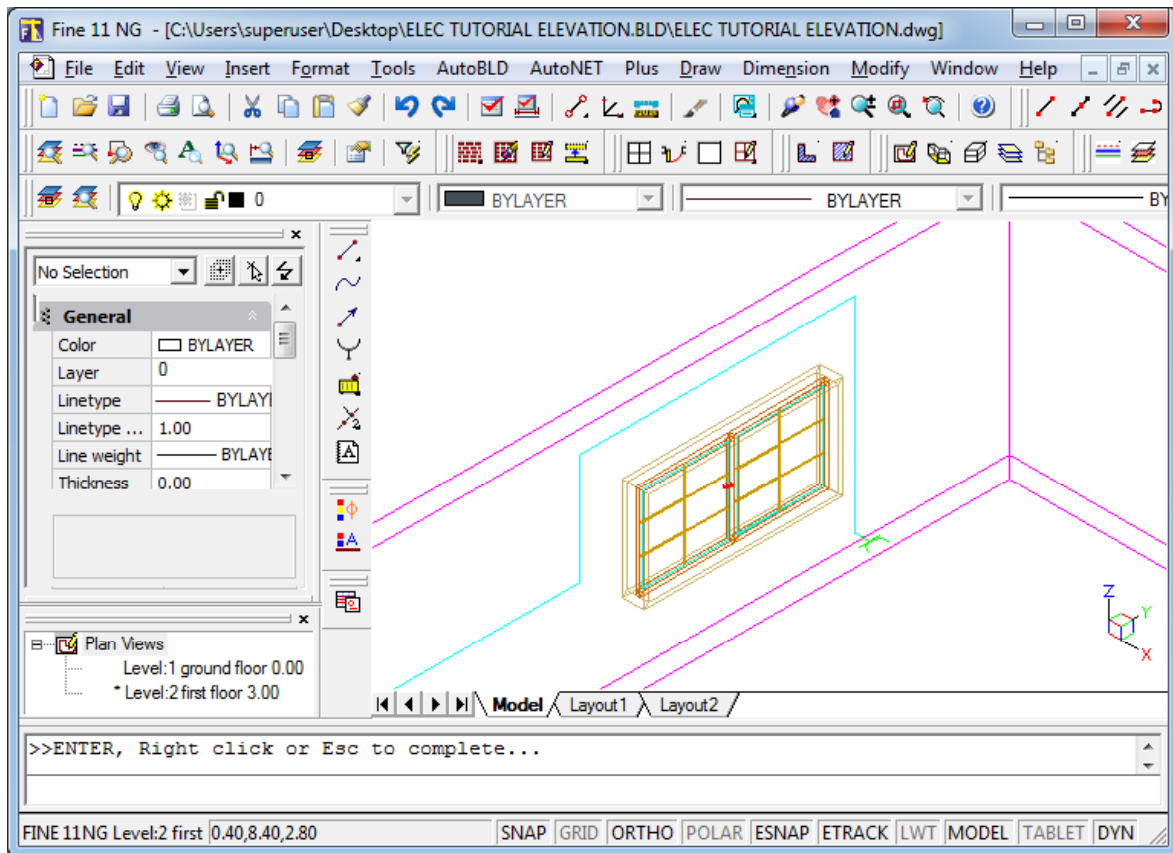
Vertical segments within the same floor: If you want to elevate or lower a cable within the same floor without having the elevation-lowering symbol inserted (Mark1), you can use the command "Cable".

Example: Assume that you want to elevate by 2.5 m the cable shown in the adjacent screen, to continue over and along the window and finally descend by 1.5 m.

Run the command "Cable" and select the cable end by using the "Endpoint" snap. After that, in the prompt "Enter next point" insert @0,0,2.5 which means that the next cable end is found at the same co-ordinates x, y (relative co-ordinates 0,0) and height (z) 2.5 m.



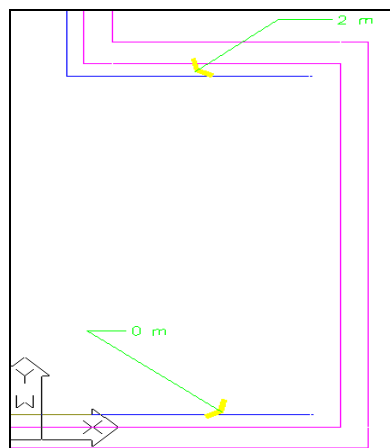
Then you can continue drawing the cabling, using the mouse in order to move towards the lower part of the window and "descend" from that point by typing @0,0,-1.5 as next end. This means that there will be a lowering of 1.5 m. Right clicking terminates the drawing of the cabling. For better viewing of the drawing, run "3D View" command and the following screen appears:



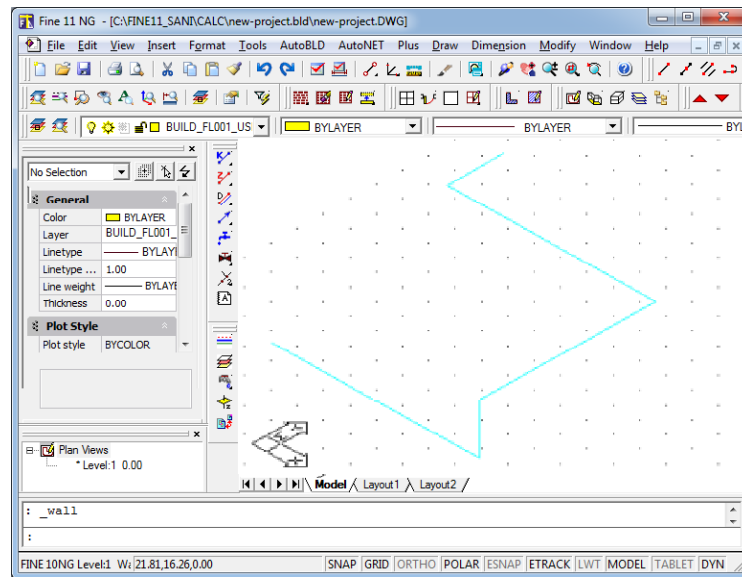
Note that you can draw cabling in 3 dimensions easily, if you use the above drawing mode.

Connecting network segments: Connections between network segments (horizontal, vertical or both) as well as between network parts and receptors can be easily handled by using the "ESNAP" commands.

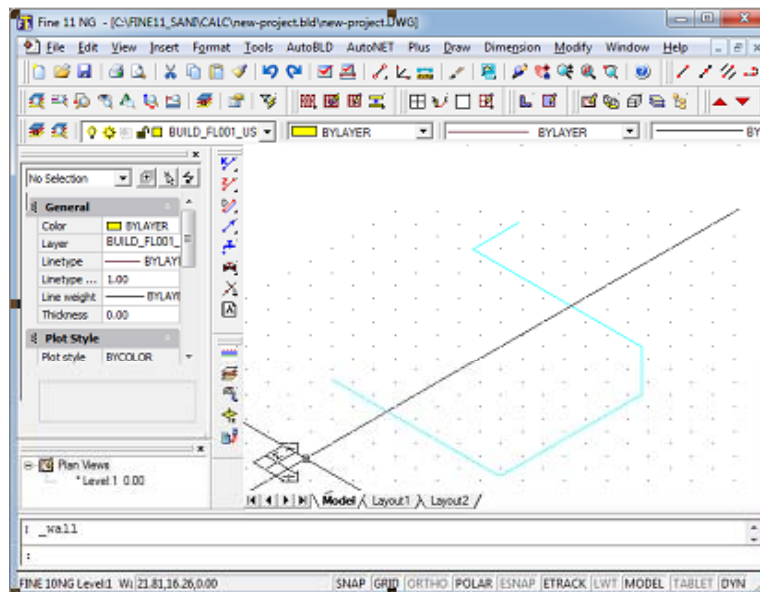
Example: Assume that the two horizontal segments of the ground plan below, which are placed in different heights, have to be connected.



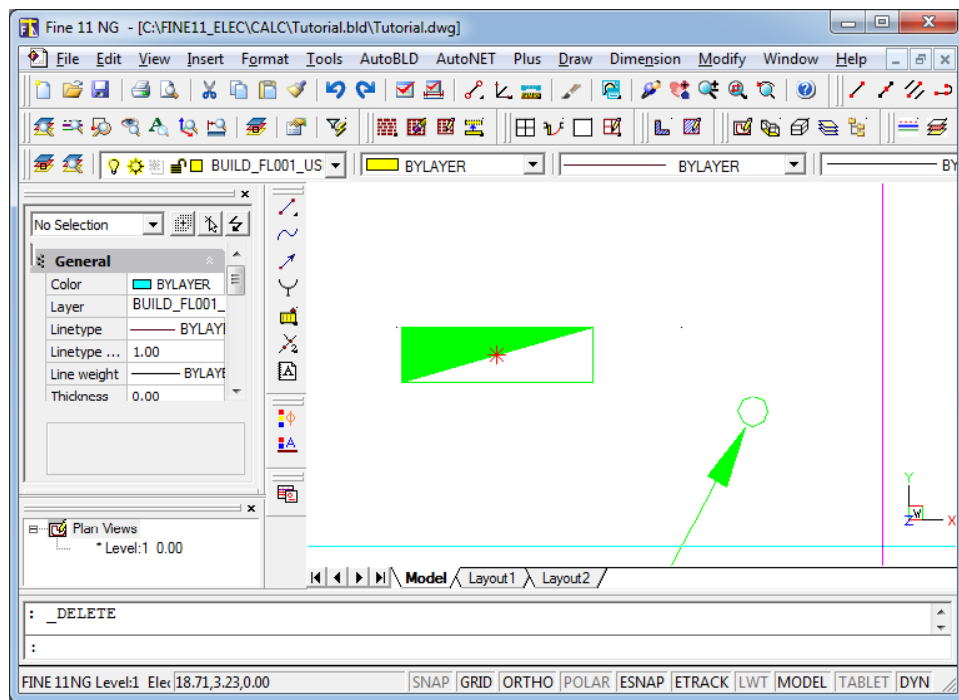
If you start by "selecting" the "upper" cable end and then end up at the "lower" cable end, the result in the three-dimension view will be as follows:



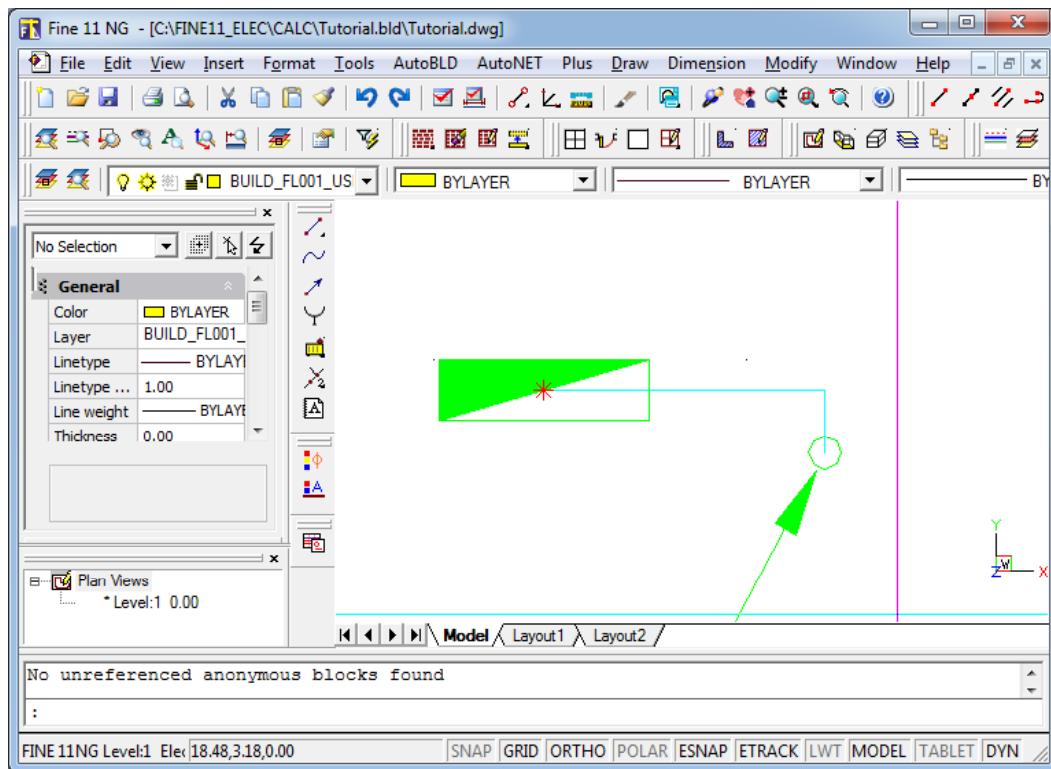
On the other hand, if the cable is drawn by using as the first end, the cable end, that belongs to the cable that lies on the lower height, and the "upper" cable as the second end, the result will be as follows:



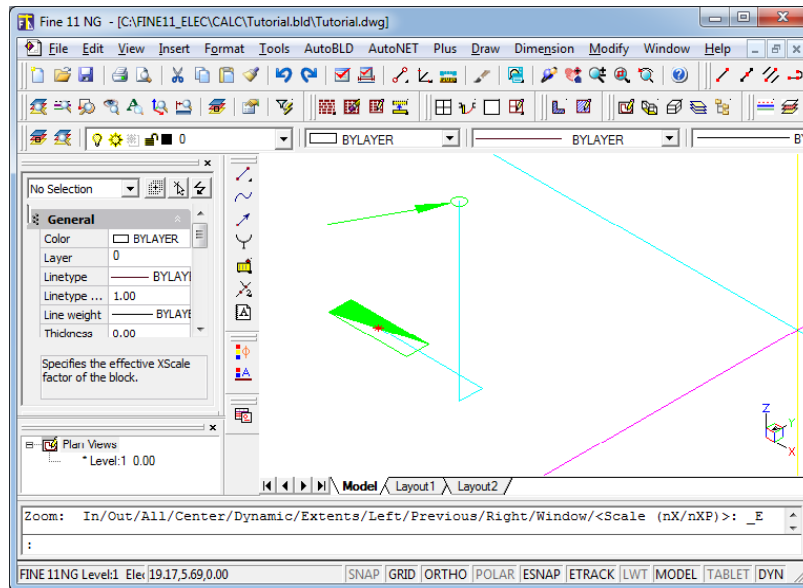
Example 2: Assume the panel of the ground plan below has to be connected to the vertical cable.



With the connection point as the first end (using a "point" snap), the second end in between and the third end on the vertical cable (using a "perpendicular" or "centre" snap) the section shown below is created:



In the axonometric view, the result will be as follows:

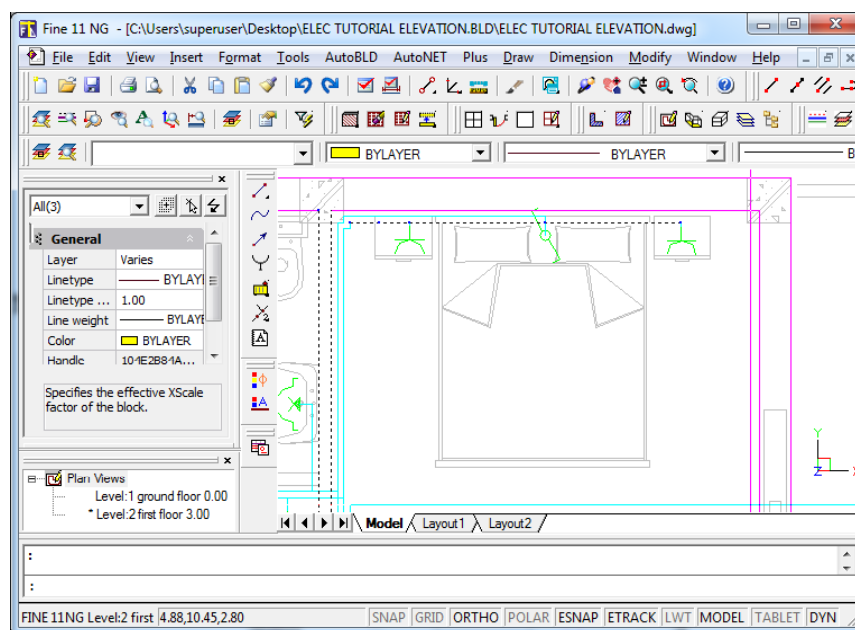


Attention! If an "endpoint" or "nearest" snap had been used for the column (in the ground plan above), the connection would not have been properly executed. It would have also been possible to work in 3 dimensions and enter a "perpendicular" snap by showing the vertical cable and therefore achieve a proper connection.

2.5.2 Special Commands for Cable Construction

This is actually a set of commands aiming at easier drawing of the installation cabling. More specifically, there are two basic commands:

Cabling parallel to Wall: A cable parallel to the wall (walls) is drawn by the user, with a given distance from the wall, in printing mm (which depends on the printing scale as well). The program asks for the first point and afterwards the wall or the walls (successively) parallel to which (in a certain fixed distance) the cable is to be drawn. For instance, if the connection point of the corner is inserted as the first point in the ground plan shown below and then the three walls of the room are "selected", a cable parallel to these walls will be constructed.



The reason for that is that the program draws a vertical line from the first point to the parallel line defined by the other two points.

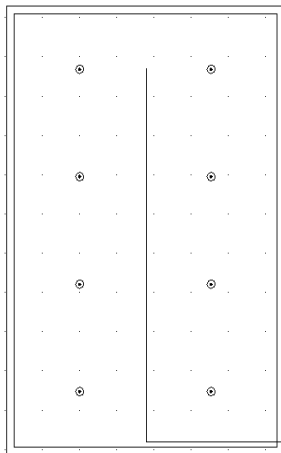
Cabling parallel to Points: A cable is drawn parallel to the points defined by the user (supported by automatic snap), with a given distance from the zigzag line defined by these points. The program asks for the first point and then for the other points (successively) parallel to which it is desired to have the cable drawn. When all points are inserted (and you right click), the distance is requested.

Cabling parallel to Wall (or Points) and Receptor Connection: This is a particularly useful command similar to the two commands above "Cabling parallel to wall" and "Cabling parallel to points", which, however, enable selecting the receptors to be connected on the routing (cabling or wiring) which will be drawn parallel to the walls or the points. Therefore, it is possible to connect a whole set of luminaires to the main panel, with just a few moves. More specifically, by selecting the "cabling parallel to points and receptor connection" command the following options appear:

- *Select receptors:* Select the receptors to be connected to the cable applied in a parallel arrangement against the wall by defining certain points on the wall.
- *Enter the 1st point & Enter the next point:* Provide the points parallel to which you want to install the cable. The points are shown on the drawing with an X.
- *Distance from a point <1.00>:* Provide the distance in printing mm where the cable is going to be drawn starting from the inserted points.

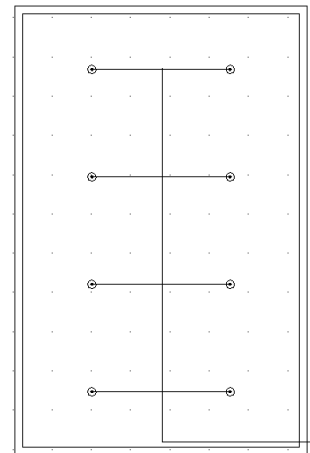
The program draws the cable and connects it to the receptors (i.e. lighting fixtures).

Connect receptors to an existing cable: This command enables you to select the



receptors to be connected to an already existing cabling. This command requires the selection of the receptors and the cable to get connected. The program draws network segments from the receptor connection point vertically on the existing line. Assume that the spot lights have been placed on the plan view and you want to have them connected to a main supply cable.

Select the command "Connect receptors to an existing cable" and the following options will appear:



- *Select receptors:* Select the receptors you want to have connected to the existing line.
- *Select a cable:* Select the cable to which you would like to connect the receptors.

Then the program will automatically connect the receptors to the main cable.

Multi cabling: This command supports the drawing of multiple parallel cables.

2.5.3 Modifying an existing network

The user can modify an existing network by using AutoCAD or 4MCAD commands and the program will continue identifying this network. Thus, it is allowed to copy, move or erase etc. a network segment. This utility provided by the AutoCAD or 4MCAD "grips" is very useful (e.g. to move the mutual grip of two cables etc).

During drawing, the rules below should be followed: Cables supplying the receptors (electrical appliances) should be connected to the touch points of these receptors. Obviously only one cable can be connected to a touch point. The connection with the touch points, which appear as "stars" in the ground plan, can be done with the 4MCAD "esnap" function, which can be activated by clicking the middle mouse button (for a 3-button mouse) or by pressing Shift and the right mouse button (for a 2-button mouse). Therefore, if you press the middle button while drawing a cable, the "touch point" is selected (NODE).

Cabling can be connected to one another and extend in any way as long as they do not form loops, something which does not apply to reality anyway. If however a mistake occurs, the program (during the identification procedure) will perform all checks and indicate the mistake and its location to the user. A necessary step before the "recognition" is defining the point (a) where the network starts and that is the supply point (a). In reality, this point corresponds to the counter. This point appears on the screen as a square symbol.

Although there are no limitations regarding the order of actions followed in drawing an installation, the following order is suggested:

1. Receptor Placement
2. Drawing the vertical cabling
3. Drawing the horizontal cable segments
4. Defining the Supply point(s)
5. Network Recognition (Identification)

The program locates the receptor loads by their features within the numeric libraries.

2.5.4 Receptors

The "Receptors" selection shows the screen including the receptors of each installation in the form of slides. Since the receptors of an installation cannot usually fit to a screen, it is possible to move to following pages where additional receptors appear. Placing a receptor can be done simply through the following steps:

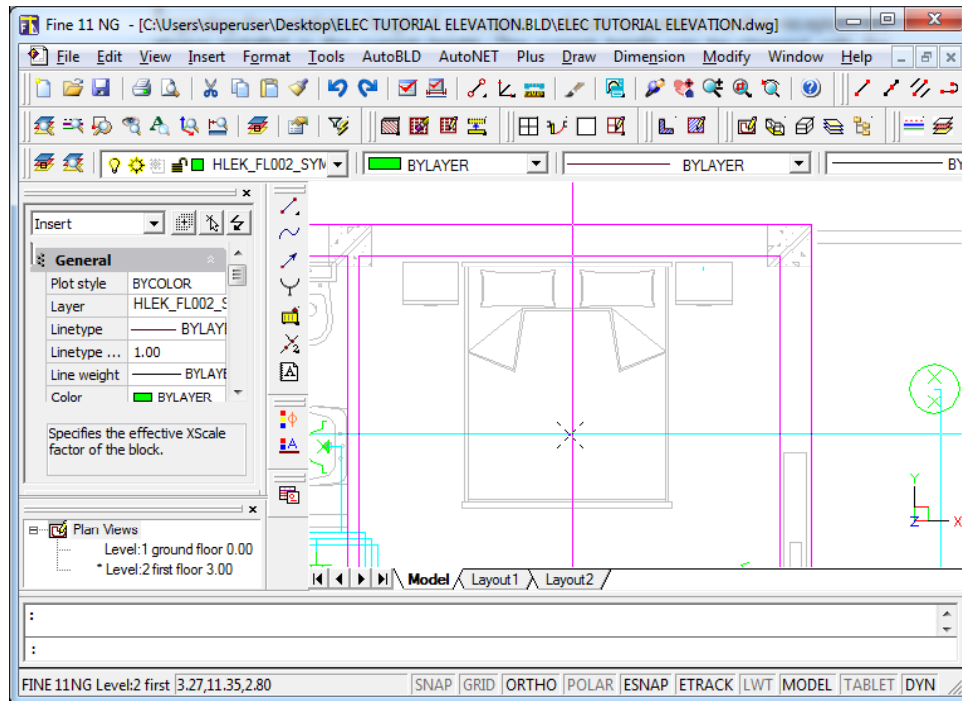
1. In the receptor screen, select a receptor, press <Enter> and then press "OK" (or alternatively double click). Then the user can see that the receptor moves on the ground plan with the graphic cursor.
2. If you move the mouse properly, the receptor can be carried in such a way that its base point (which coincides with the cross of the graphic cursor) can be placed in the desirable point. Right click to confirm your selection.
3. If you move the mouse again, the receptor will rotate around the base point. Thus, if you confirm the angle in which you desire to have the receptor placed (again by right clicking), the receptor "freezes" in its final position.

The above procedure is quite similar to the block insertion procedure of AutoCAD or 4MCAD. Another option related to the placement of the receptors is: By checking properly the box on the upper-right side of the window, the user can insert and place either the whole receptor or only its touch points (connection points) in the ground plan. This is important when an existing ground plan includes already drawn receptors and there is no need to redraw them, but just move the touch points so that the information for the respective receptors is available for the calculations component.

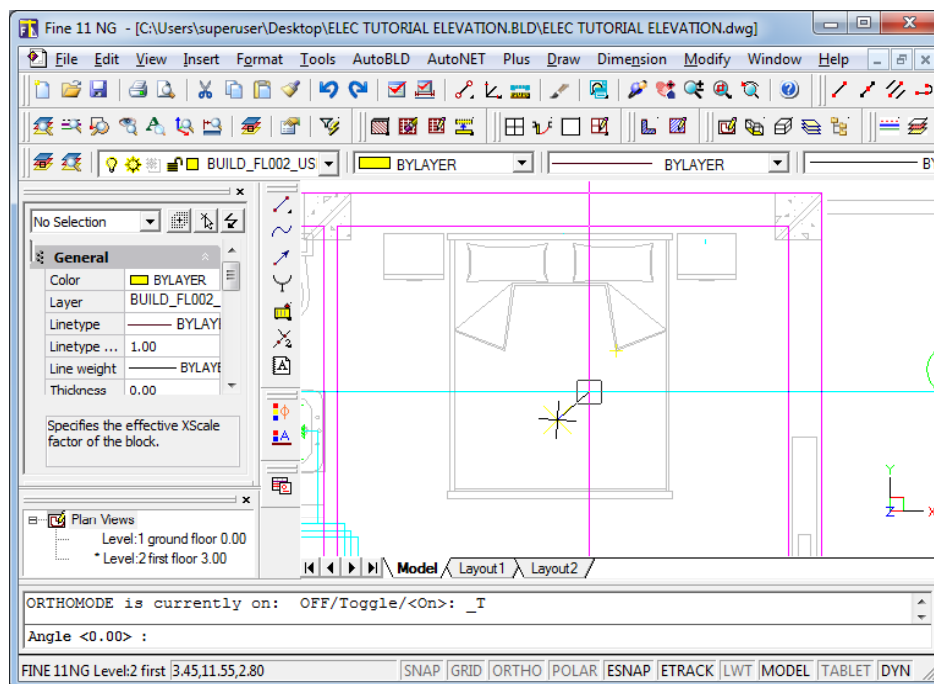
Note: Since names might not be fully shown in the receptor slides, on the upper part of the dialogue box exists the indication "Current symbol" with the full name of the selected receptor.

Regarding the installation height of a receptor, it should be pointed out that receptors are always installed in the current height. The current height can be changed with the "Set elevation" command.

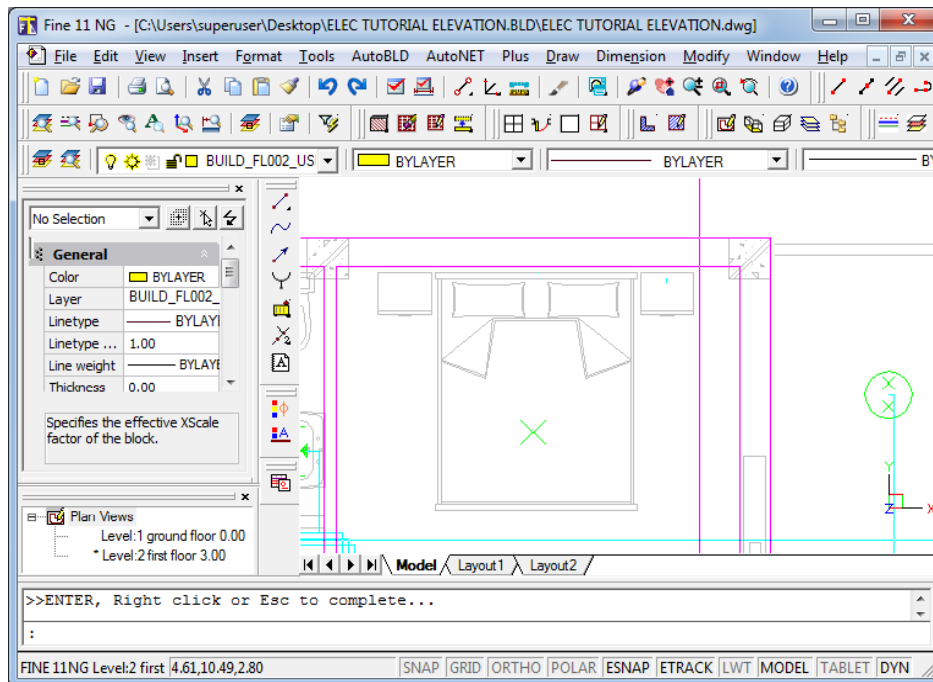
Example: Assume that a luminaire has to be installed in a 2.85 m height from the floor. After selecting "Set elevation" (Plus->Set elevation) or executing the "setelev" command by typing it in the command line and inserting value 2.85, press <Enter> in the receptor screen "on" a luminaire and afterwards press "OK" (or alternatively double click). Then you can see the luminaire moving on the plan view together with the graphic cursor.



If the mouse is moved properly, the luminaire can be moved in such a way that its base point (which coincides with the cross of the graphic cursor) will be placed in the respective point.



It can now be noticed that if the mouse moves, the luminaire rotates around the base point. Thus, if you confirm the angle in which you desire to install the receptor, the luminaire can be seen in its final position.



Two additional commands related to the receptors location are described below:

Receptors grid: It is also possible to draw grids (eg. from luminaires) by using just a few moves completing the installation easily.

Automatic placement of receptors: It is possible to install the receptors automatically in the plan view and more specifically to install receptors at a space's centre. Of course the user can proceed to any modifications (e.g. move, erase etc).

Automatic placement of lamp centrally: It is possible to install a luminaire automatically in the plan view and more specifically to install it at a space's centre. Of course the user can proceed to any modifications (e.g. move, erase etc).

Control Receptors from switch: This option allows the line name display in a receptor and its correspondent switch. The user can write a text in an easy way and place it next to the luminaires and their switches. This text contains the line number and the serial number of the control switch and indicates the relationship between the receptor and its switch.

2.5.5 Symbols

"Symbols" include various general symbols, configurations and other drawings that can be used in the electrical installation.

2.5.6 General Symbols

The "General Symbols" option "opens" the general symbol library, which includes sub-libraries in which the user can save (and recall) various drawings. There are simple drawings without numerical attributes.

2.5.7 Draw Earthing conductor

By using this command, the earthing conductor can be drawn. When the user selects this option, a window appears in which certain numeric data and drawing parameters are requested to be filled.

By pressing the buttons “Color” and “Linetype”, the user can select respectively the color and linetype of the earthing conductor line.

By pressing the button “Points”, the program asks for the successive points for the conductor’s drawing (1st point, 2nd point, etc). Having selected the last point, the user presses the right mouse button (or ENTER) in order to have the design finished. Simultaneously, the earthing conductor initial window appears again.

By pressing the button “Sign”, the program asks for the earthing conductor sign’s insertion point.

When the user selects “Accept”, the command is completed.

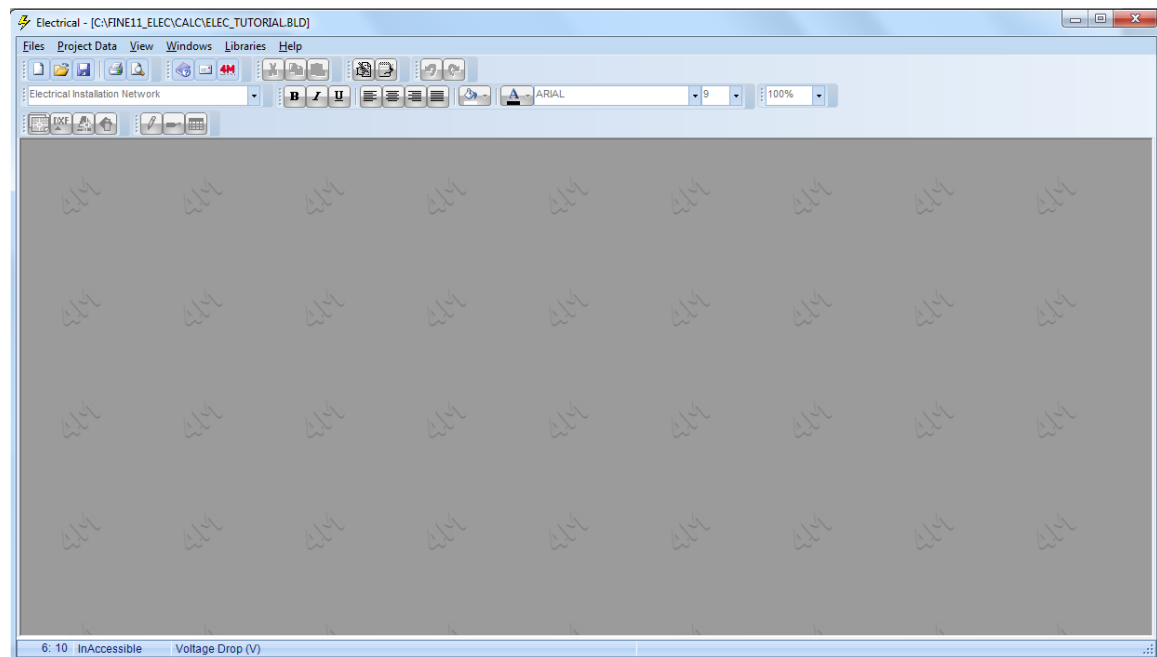
2.5.8 Network Recognition and Numbering

Once a network has been drawn according to the rules stated above and the supply point has been defined via the respective command, then the "Network Recognition" option converts the network into a mathematical model, which updates properly the calculation sheet. Through the recognition, nodes and receptors are numbered on the ground plan.

Notes:

1. *If a receptor is not numbered, that means that the receptor is not connected to the network.*
2. *If a network segment has a different colour, it cannot be connected to the network. Connect it or select "Break at selected point" at the connection point with the previous cable.*
3. *Nodes are numbered with font 4MS1 (included within the attributes of the block NODE.DWG).*
4. *If the user wants to move the number of a junction point or a receptor, he can do it by using the grips.*

2.5.9 Calculations



The "Calculations" option results to the activation of the calculation component of FineELEC.

For transferring the data from the drawings, the user has to select "Update from Drawing" in the menu "Files" of the corresponding calculating application and press "Yes" to the question "Calculate"). As a result, all the network segments along with their lengths, the receptors with their power values etc, are transferred within the calculation sheet.

2.5.10 Update Drawing

This option is used for the automatic updating of the ground plans views with the required information from the calculations. This information is saved automatically in a specific layer in which the user can intervene, according to the above-described overall layer management.

2.5.11 Legend

The "Legend" option creates a legend (table) with all the symbols that have been used in this specific project. By selecting it, the program asks for the location in the drawing to insert it.

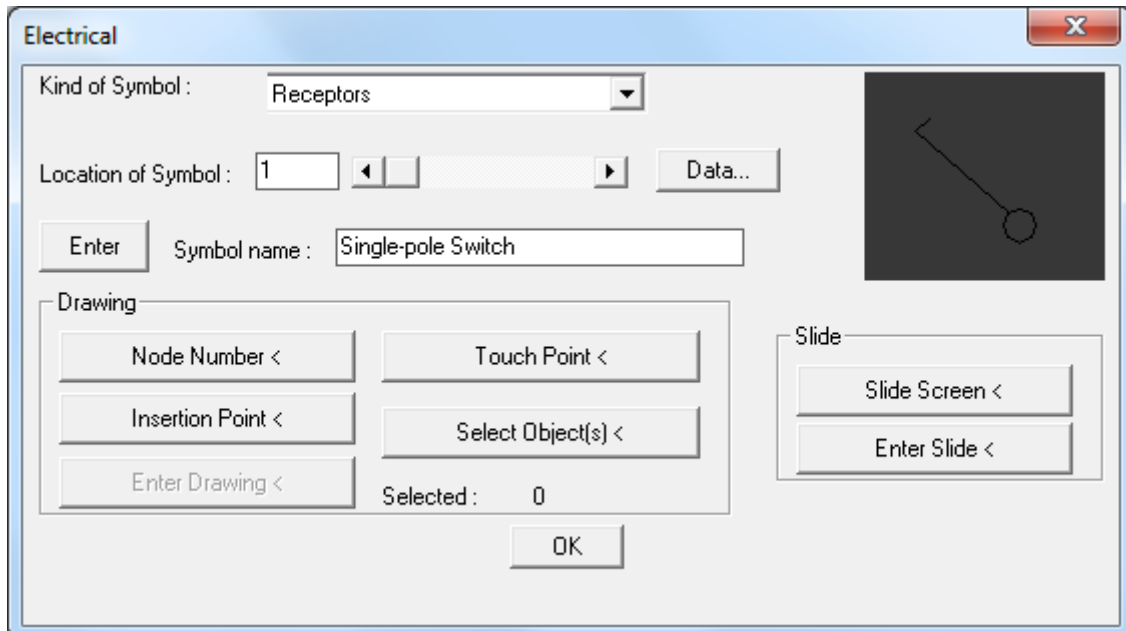
2.5.12 Vertical Diagram

This option creates three kind of drawings: the "Panels Single-Line Diagram", the "Panels Distribution Diagram" and the "Short Circuits Diagram". If the drawing exists then the program asks the user about updating it. All the drawings are editable by the user.

Note: For the automatic management of the vertical diagrams, FINE uses a specific file terminology. Particularly, vertical diagrams have names such as <NAME>DP.DWG, and <NAME>DD.DWG where <NAME> is the project name.

2.5.13 Library Management

This option leads to a submenu including the options "Numerics", "Drawings" and "General Symbols". The first option shows the numerical data while the "Drawings" option opens the dialog box corresponding to the drawings:



Kind of Symbol: This is the category type where the symbol belongs.

Location of Symbol: It refers to the position of the symbol, which you want to view or insert in the library, as well as in the numerical data library.

Symbol name: This is registered in the "numerical data" libraries. There is a set of commands on the right side of the screen, which enable the insertion of a slide in a position within the library. More specifically:

Slide screen: The slide screen provides a dynamic zoom in the drawing. This capability is particularly useful in case it is desirable to insert a lot of symbols at the same time.

Enter Slide: This option enables saving the current screen as a slide. On the left side, a set of commands helps you to define a block and insert it in the library. It consists of the following commands which should be followed in the given order.

Node Number: Determine the position where the numbering of the receptor should be shown, as well as the font type and height (or simply press <Enter> twice after providing the receptor location).

Touch point: Insert and place the receptor touch points (connection points).

Attention! If you do not want to have the touch points printed in the final drawings, the "touchpoints" layer should be de-activated (select "Freeze") in the "Layer Manager".

Insertion point: Determines the point according to which the drawing will be inserted.

Select Object(s): Select which entities of your drawing will create the Block. It should be pointed out that, in case the symbol type stands for a receptor or an accessory, the receptor touch points as well as the receptor attributes should be also determined.

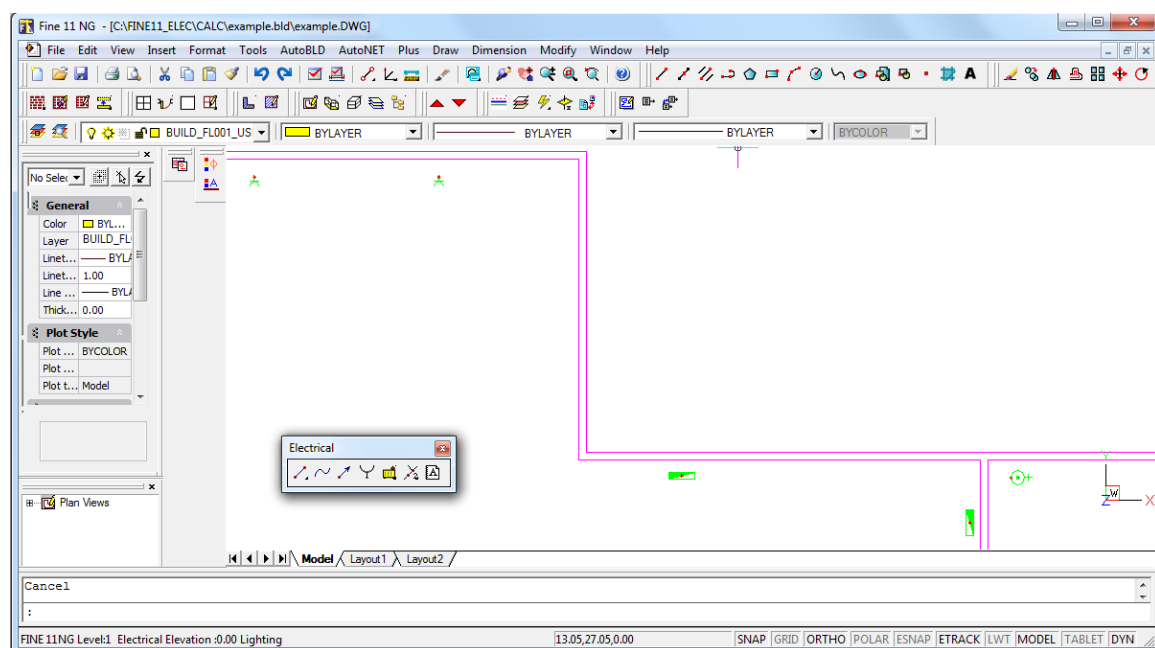
Enter drawing: Run this command to save the selected block in the respective library directory.

2.6 A simple example

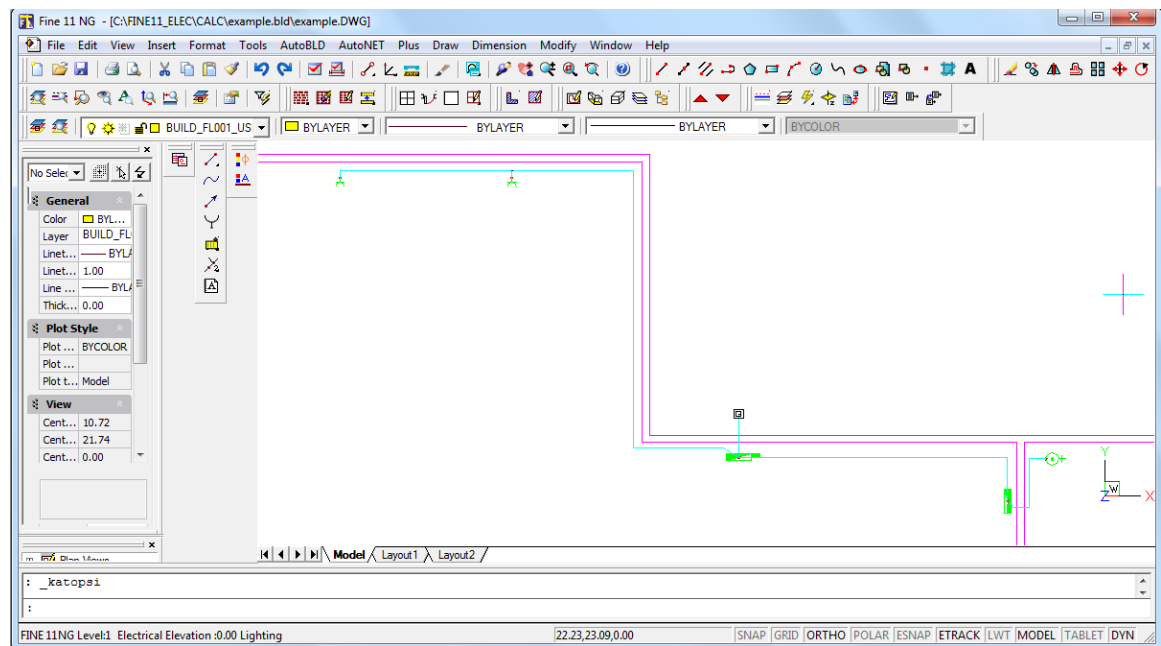
The example presented in this section helps the user understand in a practical way the contents of Chapter 4. As mentioned above, the steps according to which a standard electrical network is drawn, are the following:

- Select from the libraries and install on the ground plan all the load receptors (sockets, light fixtures –one or in a grid etc), the panels and the other installation equipment (switches etc).
- Draw the horizontal and vertical cablings from and to the panels, according to the existing layout of connections.
- Define the supply point of the main panel.
- Network Recognition
- Calculations
- Update Drawing
- Panel Single-Line Diagrams – Panels Distribution diagram

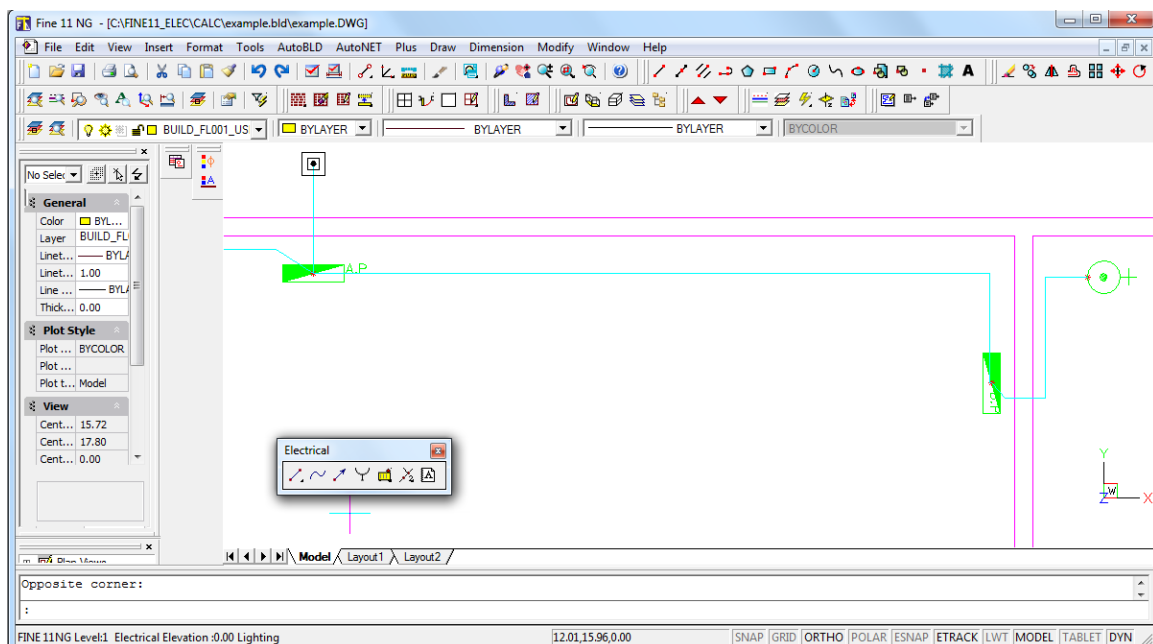
In this simple example assume that you want to connect the panel of the following ground plan to a line that supplies the 2 sockets on the left and to a second line that supplies the sub-panel (on the right), the latter being connected to the water heater. After placing the receptors (also using the "setelev" command to move to different levels), the ground plan is the following:



Run the “Cabling” command, which is completely similar to the “Cabling” command of the example in section 5.1, to join the connection points (by elevating or lowering, wherever needed). Finally, the following ground plan comes up:



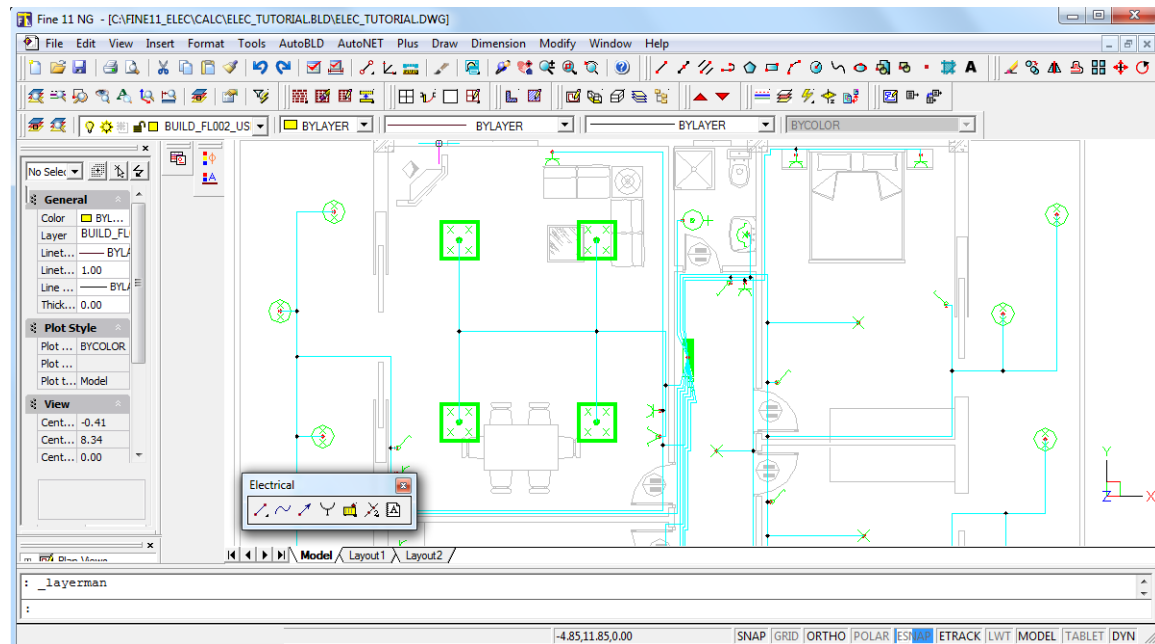
If you have defined a supply point and select “Network Recognition”, the network is recognized and the panels are automatically named with letters, plus the letter P (for Panel), that is panel A.P (which is always the main panel), panel B.P and so on. In case some panels are not named, this means that they are not connected to the network, in which case you should check the connection points. If none of the panels is named, you should check if the supply point (network starting point) has been defined correctly.



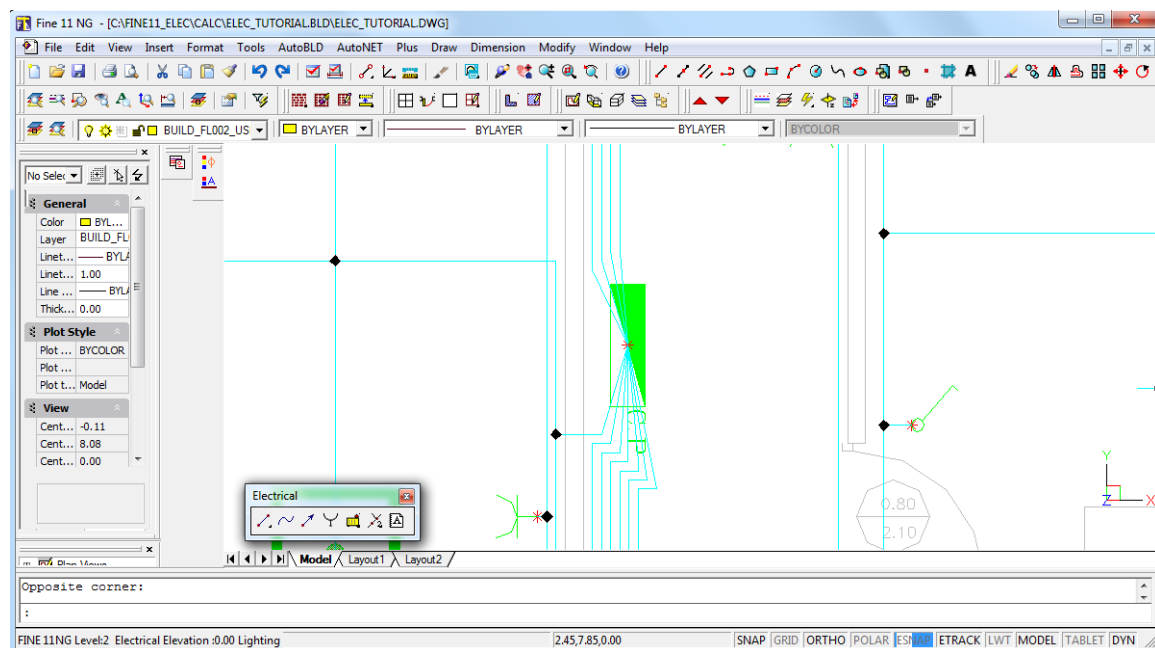
As soon as the network is recognized and you select “Calculations”, the calculation sheet opens. There you will see those panels along with their lines (e.g. A.1 for the line connecting the two sockets, B.1 for the line connecting the sub-panel to the water heater and so on if there were more lines) and with all their data.

Return from the calculation sheet to the ground plan and run the command “**Update Drawing**”. The ground plan layouts of the Electrical installation are automatically updated, especially the distribution lines, so that a full and immediate supervision of the installation network can be possible, in reference with the calculation sheet data and the panel diagrams.

Working in a similar manner, you can draw larger networks, like the one depicted in the following ground plan:



In a large installation like the previous one, you can observe in detail how lines should start from the main panel, so that clarity and increased supervision are possible.



Furthermore, the user should pay attention to the following details:

- Lines should start from the panel touch points and follow a completely separate route (meaning that they are not allowed to have a common segment or having a common starting segment and then split).
- Lines between panels start from the supply panel's touch point and end at the sub-panel touch point. Especially for the main panel (A), the supply line, which also ends at its touch point, should start from any point (other than a touch point). This way, the panel supply line is actually drawn; the first point of which should be defined as the "Supply Point".

-
- The horizontal segment that is connected to the panel touch point should be at the same level with the touch point. That is, no vertical segment should exist at the touch point.
 - In order for the panel and the distribution diagram layouts to be created, you should have created a DXF or DWG file for the panels and the charts respectively, within the calculating environment, (as in the "Single-pipe System" application).

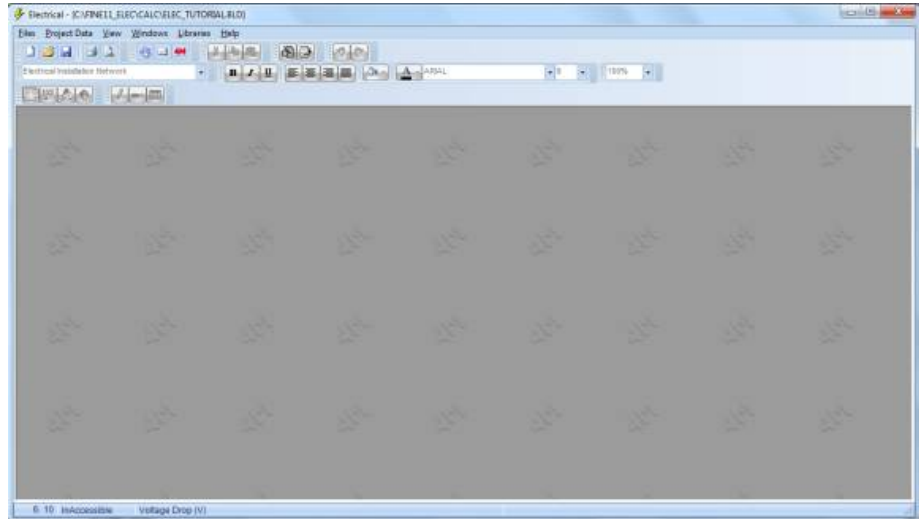
Finally, it is noted that the application outputs the error message "WRONG SYMBOL", when more than two cables end at a single receptor.

Notes:

1. *The logical parameters - drawing commands are again defined in the "Autofine.ini" file (in the section FINE11_ELEC\FINE), in the part of the text referring to Electrical Networks, with commands similar to those of cable networks.*
2. *In case you want to perform a "Nets" study, you should select the "Nets" project in the "Select Application" option, in order to have an independent layer management.*

3. Calculations

This chapter provides a description of the Calculations Component of FineELEC. Each module can be used either independently, by filling the respective numeric data, or in co-operation with the CAD component of FineELEC, in which case the calculation environment acquires automatically the data directly from the drawings.



At the top of the application window appear the general options of each application menu, constituted of the group options **"Files"**, **"Project Data"**, **"View"**, **"Windows"**, **"Libraries"** and **"Help"**.

3.1 Files

The "Files" option deals with the file management and printing options according to the windows standardization. In details:

New project: Type a name in order to save the new project in a file.

Project Selection: A window appears where you can select the desired (existing) project file and load it.

Update from Drawing: As pre-mentioned earlier, by selecting this option, the project calculation sheets are updated with the drawing data.

Save Project: The project you are currently working on is saved on the hard disc (with the previously given name).

Save Project As...: The project you are currently working on is saved in a different file with a new name.

Load Prototype: The saved prototype appears on the screen.

Save As Prototype: The form, which has been created by the user and is displayed on the screen when this option is selected, is saved as a Prototype.

Printing Prototypes: The printing prototype management window is activated.

Printing: The project issue is printed according to the previously selected options in "Printing Contents" and "Printing Parameters", following the print preview output.

Printing Contents: You can select the project contents you want to print. The program offers the possibility of printing many different results and reports at the same time.

Printing Parameters: The desired printing parameters can be selected in this window according to the procedure already mentioned in Chapter 1.

Print Preview: The complete project issue appears on the screen, exactly as it will be printed.

Export to RTF, MS-Word, 4M Editor, MS-Excel, PDF commands create files containing the selected printing contents.

Exit: This command leads to exit from this application.

3.2 Project Data

This group of commands includes the project data, which are divided into project info (project headings), network options, cable data and typical load types.

3.2.1 Project info

The project info refers to the titles and headings related to the project id.

3.2.2 Network

The network options dialog contains the main parameters of the installation. More specifically:

The screenshot shows a dialog box titled "Network Options" with a close button (X) in the top right corner. The dialog contains the following settings:

Parameter	Value
Mains Phase Voltage (V)	230
Maximum Voltage Drop (%)	2.500
Type of Cable	Copper
Electrical Conductivity (S m/mm ² Ohm)	56
Supply Type	Three-Phase
Ambient Temperature (up to 50 °C)	33
Protective Devices Calculations	based on Current
Short Circuit calculation method	NO
Short Circuit Time (s)	0.5
Calculation Method	HD 384
Panel Loads Grouping for Coincidence Factor	Sub-panels
Cable Standardisation	DIN
Terminal Strip Connectors Standardisation	R S T
Setting Different Lines of Departure and Arrival of Electrical Panels	<input type="checkbox"/>
Maximum Cable Cross Sectional Area that can be Used	500.0

At the bottom right of the dialog are "Ok" and "Cancel" buttons.

Mains Phase Voltage: This value refers to the voltage difference between the conductor and the neutral (line-to-neutral voltage 230V). The program automatically calculates the line-to-line voltage. The designer may modify this value either for the entire network (for each network line) or selectively (for a specific line) in the calculation sheet.

Maximum voltage drop (%) (in lines): It is about the maximum voltage drop, according to which the cross-sectional areas will be calculated. The designer has the option to modify this value here too, either for the entire network or selectively, for a specific line.

Type of Cable: The conductor material (copper, aluminium etc) is defined as it affects the electrical conductivity coefficient of the cables.

Electrical Conductivity (of cables): Depending on the conductor material, the electrical conductivity coefficient is automatically filled while the designer can modify it optionally.

Supply type (single-phase or three-phase): In case a three-phase voltage supply is provided in the network options, it is possible to convert it into single-phase selectively for certain lines or panels within the calculation sheet.

Ambient Temperature (up to 50°C): It affects the maximum permissible current-carrying capacity of the cables.

Protective Devices Calculations (based on current or based on cable): One of two methods can be selected, which can be specialised for use with the calculation sheet.

Short-circuit calculation method:

The calculation of short-circuit currents is selected by the user. Specifically the choice of approximate or analytical calculation of short circuit currents is given. In order to calculate the short-circuit current, the type of transformer, which feeds the network and its data are given at the window "substation", should be selected.

If "No" is selected, there will be no calculation of the short-circuit currents.

Short-circuit Time (s): All short-circuit current calculations will be performed according to this value.

Calculation method: The results are calculated according the VDE, HD 384, IEC 60364 or BS 7671 Standard.

Panel loads Grouping for Coincidence Factor: The two options «Sub-panels» and «Analysis» affect the way in which the coincidence of the loads will be considered. As far as the first is concerned, the sub-panel loads of the main panels appear as "panel" and can be coincided totally. As for the second option, the sub-panel loads are considered and displayed in full details (lighting appears as lighting and so on).

Cable Standardization: Defines the way of appearance of the cable names.

Terminal Strip Connectors Standardization: The user can choose between the options RST or L1L2L3 as the names of the terminal strip connectors appearing in the panel single-line diagram.

Setting Different Lines of Departure and Arrival of Electrical Panels: The user can define whether the arrival line diagram in a sub-panel is the same with the departure line diagram from the main panel.

Maximum Cable Cross Sectional Area that can be used: The user can define the maximum cable cross sectional area that can be used in an arrival or departure line.

3.2.3 Cables by VDE

Given that the selected standard is the VDE one, the following information on the cables of the specific installation has to be defined:

Cable Data

- NYY Cables Location (air or in ground)
- Maximum Permissible Temperature of NYY Cables (up to 85°C)

Single-Core Cables in ground

- Cable Arrangement (Flat or Trefoil)
- Total number of Neighboring Three-Phase Cable Arrangements (1-4)
- Soil Thermal Resistivity ($^{\circ}\text{Kxdm/W}$) (5-30)
- Operation (Continuous or Intermittent)
- Installation Method (Free, Protection Cover, Protection Cover with sand)

Multicore Cables in ground

- Total Number of Cables (1-10)
- Soil Thermal Resistivity ($^{\circ}\text{Kxdm/W}$) (5-30)
- Operation (Continuous or Intermittent)
- Installation Method (Free, Protection Cover, Protection Cover with sand)

Single-Core Cables in air

- Cable Arrangement (Flat or Trefoil)
- Total number of Neighboring Three-Phase Cable Arrangements (1-4)
- Routing (No Derating, In the ground, On a Closed Cable Tray, On an Open Cable Tray, Next to a Wall, On a Wall etc)
- Number of Cable Trays (For Cable Trays Routing Only) (1-6)

Multicore Cables in air

- Air Gap between Cables and Distance from the Wall
- Total number of Neighboring Cables (1-9).
- Routing (No Derating, In the ground, On a Closed Cable Tray, On an Open Cable Tray, On a Wall etc)
- Number of Cable Trays (For Cable Trays Routing Only) (1-6)

3.2.4 Cables by HD 384

In case the user has selected the method of calculation according to HD 384 Standard, then the following information on the cables of the specific installation has to be defined:

Insulated Conductors

- Installation Method (In a conduit in a wall, enclosed in conduit on a wall).
- Routing (Bunched in air, on a surface, embedded or enclosed, No Derating etc).
- Number of circuits

Multicore Cables

- Installation Method (Direct in a wall, Clipped direct, In a conduit in a wall, Enclosed in conduit on a wall, In free air, In ground).
- Routing (Bunched in air, on a surface, embedded or enclosed, No Derating etc)
- Number of circuits
- Number of trays or ladders

Single-Core Cables

- Installation Method (Touching flat in free air, Touching trefoil in free air, Horizontal, spaced in free air, Vertical, spaced in free air, In ground).
- Routing (Touching, on unperforated cable tray systems, Touching, on perforated cable tray systems, Touching, on vertical perforated cable tray systems, Touching, on cable ladder systems, cleats, etc, No Derating etc)
- Number of circuits
- Number of trays or ladders

Soil Data

- Soil Thermal Resistivity ($^{\circ}\text{Kxdm/W}$) (5-30)
- Ground Temperature ($^{\circ}\text{C}$)

3.2.5 Cables by IEC 60364

In case the user has selected the method of calculation according to IEC 60364 Standard, then the following information on the cables of the specific installation has to be defined:

Multicore Cables

- Installation Method (Direct in a wall, Clipped direct, In a conduit in a wall, Enclosed in conduit on a wall, In free air, In ground).
- Routing (Bunched in air, on a surface, embedded or enclosed, No Derating etc)
- Number of circuits
- Number of trays or ladders

Single-Core Cables

- Installation Method (In a conduit in a wall, Enclosed in conduit on a wall, Clipped direct, Touching flat in free air, Touching trefoil in free air, Horizontal, spaced in free air, Vertical, spaced in free air, In ground).
- Routing (Touching, on unperforated cable tray systems, Touching, on perforated cable tray systems, Touching, on vertical perforated cable tray systems, Touching, on cable ladder systems, cleats, etc, No Derating etc)
- Number of circuits
- Number of trays or ladders

Soil Data

- Soil Thermal Resistivity ($^{\circ}\text{Kxdm/W}$) (5-30)
- Ground Temperature ($^{\circ}\text{C}$)

3.2.6 Cables by BS 7671

In case the user has selected the method of calculation according to BS 7671 Standard, then the following information on the cables of the specific installation has to be defined:

Multicore Cables

- Installation Method (Direct in a wall, Clipped direct, In a conduit in a wall, Enclosed in conduit on a wall, In free air, In ground).
- Routing (Bunched in air, on a surface, embedded or enclosed, No Derating etc)
- Number of circuits
- Number of trays or ladders

Single-Core Cables

- Installation Method (In a conduit in a wall, Enclosed in conduit on a wall, Clipped direct, Touching flat in free air, Touching trefoil in free air, Horizontal, spaced in free air, Vertical, spaced in free air, In ground).
- Routing (Touching, on unperforated cable tray systems, Touching, on perforated cable tray systems, Touching, on vertical perforated cable tray systems, Touching, on cable ladder systems, cleats, etc, No Derating etc)
- Number of circuits
- Number of trays or ladders

Soil Data

- Soil Thermal Resistivity ($^{\circ}\text{Kxdm/W}$) (5-30)
- Ground Temperature ($^{\circ}\text{C}$)
- Depth of laying in ground (m)

3.2.7 Typical Load Types

By using this table, the user can define a set of typical load types (optionally) to be used as templates. For each typical load type – the name of which is inserted in the first column of the relevant screen - the following characteristics can be provided:

Load type: It is provided with a serial number (e.g. 1, 3 etc), which corresponds to the load types according to the standardisation used in the load type library (1:Lighting, 2:Socket, 3:Water Heater, 4:Single-Phase

Cooker, 5:Motor, 6: Electrical Panel etc). The designer may consult the load type library by pressing <F11>. There is also the option to define sub-categories of loads by adding a second number right after a dot is inserted (.) (i.e. 1.2, 3.2, 5.6 etc). For example, with the number 1.2 you may define a lighting load with fluorescent lamps and with the number 1.3 a lighting load with sodium-vapor lamps. The load type, as already mentioned in libraries, "carries" the type of the drawing line too.

Power factor: It refers to the power factor ($\cos\phi$) of the load type inserted in the first column (the following guidance table with typical values of $\cos\phi$ appears on the screen).

HP	kW	$\cos\phi$	n%
¼	0.19	<u>0.7</u>	60
½	0.37	<u>0.7</u>	64
¾	0.55	<u>0.75</u>	69
1	0.75	<u>0.79</u>	74
1½	1.10	<u>0.8</u>	76
2	1.50	<u>0.8</u>	77
3	2.20	<u>0.8</u>	79
4	3.00	<u>0.82</u>	85
5	3.70	<u>0.82</u>	85
6	4.50	<u>0.83</u>	86
7½	5.50	<u>0.83</u>	86
10	7.50	<u>0.83</u>	86
12½	9.30	<u>0.83</u>	87
15	11.00	<u>0.83</u>	87
20	15.00	<u>0.84</u>	89
25	18.60	<u>0.85</u>	90

Coincidence factor: It refers to the coincidence factor of the load type inserted in the first column (by pressing **F11** the following guidance table appears on the screen, with the typical values).

Guidance Table of Coincidence Factors								
Panel Type	Load Type							
	Lighting		Sockets		Thermals		Motors	
	from	to	from	to	from	to	from	to
Sub-panels	<u>1.0</u>		<u>0.6</u>	<u>0.7</u>	<u>1.0</u>		<u>0.7</u>	<u>1.0</u>
General	<u>0.8</u>	<u>0.9</u>	<u>0.4</u>	<u>0.5</u>	<u>0.6</u>	<u>0.8</u>	<u>0.6</u>	<u>0.7</u>
Main	<u>0.7</u>	<u>0.8</u>	<u>0.2</u>	<u>0.3</u>	<u>0.3</u>	<u>0.5</u>	<u>0.5</u>	<u>0.6</u>

Guidance Table of Coincidence Factors

Voltage drop (%): It refers to the maximum permissible voltage drop between the origin of an installation and any load point and represents a percentage of the mains phase voltage.

Starting Method: This option is only for motors, provided that you want to define the starting method, in order for the cable cross-sectional area as well as the motor protective devices to be properly calculated.

Code	Starting method:
1	Direct on line Starter
2	Star-Delta Starter

In case this field is left blank, motor starting is considered as direct on line.

Line Type: It is filled in order to specify whether the line is a single-phase (1) or a three-phase (3) one.



Notes:

- It is not necessary or mandatory to insert values in all fields for each load type. As a result, in the fields which have been left blank will be assigned either the generally defined values for the network (e.g. voltage drop) or the values from the libraries ($\cos\phi$) or finally they will be filled within the line calculation sheets and the panel calculation sheets.
- The definition of typical data provides a great convenience, i.e. the fact that every modification of such data, performed in any project step, will affect the calculations. In other words, there is a possibility of an overall check over the project, since the user is able to modify load parameters easily and quickly.

3.3 View

This option follows the known windows standardization.

3.4 Windows

The "Windows" option includes the calculation sheet, as well as some other windows with important project results. In some cases, an additional basic option is automatically inserted in the main menu, named as the active window including some additional options.

3.4.1 Calculation Sheet

Each row of this sheet corresponds to a different network segment while each column refers to the data that will be provided or result automatically during the data insertion procedure.

Network Segment	Line Length (m)	Load of the Line (KW)	Load Type	Load Type	Power Factor	Des. Phase	Phase	Max Volt. Drop (%)	Voltage Drop V	Line Type	Des. Cr. Sect. (mm²)	Cr. Sect. Calc. (mm²)	Max Fuse Size (A)
1 C.P		10.42	6	Electrical Panel	1.000		1	2.500		1		16	50
2 C.1	7.7	0.800	2	Sockets	1		1	2.500	0.383	1		2.5	16
3 C.2	4.6	0.600	2	Sockets	1		1	2.500	0.171	1		2.5	16
4 C.3	5.3	0.600	2	Sockets	1		1	2.500	0.198	1		2.5	16
5 C.4	6.7	0.100	1	Lighting	1		1	2.500	0.069	1		1.5	10
6 C.5	4.5	0.200	1	Lighting	1		1	2.500	0.093	1		1.5	10
7 C.6	9.7	4.000	4	Single-Phase Cooker	1		1	2.500	1.004	1		6	25
8 C.7	13.7	0.800	1	Lighting	1		1	2.500	1.135	1		1.5	10
9 C.8	10.7	1.000	1	Lighting	1		1	2.500	1.108	1		1.5	10
10 C.9	2.6	2.000	3	Water Heater	1		1	2.500	0.202	1		4	20
11 C.10	4.5	0.320	1	Lighting	1		1	2.500	0.149	1		1.5	10
12 B.P		0.760	6	Electrical Panel	1.000		2	2.500		1		4	20
13 B.1	7.3	0.160	1	Lighting	1		2	2.500	0.121	1		1.5	10
14 B.2	2.9	0.200	2	Sockets	1		2	2.500	0.036	1		2.5	16
15 B.3	7.6	0.400	2	Sockets	1		2	2.500	0.189	1		2.5	16
16 A.P		11.18	6	Electrical Panel	1.000		123	2.500		3		16	50
17 A.C	10.1	10.42	6	Electrical Panel	1.000		1	2.500	1.021	1		16	50
18 A.B	0.9	0.760	6	Electrical Panel	1.000		2	2.500	0.027	1		4	20
19													
20													

Help instructions concerning data entering appear at the bottom of the screen (status bar). In each row, first of all you should fill the first column which refers to each segment coding.

Regarding the editing facilities of this calculation sheet, first of all, the user has the possibility, as stated earlier, to use **in the frames where the Calculation Sheets appear** the "Font" option for both the calculations zone (so that values appear with the desired size and style) and the headings zone (so that headings are shown to the user satisfaction). As far as the **headings zone** is concerned the user has also the possibility to increase or decrease the column width using the mouse: As long as the mouse pointer rests on the vertical line separating two adjacent columns, it takes the form of a double arrow and then by pressing (and keeping pressed) the left mouse button and dragging, the column width is increased or decreased depending on the direction of mouse movement. In the spread sheet below we can see columns having different widths.

Above alternative supervision possibilities available to the user depend on several factors such as the resolution of the graphics card and screen size, and for this reason any possible interventions are left to the user discretion. For that matter, there is also the possibility of "Load Prototype" from the user. Note however, that best supervision results are achieved with higher resolutions and large screens

Access to the positions of the zone for filling in values is carried out by means of the mouse and the arrow keys of the keyboard. Moving the mouse pointer in the zone for filling in values we can see that in some columns the pointer takes the form of a vertical line (|) while in other columns it takes the form of a prohibitive traffic sign. We cannot modify the values contained in these last columns (because they result from calculations). If we move the mouse pointer (having the form of a cross) in to a cell or small square and click the left mouse button, we'll see that the cell contour (outline) becomes dark and we can fill in a value or modify the cell content. In the same way we can move to any other cell, while:

- With the <Enter> key we move to the next cell below and so on.
- With the <Tab> key we move to the next cell at the right and so on.

Also, in case the window width is not large enough to accommodate all columns, we can review the entire calculation sheet by manipulating it up-down or left-right using the vertically or horizontally sliding keys (potentiometer like). In addition, when access to a column for filling values is denied the mouse pointer takes the form of a prohibitive traffic sign. This way, the user is informed that the quantity under examination is a derivative one i.e. resulted automatically from calculations.

The user should keep in mind the following useful commands when **entering values** in the Calculation Sheets of any application:

- **Deleting cell content:** Pressing the key on a cell, the value it contains is deleted, and the cell is blank.
- **Deleting a row:** Pressing the keys <Ctrl>& in combination, the row we are in is deleted.
- **Inserting a row:** Pressing the keys <Ctrl>&<Ins> in combination, a new (blank) row is inserted immediately below the cell we are in.
- **Moving to the beginning of a row:** Pressing the <Home> key we move automatically in the first column of the row we are in.
- **Moving to the end of a row:** Pressing the <End> key we move automatically in the last column of the row we are in.

-
- **Moving to the upper part of the sheet** (first column-first row): Pressing the keys <Ctrl>&<PgUp> in combination, we automatically move in the first column-first row of the calculation sheet.
 - **Moving to the lower part of the sheet** (first column-last row): Pressing the keys <Ctrl>&<PgDn> in combination, we automatically move in the last row of the calculation sheet.
 - **Freezing the first column:** Pressing the “stable column” command
 - Finally, we can move from an upper to a lower cell using the <Enter> key and from a left cell to a right cell using the <Tab> key.

Note that in order to fill in or select appropriate values you can activate dialog boxes in some positions in the filling in zone, using the keys <F11> and <F12>.

General editing commands described above (deleting cell content etc.) are also applied to these auxiliary windows. Finally, in case we want to repeat a row (typical segment), it is sufficient to fill in the content of the first column, i.e. the section name, (or simply mark the corresponding cell, proceed with copy & paste and finally press <Enter>). This will make a copy of the row except for the section name which remains blank.

When the calculation sheet is activated, you will see in the main menu options an additional one namely “Calculation Sheet” with a secondary option “Printing Parameters”. Selecting “Printing Parameters” the adjacent dialog box appears from where the user may affect the appearance of the printed Calculation Sheet. Specifically, the user may define a bold outline (frame), a normal outline, or no outline, horizontal and/or vertical lines, as well as a raster for the titles (headings) of the spread sheet with the desired shading of tints (using the sliding key).

Concerning now, the network segment designation, this is standardised as follows: The electrical panels and lines are named as below:

- Each panel is inserted with its name, a dot (.) and the extension "P" (e.g. A.P, B.P, C1.P etc). Each panel's and sub-panel's name consists of one letter, two letters or a letter and a number (e.g. A ř AD ř C3 etc). Note that the main electrical panel is named A and that no panel designation should contain the letter "P".
- Each line is inserted with the panel's name from which it departs, a dot (.) and the extension of the coding number (e.g. B.1, C.12 etc). Note that if the line ends at a panel, it is not numbered (it is automatically defined by the pair of the two panel names).

The simple example of the figure above makes the standardisation mentioned above easier understood.

Within the calculation sheet, you will define the panels A.P, B.P and C.P by naming them A.P, B.P and C.P. The line between the panels A and C will be named A.C and the line between the panels A and B will be named A.B (**Attention!** The direction is important as it indicates that A supplies B), while the lines 1 and 2 which start from panel B will be filled as B.1 and B.2. Note that the panels and the lines should be filled in such a way that every line is placed under the corresponding panel. In addition, it is strongly recommended to provide the network options starting from the terminal panels in order to reduce the huge amount of calculations.

According to the standardisation described above, the loads are automatically summed up and calculated for each panel separately.

By entering the load type (column 4) to a segment (column 1), the following columns related to the corresponding values are automatically filled:

(a) **Power factor**

Applies the value for load inserted in the typical data sheet or the value for the corresponding load type in the load type library. The designer can either insert it or modify it by typing in the relevant field.

(b) **The maximum permissible voltage drop**

Applies the value existing in general or typical data sheet.

(c) **The line type**

Assign number 1 to a single-phase line or number 3 to a three-phase line.

(d) **The protective device type**

Note that the supply voltage of the specific segment is provided in the general data sheet and, if needed, it may be modified by the designer after pressing <F8> in column 3.

These values may change, of course, whenever the user desires.

As for the calculations, the following data should be inserted for each line: a) the line length (otherwise the voltage drop of the line cannot be calculated), b) the load of the line, c) the line type and d) the power factor of the load of the line.

The load type is inserted in column 3 by defining a serial number according to the load type assigned to the load type library (The load type library is displayed if <F5> is pressed). There is also the option for an extension, such as 1.2 instead of 1, provided that the sub-category 2 of load type 1 (lighting) constitutes a load type sub-category with specific behaviour ($\cos\phi$, coincidence factor etc) different from that of the load e.g. 1.3. In the case that the designation of the load type has been filled in the typical load table of the project, then all the characteristics of the corresponding load are transferred automatically in the row of the calculation sheet. Yet, a possible modification of them in the typical lines sheet, will change the corresponding values in the calculation sheet, affecting correspondingly all the network data (re-calculation).

As long as the values mentioned above are known, calculations are carried out automatically.

Calculation of cables and protective devices: The calculation of the cable protective devices can be performed based either on the current that flows through the line or on the cable cross-sectional area of the line cable. The selection of the calculation method can be assigned to each line separately, according to the designer's demands.

For calculating the cable and the protective devices you should have in mind the following parameters:

- The line diagram (completing this line is essential for calculating the protective devices)
- The type of cable and the number of cable cores.
- The ambient temperature.
- The maximum permissible cable temperature
- The installation method
- The routing

All the above parameters receive default values from the typical data sheet and may be selectively updated, after pressing F5 (or by selecting the cables data from the list which is displayed a right click) so that the relevant window from the selected line is being activated. Then a window appears, summarizing all the data that must be filled.

Line Diagram	1. - Miniature Circ. Breaker (L-C) ...
Number of Cable Cores (1-5)	3
Ambient Temperature (°C)	33
Protective Devices Calculations	based on Current
Type of Cable	H07V-U (UK:6491X)
Installation Method	In conduit in a wall
Routing	Bunched in air, on a surface, embedded or enclosed
Number of circuits	1
Mains Voltage (V)	230.0
Actual Length of Cable(m)	17.30

Close

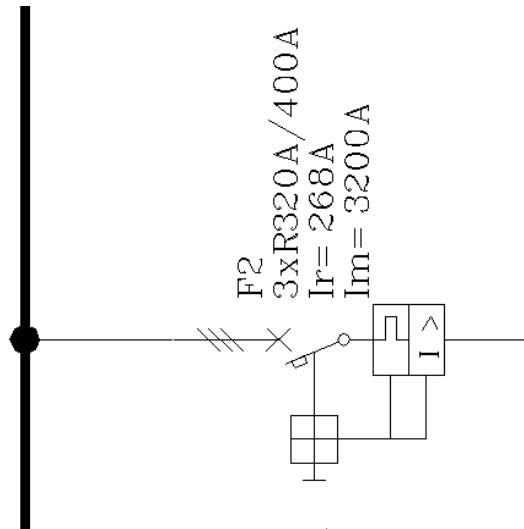
As for the line diagram, by pressing the ... button in this field, the user may view all the line types of the library, while “being” on a specific line type, the user can see, at the bottom, its diagram and its parameters which will get values during the calculations (e.g. AB, DP etc). In this window we can sort the data for an easier and faster seek of the desired line.

No	Description	Category
1	Miniature Circ. Breaker (L-C)	
2	Miniature Circ. Breaker - Led	
3	Rail Swit.-Min.Circ.Breaker	
4	Rail Sw.-Min.Circ.Br.-Led	
5	Rail Switch-Scr.Fuse	
6	Rot.Cam.Switch-Scr.Fuse	
7	Rot.Cam.Switch-Scr.Fuse-Led	
8	Kn.Sw.Disc.-Kn.Fuse	
9	Min.Circ.Br.-Remote Con.Switch	
10	Min.Circ.Br.-Rem.Con.Sw.-Therm	
11	Min.Circ.Br.-R.C.Sw.-Therm-Led	
12	Rot.Cam.-Kn.Fuse-R.C.Sw.-Thermal	
13	Min.Circ.Br.-Remote Con.Switch	
14	Switch 2Poles-Min.Circ.Breaker	
15	Miniature Circ. Breaker-S/D	
16	Rot.Cam.-Fuse-Transf.-Circ.Break.	
17	Residual-current Device	

Analysis - Synthesis of the Line

Import >>

There are protective devices with a fixed size (i.e. a screw-type fuse) and other devices that give us the option to adjust their thermic or magnetic element, such as a circuit breaker. In case that such a breaker is selected, both adjustments (I_r and I_m) will be written down (see the following example where the indication "3xR320A/400A" refers to a breaker of 400A, thermic element 320A adjusted to 268A (I_r) and magnetic element adjusted to 3200A (I_m)).



Number of Cable Cores: The user defines the number of the cable cores of the line of the load. The usual number of cores used depending on the load type is the following:

- 1Ph-Lighting, 1Ph-Sockets → 3 cores
- 3Ph-Lighting, 3Ph-Sockets → 5 cores
- 3Ph-Motor → 4 cores

A crucial factor to the calculation is whether the load is a resistive one or a motor. If the load is a motor then it is calculated according to the following table:

Motor		Direct on line start			Star-Delta start	
Power		Nominal Current A	Fuse A	Cable Cross-sectional area mm ²	Fuse A	Cable Cross-sectional area mm ²
Kw	PS					
0,135	0,18	0,5	2	2,5	2	2,5
0,22	0,3	0,72	2	2,5	2	2,5
0,4	0,54	1,1	2	2,5	2	2,5
0,55	0,75	1,5	4	2,5	2	2,5
0,8	1,00	2,0	4	2,5	4	2,5
1,0	1,36	2,5	4	2,5	4	2,5
1,5	2,04	3,5	6	2,5	4	2,5
2,2	3	5,0	10	2,5	6	2,5
3	4,1	6,7	10	2,5	10	2,5
4	5,4	8,8	15	2,5	10	2,5
5,5	7,5	10,8	20	2,5	15	2,5
7,5	10,2	15,6	25	4	20	2,5
10	13,6	20	35	6	25	4
11	15	24	35	6	25	4
12	16,3	25	36	6	25	4
14	19	30	50	10	35	6
15	20,4	32	50	10	35	6
19	25,6	39	60	16	50	10
22	30	45	60	16	50	10
28	38	55	80	25	60	16
32	44	64	100	35	80	25
38	52	74	100	35	80	25
43	58	83	125	50	100	35
50	68	96	125	50	100	35
57	78	110	160	70	125	50
62	84	120	160	70	125	50
70	95	130	160	70	160	70
80	109	150	200	95	160	70
90	122	170	200	95	200	95
100	136	190	225	120	200	95
110	150	205	250-400A	120	250	95
132	180	245		120	250	120
160	220	290	400	150	315	150
200	270	360	500	185 or 2X70	400	185 or 2X70

If the designer ignores the fact that the load is a motor and he wants its cable and device calculations to be calculated based on the line current, all he has to do is to insert "no" in the "Motor" field in the load type window.

Voltage Drop in lines: For the calculation of the voltage drop, the following parameters are taken into account:

- The equivalent length of cable which is calculated by using the Torque Theory (directly from the drawing, in case "Network Recognition" has already been performed through FINE)
- The Resistance as well as the Reactance of the cable



Note: In case data are typed (and not automatically transferred through FINE), there are two types of line lengths: The actual length (for bill of cables) and the equivalent length (for voltage drop calculations). The equivalent length is the value provided in the second column of the calculation sheet while the actual length can be inserted in the window mentioned above, which can be activated in each row by pressing **F5**. While drawing both are automatically updated. Regarding the line, which supplies the main panel A, in particular, provided there is a transformer and short circuit calculations are desirable, the cable length between the transformer and the panel can be inserted in the second column.

Aside from the data that are inserted directly by the user and those displayed in the calculation window, all intermediate results may appear on the screen as well (by pressing **<F9>**) to facilitate direct control.

Attention! In order to return to the previous mode, press **<F9>** in the first column of the sheet.

Electrical - [C:\FINE11_ELEC\CALC\ELEC_TUTORIAL.BLD] - [Calculation Sheet]

Files Project Data View Calculation Sheet Windows Libraries Help

Electrical Installation Calculations

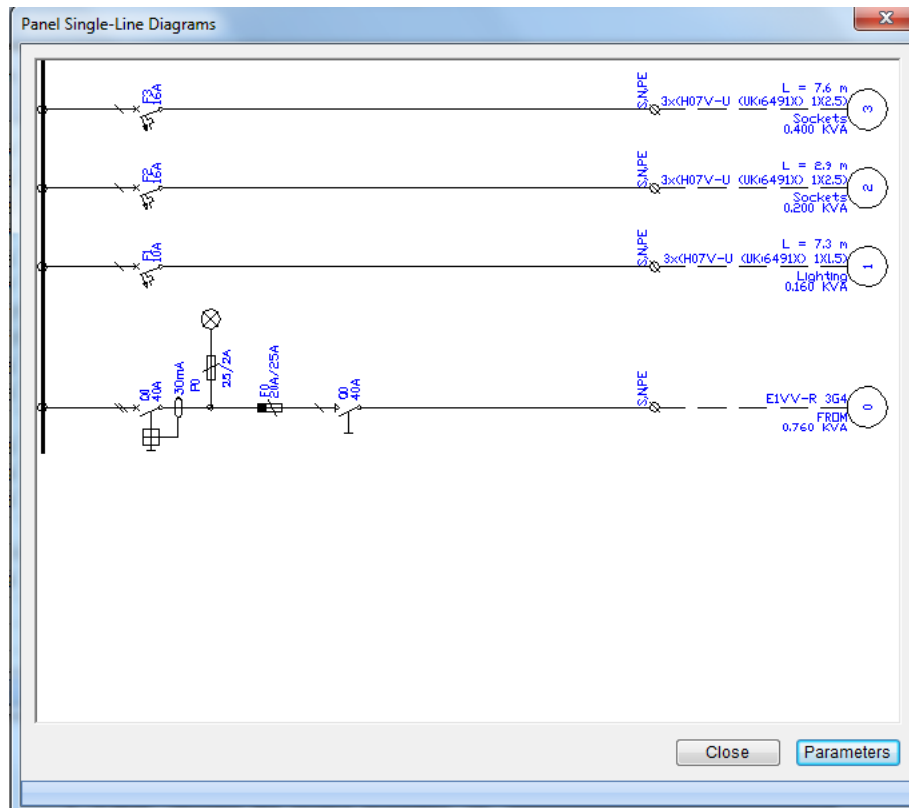
100%

	Network Segment	Line Length (m)	Load of the Line (kW)	Load Type	Power Factor	Type of Cable	No of Parallel Cables	Cr.Sect. Calc. (mm ²)	Des. Cr.Sect. (mm ²)	Current-Carrying Capacity No.Cond.	Corr. Factor	Current-Carrying Capacity (A)	Max Fuse Size (A)	Line Current (A)
1	C.P		10.42	Electrical Panel	1.000	E1VV-R		16		56.00	0.964	53.98	50	45.30
2	C.1	7.7	0.800	Sockets	1	H07V-U (UK)		2.5		19.50	0.964	18.80	16	3.478
3	C.2	4.6	0.600	Sockets	1	H07V-U (UK)		2.5		19.50	0.964	18.80	16	2.609
4	C.3	5.3	0.600	Sockets	1	H07V-U (UK)		2.5		19.50	0.964	18.80	16	2.609
5	C.4	6.7	0.100	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	0.435
6	C.5	4.5	0.200	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	0.870
7	C.6	9.7	4.000	Single-Phase Cooker	1	H07V-U (UK)		6		34.00	0.964	32.78	25	17.39
8	C.7	13.7	0.800	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	3.478
9	C.8	10.7	1.000	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	4.348
10	C.9	2.6	2.000	Water Heater	1	H07V-U (UK)		4		26.00	0.964	25.06	20	8.696
11	C.10	4.5	0.320	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	1.391
12	B.P		0.760	Electrical Panel	1.000	E1VV-R		4		24.00	0.964	23.14	20	3.304
13	B.1	7.3	0.160	Lighting	1	H07V-U (UK)		1.5		14.50	0.964	13.98	10	0.696
14	B.2	2.9	0.200	Sockets	1	H07V-U (UK)		2.5		19.50	0.964	18.80	16	0.870
15	B.3	7.6	0.400	Sockets	1	H07V-U (UK)		2.5		19.50	0.964	18.80	16	1.739
16	A.P		11.18	Electrical Panel	1.000	E1VV-R		16		52.00	0.964	50.13	50	45.30
17	A.C	10.1	10.42	Electrical Panel	1.000	E1VV-R		16		56.00	0.964	53.98	50	45.30
18	A.B	0.9	0.760	Electrical Panel	1.000	E1VV-R		4		24.00	0.964	23.14	20	3.304
19														
20														
21														

34: 10 InAccessible Current-Carrying Capacity in Norm.Cond.

More specifically, the following data appear for each line: line length (equivalent length), load (kW) and type, power factor, type of cable, calculated and desirable cable cross sectional area, current-carrying capacity on normal conditions, correction (rating) factor of the permissible current-carrying capacity, permissible current-carrying capacity at project conditions, selected maximum fuse size and finally total line. The appearance of all these information is very useful since it provides the user with advanced monitoring. Apparently, each modification made by the user lead to automatic update of the values in the calculation and result sheets.

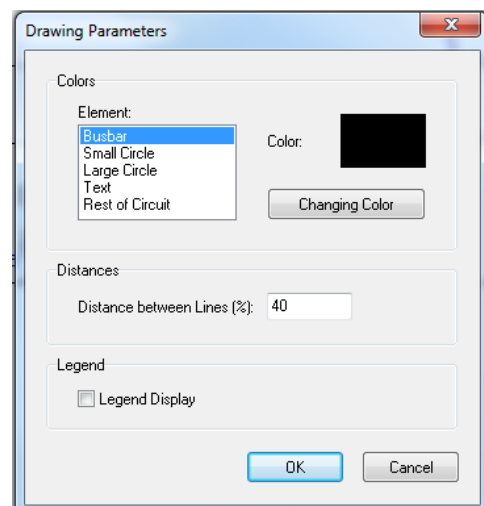
Automatic Drawing of Panel Single-Line Diagrams: Regarding the line diagrams, they can be displayed by pressing or selecting <F3>" Panel Single-Line Diagram" from the list that appears by pressing the right mouse button on any column of the corresponding row, while in the same manner, the total panel single-line diagram appears as long as you click on a panel row.

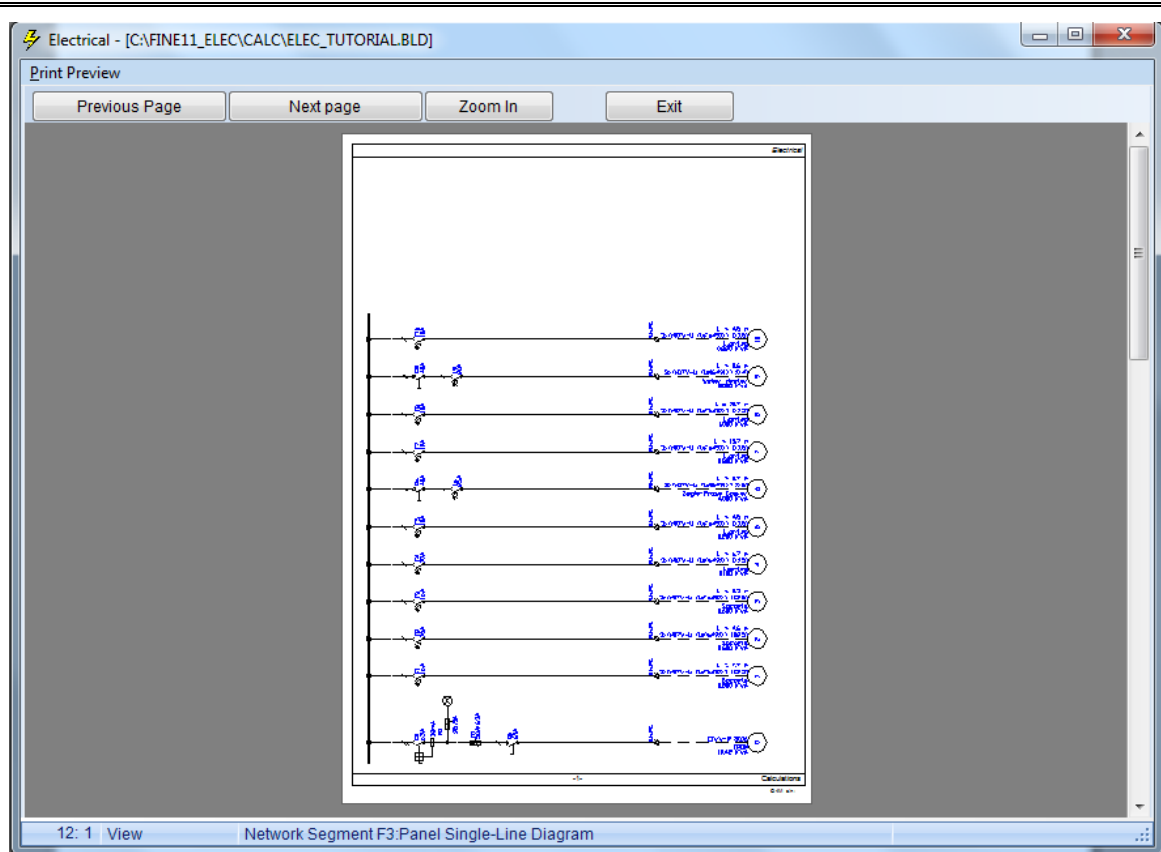


Furthermore, the user is able to modify a range of parameters concerning panel single-line diagram. These parameters are listed below:


Colors of drawing elements (bar, small circle, large circle, text, rest of circuit): For example, if you want to modify the color of a selected text segment, click the "Change Color" key to select the new color which is displayed on the window top right side.

- Distance between panel lines. The default value is 40. Therefore if a lower value (e.g. 30) is inserted, the distance is reduced accordingly while it increases for a higher value.
- "Legend". This option shows or not the project properties, on the printing page.





Caution! The special case of large loads requiring extremely large cable cross sectional areas (over 300 mm²) can be easily handled. As soon as the user selects the desirable cable cross sectional area (e.g. 200 mm²), the program automatically selects more than one cable of the same cross sectional area (e.g. 2 cables of 200 mm²). More specifically, this is done when the user selects (by pressing **F12** in the column of the desirable cross sectional area) the particular cable cross sectional area (of the same cable type) and then presses **F9** within the calculation sheet. The required number of such cables is shown.

 **Note:** The program allows the fast data entering in case of similar lines or panels. A similar (typical) line is repeated by filling its name in the first column (all data of the existing line appear, except the name which has to be typed). In order to insert a typical panel, you should type the panel name in the first column (e.g. B.P), select it and press **F11**. A list including the existing panels will appear, in order to select the desirable one.

3.4.2 Panel Options

Based on the data entered in the calculation sheet, all data are automatically calculated for each panel separately. More specifically, each panel corresponds to a page, which can be viewed by pressing **<F7>** in the first column (The displayed panel is the one corresponding to the row that the cursor is placed upon). To return to the calculation sheet, you should press **<F7>** again.

Electrical - [C:\FINE11_ELEC\CALC\ELEC_TUTORIAL.BLD] - [Calculation Sheet]

Files Project Data View Calculation Sheet Windows Libraries Help

Panel Loads

100%

	Load Type	Installed Power (kW)	Power Factor	Apparent Power (kVA)	Coincidence factor	Max. Demand (kVA)
1	Sockets	2.00	1.00	2.00	1	2.00
2	Lighting	2.42	1.00	2.42	1	2.42
3	Single-Phase Cooker	4.00	1.00	4.00	1	4.00
4	Water Heater	2.00	1.00	2.00	1	2.00
5						
6						
7						
8						
9						
10						
..	TOTAL	10.42	1.00	10.42		10.42

Phases Power Distribution	
Phase R (kVA)	3.47
Phase S (kVA)	3.47
Phase T (kVA)	3.47

Max.Occurring Current Intensity (A)		15.10
Total Demand Factor		1.00
Intensity for Phases Equal Power Distribution		15.10
Possible Max.Occurring Current Intensity (A)		15.10
Short Circuits		
Short Circuit Current (kA)		
Permissible Short Circuit Current (kA)		

Panel Name	C.P
Panel Name	
Panel Type	
Increments	
Due to Reserve (%)	
Due to Motors (A)	
Due to Lamp Starting (A)	
Total Current (A)	15.10
Recommended	
Main Switch (A)	40
Fuse or Circuit Breaker (A)	25
Power cord (mm ²)	6.0
Selected	
Main Switch (A)	
Fuse or Circuit Breaker (A)	
Power cord (mm ²)	
IP Degree of Protection of Panel	
Embedded to another Panel	


1: 1 InAccessible

In the upper-right part of the window, a detailed description for the panel can be given (in addition to the symbolic name A.P, B.P etc mentioned earlier). More specifically:

In the upper-left part of the window, each load type of every panel are automatically calculated (that is, in case two or more lines refer to the same type of load, e.g. lighting, they are added):

- Installed Power (kW)
- Power Factor (in case more than one lines of the same load type carry different values, a weighted average is calculated)
- Apparent Power (kVA)

Additionally, the maximum possible demand (in KVA) for each load type is calculated, using a default coincidence factor, equal to 1. The user can of course, modify this value. The coincidence factor is the only field that can be modified by the user in the upper part of the screen.

 **Note:** The user cannot modify the coincidence factor of a line, whose load type as well as its coincidence factor are defined in the typical data sheet, since the remaining data are automatically calculated from the relevant values inserted in the calculation sheet.

In the bottom-left part of the window, the following are calculated automatically:

- **Phases Power Distribution** (R,S,T), which is the distribution of loads in each phase (KVA), if we have to deal with a three-phase panel
- **Maximum Occurring Current Intensity** (A)
- **Total Demand Factor**
- **Intensity for Phases Equal Power Distribution** (A)

- **Possible Maximum Occurring Current Intensity (A).** Note that the difference between this value of intensity and the previous one evaluates the degree of equal power distribution of the phases of the specific panel.
- **Short Circuit Current**
- **Permissible Short Circuit Current**

The last two values will appear only if the option of calculating the short circuit current is activated (in network options) and the type of the transformer is selected.

On the right side of the window, increments can (optionally) be added to the panel load, due to:

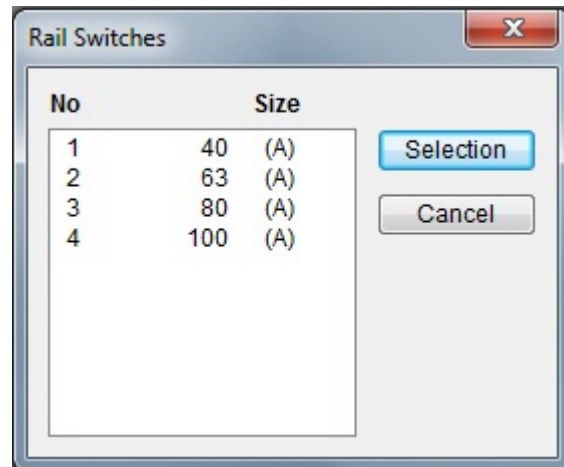
- **Reserve** (increment %)
- **Motors** (in A)
- **Lamp Starting** (in A), if there are fluorescent lamps

Basing on the above data, the total current of the panel (in A) is calculated right below.

Finally, the values of the following data automatically appear. They can also be selected by the user:

- **Main Switch (A)**
- **Fuse or Circuit Breaker (A)**
- **Power cord (mm²)**

IP Degree of Protection of Panel: The IP degree of protection of panel classifies and rates the degree of protection provided against the intrusion of solid objects (including body parts like hands and fingers), dust, accidental contact, and water in mechanical casings and with electrical enclosures. It is specified by the letters "IP" and a two-digit number. The digits, according to IEC 529, which is equivalent to the European standard EN60529:1992 indicate conformity with the conditions summarized below:



1st Characteristic Digit

Protection against access to hazardous parts and ingress of solid foreign objects

- | | |
|---|--|
| 0 | No Protection |
| 1 | Protection against solid objects of diameter > 50 mm |
| 2 | Protection against solid objects of diameter > 12 mm |
| 3 | Protection against solid objects of diameter > 2.5 mm |
| 4 | Protection against solid objects of diameter > 1 mm |
| 5 | Protection against dust |
| 6 | Sealed against dust, Complete protection against contact |

2nd Characteristic Digit

Protection against harmful ingress of water



- | | |
|---|-----------------------------------|
| 0 | No Protection |
| 1 | Protection against dripping water |

- | | |
|---|---|
| 2 | Protection against dripping water when tilted up to 15° |
| 3 | Protection of all sides against spraying water |
| 4 | Protection of all sides against splashing water |
| 5 | Protection against water jets |
| 6 | Protection against powerful water jets |
| 7 | Protection against immersion up to 1m |
| 8 | Protection against immersion beyond 1m |

By pressing **F11**, the help window appears, indicating the most common degrees of protection. The user can select the one that is the most appropriate for the panel.

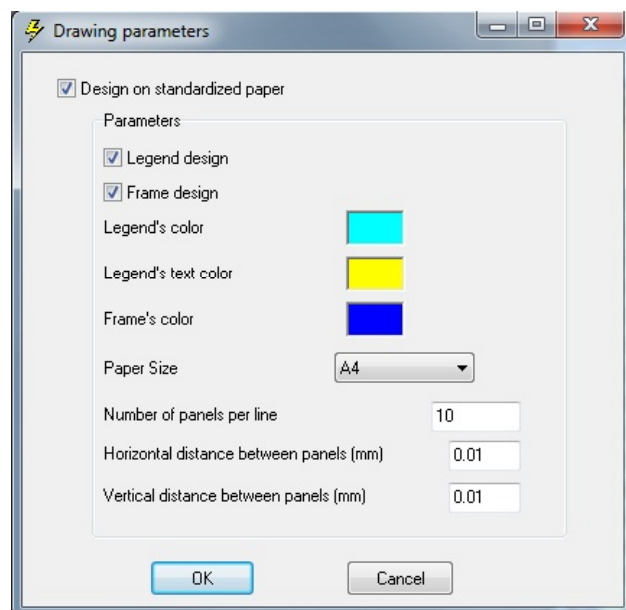
- **Embedded to another Panel:** The option “Embedded to another Panel” (1:No, 2:Yes) allows the user to deal with cases where a panel is contained within another one (busbar. If the user selects, at this point, that the panel is embedded, it will be automatically assumed that the panel does not actually exist, but it is a sub-bar of the panel supplying it. In a panel single-line diagram, it will not be displayed independently, but together with the supplying panel.

The user can modify this data, always providing, however, safer values. Values are generally inserted by pressing **<F11>** and selecting them from the corresponding table that appears on the screen.

 **Note:** The user can select the panel single-line diagram, the cable data and the panel options, by clicking on the toolbar  instead of using the keys F3, F5 and F7.

3.4.3 Export to a DWG or DXF file

As long as the calculation sheet is activated, the user can select “Export to DWG” (or “Export to DXF”) through the “Calculation sheet” group of commands in order to generate a dwg (dxf) file including the panel single-line diagrams. Besides, the user has available a set of parameters to modify the style of the panel drawings generated (paper size, distances, density, color etc).



3.4.4 Circuit checking

This option checks every line of the circuit about its cable cross section and fuse (protective device) .If the program cannot calculate for any reason these two parameters, there is a warning for the user in this window. In this case, the user should change the Line Diagram and choose something that will allow the calculation.

3.4.5 Table of symbols

This option creates a dwg (or dxf) file with the legend of the possible protective devices used in the study.

3.4.6 Substation

As far as the selection of the substation (if required) is concerned, the values that appear on screen should be properly filled. Then the required load is automatically updated, whereas the rest of the values are automatically calculated after selecting “Transformer Type” from the libraries.

3.4.7 Fan

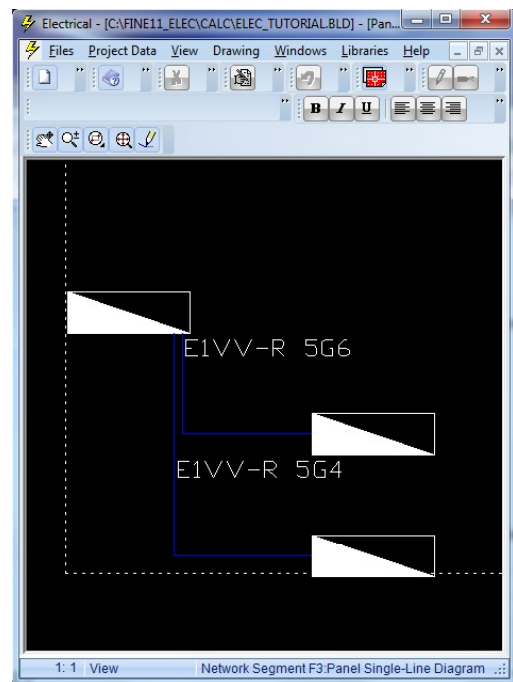
In order to select the fan for the ventilation of the substation, if required, the respective window needs to be completed. By pressing F11 in the row “Fan Selected”, the catalogue of the library fans appears, which can be used in order to select the fan that fulfils your requirements.

3.4.8 Panels Distribution Diagram

This command refers to the distribution diagram of the panels, showing the names specified in the panel calculation sheet. If a substation is determined, then the symbol of the transformer appears, as well. By activating the window, the option “Drawing” also appears in the menu, where the user can specify the printing scale and export the drawing to DWG and DXF files.

3.4.9 Voltage Drop

The total voltage drop appears in detail, for each line of the electrical network (from the main panel to each final consumption point). The value of the voltage drop is provided in Volts and in % percentage.



3.4.10 Bill of Materials-Costing

This window shows a detailed list of the materials used in the project along with their quantities, the total costs and the grand total. This list is editable by the user within a spreadsheet-like environment.

3.4.11 Detailed Bill of Materials

The detailed bill of materials used in the project is presented in this window. More specifically, the column “Analytic Quantity” displays for each cable cross-sectional area and type of cable, the real length of the network segments having the corresponding cross-sectional area. In the column “Quantity”, the total length of the cable for each cable cross-sectional area is calculated.

3.4.12 Technical Description, Assumptions, Cover Page

The above three windows support the generation of some important project reports. The user can choose among different prototypes (templates). In particular, by selecting “Technical Description” for example, the corresponding window appears, updated with the project’s results. When this window is activated, an additional option in the main menu also appears named “Technical Description”. Choosing “Prototype Selection” from this menu, the prototype management window will appear on our screen along with the list of the available prototypes for the application. Selecting the corresponding prototype (by using the “Load” key), the relevant text appears inside the Technical description window, completely updated. Pressing the “Edit Prototype” icon can do any desirable modification in the technical description of the project, either by changing the position of a word-parameter or processing the text the way we want to.

3.5 Libraries

The libraries consist of the following groups:

Type of Cable

No	Description	Type	Insulation	Description by VDE	Rated Voltage	Type	Outersheath
1	H07V-U (UK:6491X)	Insulated Conductor	PVC	NYA	450/750V	Non-armoured	
2	H07V-R (UK:6491X)	Insulated Conductor	PVC	NYA	450/750V	Non-armoured	
3	H07V-K (UK:2491X)	Insulated Conductor	PVC	NYAF	450/750V	Flexible	
4	A05VV-U	Cable	PVC	NYM	300/500V	Non-armoured	
5	A05VV-R	Cable	PVC	NYM	300/500V	Non-armoured	
6	E1VV-U	Cable	PVC	NYN	600/1000V	Non-armoured	PVC
7	E1VV-R	Cable	PVC	NYN	600/1000V	Non-armoured	PVC
8	E1VV-S	Cable	PVC	NYN	600/1000V	Non-armoured	PVC
9	H05V-U (UK:6491X)	Insulated Conductor	PVC	NYA	300/500V	Non-armoured	
10	H05V-K (UK:2491X)	Insulated Conductor	PVC	NYAF,NYFAP	300/500V	Flexible	
11	H05VV-F (UK:318V)	Cable	PVC	NYMHY	300/500V	Flexible	PVC
12	H03VV-F	Cable	PVC	NYLHY	300/300V	Flexible	PVC
13	H03VH-H	Cable	PVC	NYFAZ	300/300V	Flexible	
14	H05RR-F	Cable	Rubber 60°C	NLH,NMH	300/500V	Flexible	Rubber 60°C
15	H07RN-F	Cable	XLPE EPR	NSHou	450/750V	Flexible	PCP
16	XLPE/PVC	Cable	XLPE EPR	2XY	600/1000V	Non-armoured	PVC
17	NYCY	Cable	PVC	NYCY	600/1000V	Non-armoured	PVC
18	NYCWY/NAYCWY	Cable	PVC	NYCWY/NAYCWY	600/1000V	Non-armoured	PVC
19	A05VVH3-U/NYIFY-O	Cable	PVC	NYIFY-O	230/400V	Flat twin and earth	PVC
20	A05VVH3-U/NYIFY-J	Cable	PVC	NYIFY-J	230/400V	Flat twin and earth	PVC
21	U-1000 R2V	Cable	XLPE EPR		600/1000V	Non-armoured	PVC
22	XLPE/PVC/AWA/PVC	Insulated Conductor	XLPE EPR		600/1000V	Armoured	PVC
23	XLPE/PVC/SPA/PVC	Cable	XLPE EPR	N2XRY	600/1000V	Armoured	PVC
24	XLPE/LSF/AWA/LSF	Insulated Conductor	XLPE EPR		600/1000V	Armoured	LSF
25	XLPE/LSF/SPA/LSF	Cable	XLPE EPR		600/1000V	Armoured	LSF
26	FR-N05VV5-F	Cable	PVC	NYMHY	300/500V	Non-armoured	PVC
27	TWIN FLAT	Cable	PVC		300/500V	Flat twin and earth	PVC
28	N07V-K	Insulated Conductor	PVC		450/750V	Non-armoured	

The match between type of cable by hd/iec/bs and vde is shown below:

New Type	Old Type
H07V-K	NYAF
H07V-U	NYA (re)
H07V-R	NYA (rm)
A05VV-U	NYM (re)
A05VV-R	NYM (rm)
H05VV-F	NYMHY
H03VV-F	NYLHY (rd)
H03VH-H	NYFAZ
H05RR-F	NMH,NLH
H07RN-F	NSHou
E1VV-U	YYY (re)
E1VV-R	YYY (rm)
E1VV-S	YYY (sm)
A05VVH3-U	NYIFY

System of Cable Designation

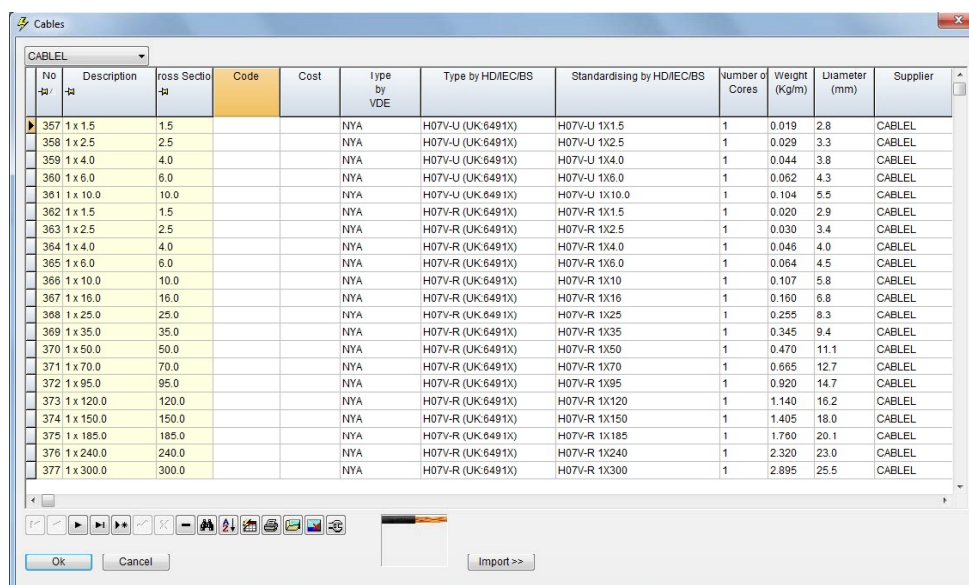
Relationship of cable to standards	
Harmonized Standard	H
Authorized National Standard	A
According to IEC Standard	J
Another National Standard (apart from IEC)	N
Rated Voltage u/U	
300/300 V	03
300/500 V	05
450/750 V	07
600/1000V	1
Insulation	
PVC soft (polyvinyl chloride)	V
Ethylene-propylene rubber or equivalent synthetic elastomer for +60°C	R
Silicone-Rubber	S
Armoring	
Armoring of steel tape, galvanized / non -galvanized	Z4
Outersheath	
PVC soft (polyvinyl chloride)	V
Ethylene-propylene rubber or equivalent synthetic elastomer for +60°C	R
Chloroprene-rubber (or equivalent material)	N
Braiding of glass fiber	J
Textile braiding over twisted conductors, impregnated/un-impregnated	T
Textile braiding with flame retardant, impregnated composition	T2
Special Versions	
Flat type as separable cables with or without jacket	H
Flat type of cables not separable	H2
Central conductor element (not as supporting element), used for lift cable	D5
Conductor	
Round conductor of single wire	U
Conductor of multi stranded wires	R
Fine wire stranded conductor for fixed installation (if not specified, equivalent to J DIN VDE 0295, class 5)	K
Fine wire stranded conductor for flexible cables according to DIN VDE 0295, class 5	F
Extra fine wire stranded conductor for flexible cables according to DIN VDE 0295, class 6	H
Tinsel conductor	Y
Sector-shaped conductor of multi stranded wires	S

Number of Conductors & Cross-section	
Number of conductors n	Number
Multiplication sign without green-yellow ground conductor	X
Multiplication sign for green-yellow ground conductor	G
Conductor color	
Color	...

Some Examples:

1. Insulated cable PVC 1,5 mm² single-core conductor 450/750 V black colour (blk): **H07V-U 1,5 blk.**
2. Flexible cable (rubber) 3 core, ground cable 450/750 V.2,5 mm²: **H07RN-F3G 2,5**
3. PVC, flexible cable, 2 core, 0,75 mm²: **H05VV-F2X 0,75**

Cables: This library contains various types of cables along with their attributes (type, description, manufacturer, cross-sectional area, number of cores etc).



No	Description	Cross Section	Code	Cost	Type by VDE	Type by HD/IEC/BS	Standardising by HD/IEC/BS	Number of Cores	Weight (Kg/m)	Diameter (mm)	Supplier
357	1 x 1.5	1.5			NYA	H07V-U (UK:6491X)	H07V-U 1X1.5	1	0.019	2.8	CABLEL
358	1 x 2.5	2.5			NYA	H07V-U (UK:6491X)	H07V-U 1X2.5	1	0.029	3.3	CABLEL
359	1 x 4.0	4.0			NYA	H07V-U (UK:6491X)	H07V-U 1X4.0	1	0.044	3.8	CABLEL
360	1 x 6.0	6.0			NYA	H07V-U (UK:6491X)	H07V-U 1X6.0	1	0.062	4.3	CABLEL
361	1 x 10.0	10.0			NYA	H07V-U (UK:6491X)	H07V-U 1X10.0	1	0.104	5.5	CABLEL
362	1 x 1.5	1.5			NYA	H07V-R (UK:6491X)	H07V-R 1X1.5	1	0.020	2.9	CABLEL
363	1 x 2.5	2.5			NYA	H07V-R (UK:6491X)	H07V-R 1X2.5	1	0.030	3.4	CABLEL
364	1 x 4.0	4.0			NYA	H07V-R (UK:6491X)	H07V-R 1X4.0	1	0.046	4.0	CABLEL
365	1 x 6.0	6.0			NYA	H07V-R (UK:6491X)	H07V-R 1X6.0	1	0.064	4.5	CABLEL
366	1 x 10.0	10.0			NYA	H07V-R (UK:6491X)	H07V-R 1X10	1	0.107	5.8	CABLEL
367	1 x 16.0	16.0			NYA	H07V-R (UK:6491X)	H07V-R 1X16	1	0.160	6.8	CABLEL
368	1 x 25.0	25.0			NYA	H07V-R (UK:6491X)	H07V-R 1X25	1	0.255	8.3	CABLEL
369	1 x 35.0	35.0			NYA	H07V-R (UK:6491X)	H07V-R 1X35	1	0.345	9.4	CABLEL
370	1 x 50.0	50.0			NYA	H07V-R (UK:6491X)	H07V-R 1X50	1	0.470	11.1	CABLEL
371	1 x 70.0	70.0			NYA	H07V-R (UK:6491X)	H07V-R 1X70	1	0.665	12.7	CABLEL
372	1 x 95.0	95.0			NYA	H07V-R (UK:6491X)	H07V-R 1X95	1	0.920	14.7	CABLEL
373	1 x 120.0	120.0			NYA	H07V-R (UK:6491X)	H07V-R 1X120	1	1.140	16.2	CABLEL
374	1 x 150.0	150.0			NYA	H07V-R (UK:6491X)	H07V-R 1X150	1	1.405	18.0	CABLEL
375	1 x 185.0	185.0			NYA	H07V-R (UK:6491X)	H07V-R 1X185	1	1.760	20.1	CABLEL
376	1 x 240.0	240.0			NYA	H07V-R (UK:6491X)	H07V-R 1X240	1	2.320	23.0	CABLEL
377	1 x 300.0	300.0			NYA	H07V-R (UK:6491X)	H07V-R 1X300	1	2.895	25.5	CABLEL

Load Types: This library contains the various types of electrical loads.

The user can create his/her own load types or modify the existing ones. The columns in load types' window are the following:

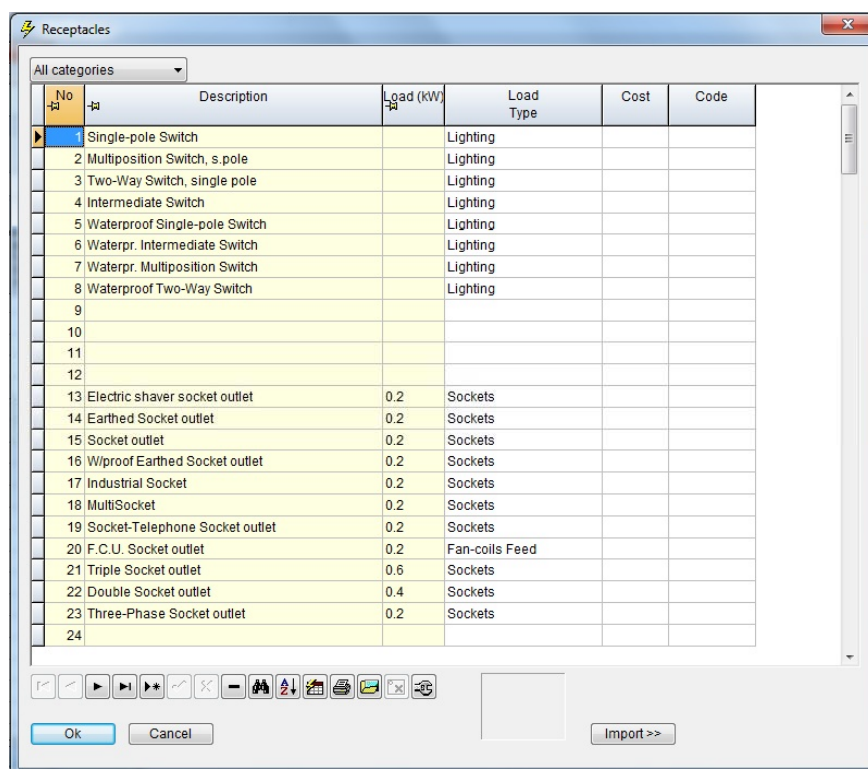
Description: Specify the load description. This description is printed in the calculations report and in the panel single-line diagram.

No.	Description	Min Cable Cross Sectional Area	Power Factor	Minimum Fuse Size	Line Diagram	Motor	Type of Cable	Type by HD/IEC/BS	Single-Phase	Three-Phase
1	Lighting	2.5	1	10	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
2	Sockets	2.5	1	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
3	Water Heater	4.0	1	20	Switch 2Poles-Min.Circ.Breaker	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
4	Single-Phase Cooker	6.0	1	25	Switch 2Poles-Min.Circ.Breaker	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
5	Motor	2.5	0.8	16	Min.Circ.Br.-R.C.Sw.-Therm-Led	No	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable
6	Electrical Panel	4.0		20	Supply Panel	No	NYI	ETVV-R	3-core Cable	5-core Cable
7	Three-Phase Cooker	6	1	25	Rail Sw.-Min.Circ.Br.-Led	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
8	Standby Line	1.5	1	10	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
9	Surge Protector	3.5	1	10	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
10	TV Amplifier	2.5	1	10	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
11	Electric Radiator	2.5	1	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
12	Centrifugal Fan	2.5	0.85	10	Rail Sw.-Min.Circ.Breaker	No	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable
13	Heat-pump	2.5	0.87	16	Min.Circ.Br.-R.C.Sw.-Therm-Led	Star-Delta Starter	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable
14	Total Fan	2.5	0.87	16	Rail Sw.-Min.Circ.Breaker	No	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable
15	Water cooler	2.5	0.87	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
16	Speaker Amplifier	2.6	0.87	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
17	Security Lighting Feed	1.5	1	10	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
18	Garage Door	2.5	0.87	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable
19	Dishwasher	2.5	0.88	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	5-core Cable
20	Blender	2.5	0.88	16	Miniature Circ. Breaker (L-C)	No	N/A	H07V-U (UK6491X)	3-core Cable	4-core Cable

- **Minimum Cable Cross Sectional Area:** Determine the minimum cable cross sectional area that is permissible by the regulations for the specific load type, e.g. 2.5 mm² for sockets.
- **Power factor:** Determine the load power factor. For an resistive load, value 1 is assigned. For a non-resistive load, it is power factor < 1.
- **Minimum Fuse Size:** Specify the minimum fuse size in A that will enable the protection of the load by the program.
- **Line Diagram:** Specify the line number, from line types library, which will be used by the program in order the departure of the supply line of the load to be designed. The term "Line Diagram" (line diagram for protective devices) refers to the combination of appliances that must be placed in the Electrical Panel, in order to protect the supply cable of the load and to control the load.
- **Motor:** Specify if the load is a motor and its starting method (1:direct on line, 2 Star-Delta starter). This option greatly affects the way the cables and the protective devices are calculated. The way the protective devices and the cables are calculated for thermal loads is completely different than for motor.
- **Type of Cable:** Specify the cable type according to VDE.
- **Type of Cable by HD/IEC/BS:** Specify the cable type according to HD384/IEC 60364/BS7671.
- **Single-Phase:** Specify the number of cores in a single-phase line.
- **Three-Phase:** Specify the number of cores in a three-phase line.

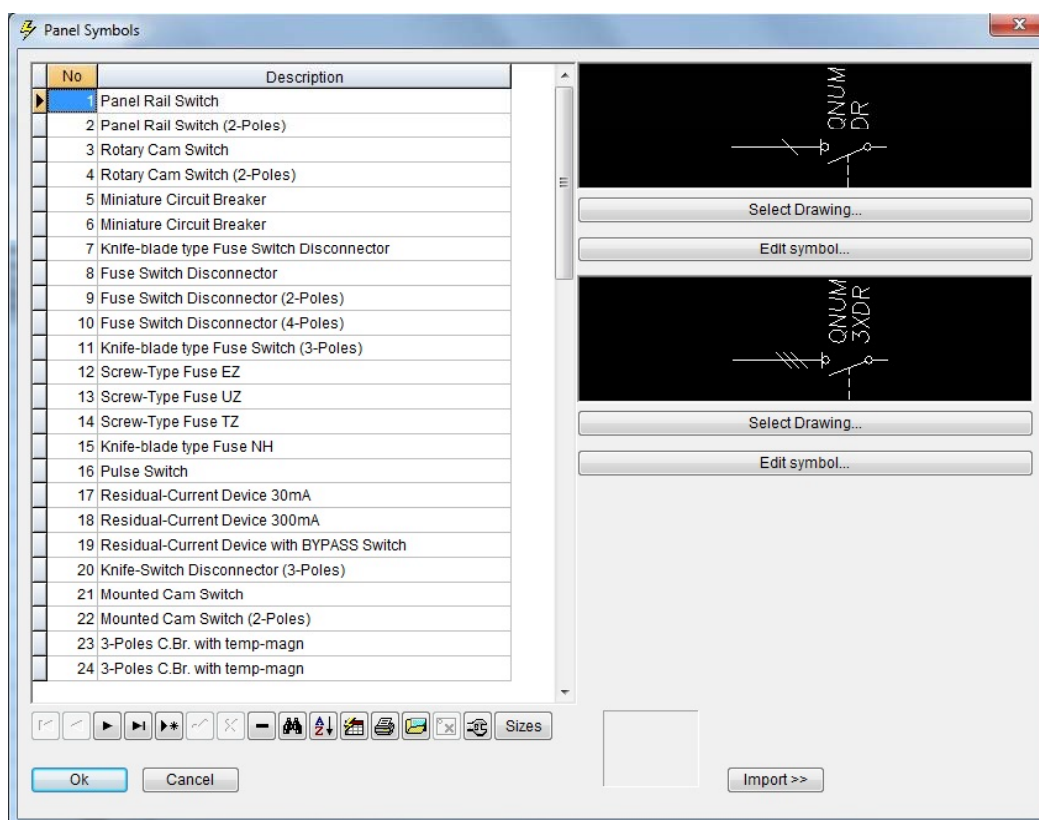
Transformers: It includes the available transformer types in the market, along with a complete list of their features.

Fans: It includes available fan types in the market, along with a complete list of their features (supply, static pressure, electrical data, cost etc).



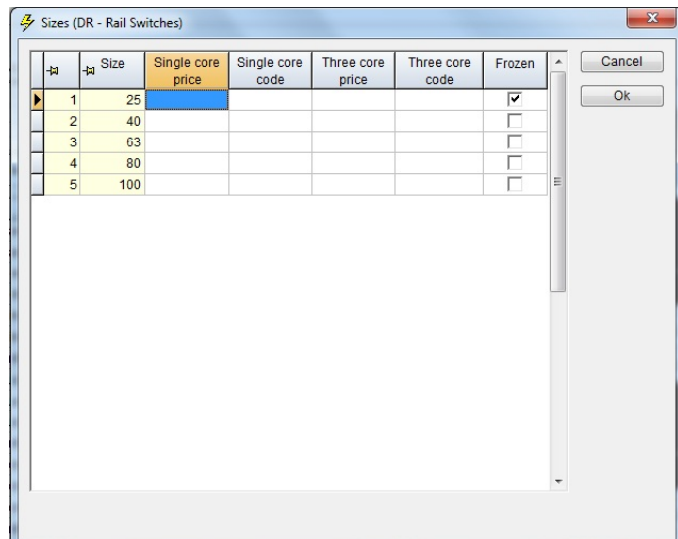
Receptacles: It includes receptacles as well as appliances, along with their features (load in kW, load type and cost).

Panel Symbols: Here the user can edit either the symbol drawings or their attributes.

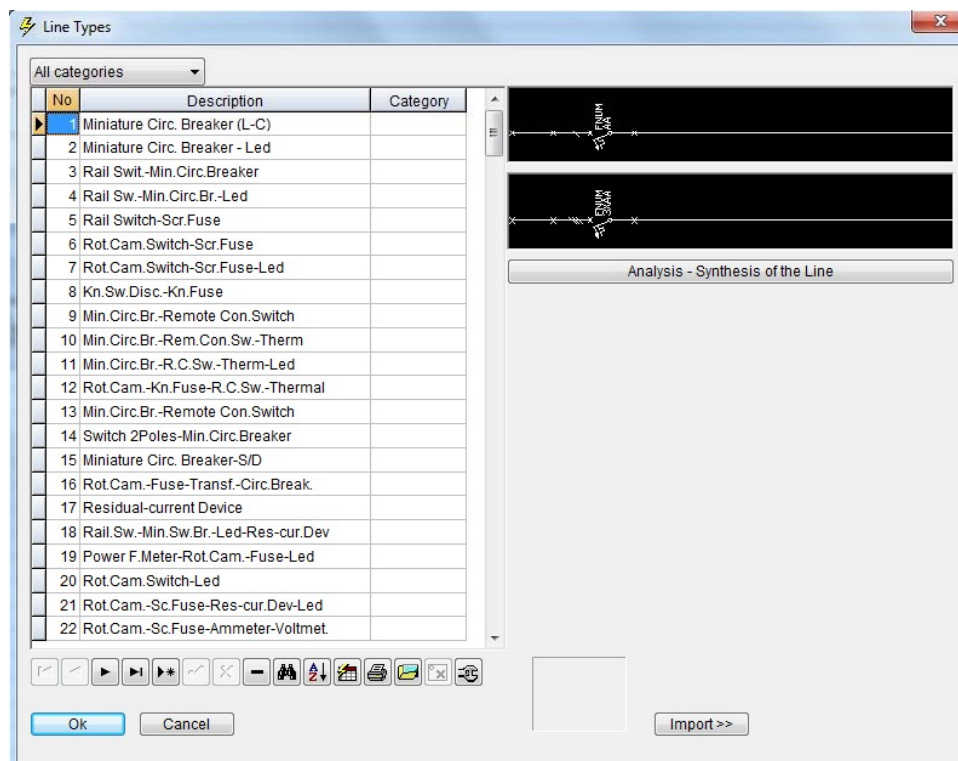


By selecting a certain symbol and by pressing the “Sizes” button, the user can edit the protective device's values.

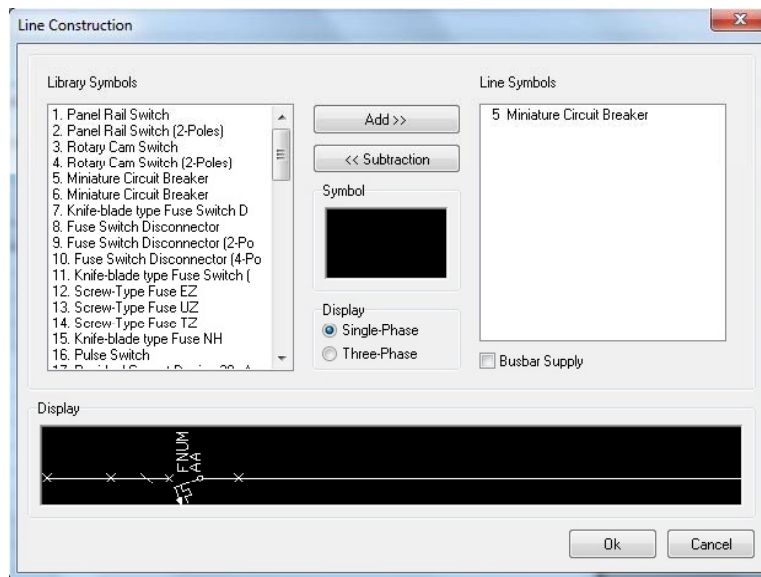
The two fields related to the drawings are referred to the single-phase or three-phase drawings respectively. Using the “drawing selection” the user can insert its own drawing and assign it with the symbol on the left. The symbols drawings in a DWG form are contained in the folder **DBJ** that is located at the libraries folder FINE11_ELEC\LIBS\DATAF\ of the program.



Line types: In this library, the user can create new lines, as well as edit the existing ones.



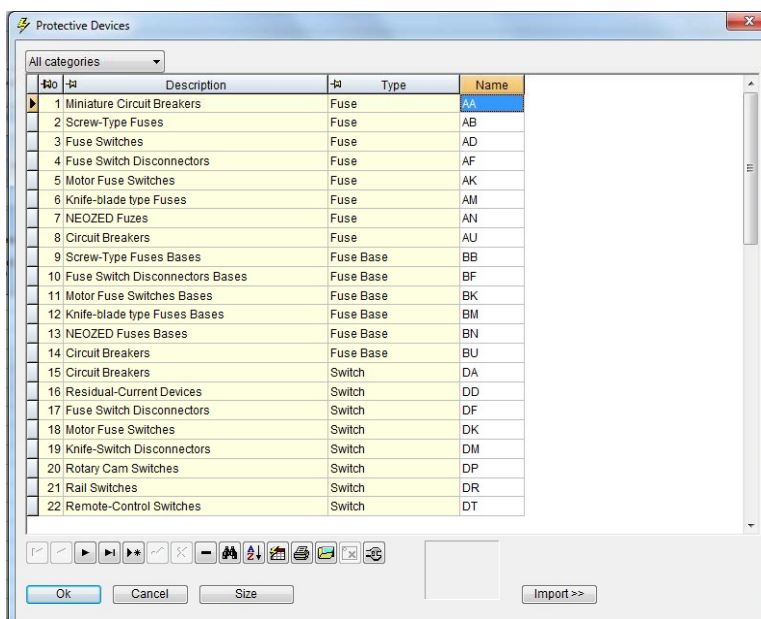
Analysis-Synthesis of a line: In order to create (compose) a new line, we have first to select an empty line (i.e. the 18th). Then, after filling the name of this line in the description field, the user has to press the respective button, so that the line creation dialog appears on screen.



Elements and protective devices can be easily added or removed by using the options “Add” or “Remove” respectively. The single-phase or three-phases drawing of any line is shown at the bottom of this dialog. The protective devices exist as DWG drawings within the folder **DBJ** that is located at the libraries folder FINE11_ELEC\LIBS\DATAF\ of the program.

Protective Devices

For each device, a new window containing the detailed sizes appears by pressing the button “Size”.



All the above libraries are available for editing by the user.

3.6 Help

This option includes a number of options that aim to support the user in learning each application-program following various ways. The most important of them is the **Contents and Index** option according to the common windows standards.