# ElectricalOM Getting Started

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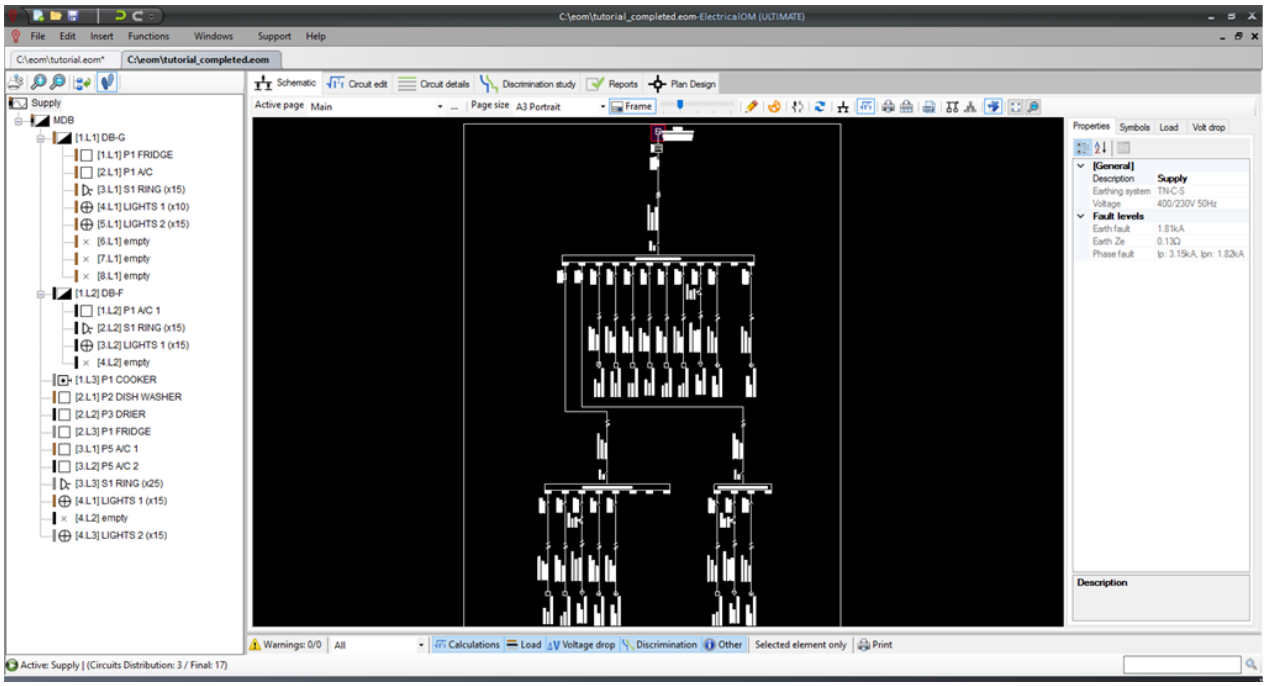
# Tutorial - Quick Start

This tutorial is a quick start for users with little or no experience using the software. The purpose of the tutorial is to guide the user through the basic functionalities of the software so that they can be ready to start designing and studying low-voltage electrical installations of their own.



## Main Environment

The main operating environment has a main menu, and areas for modeling, information and warnings.

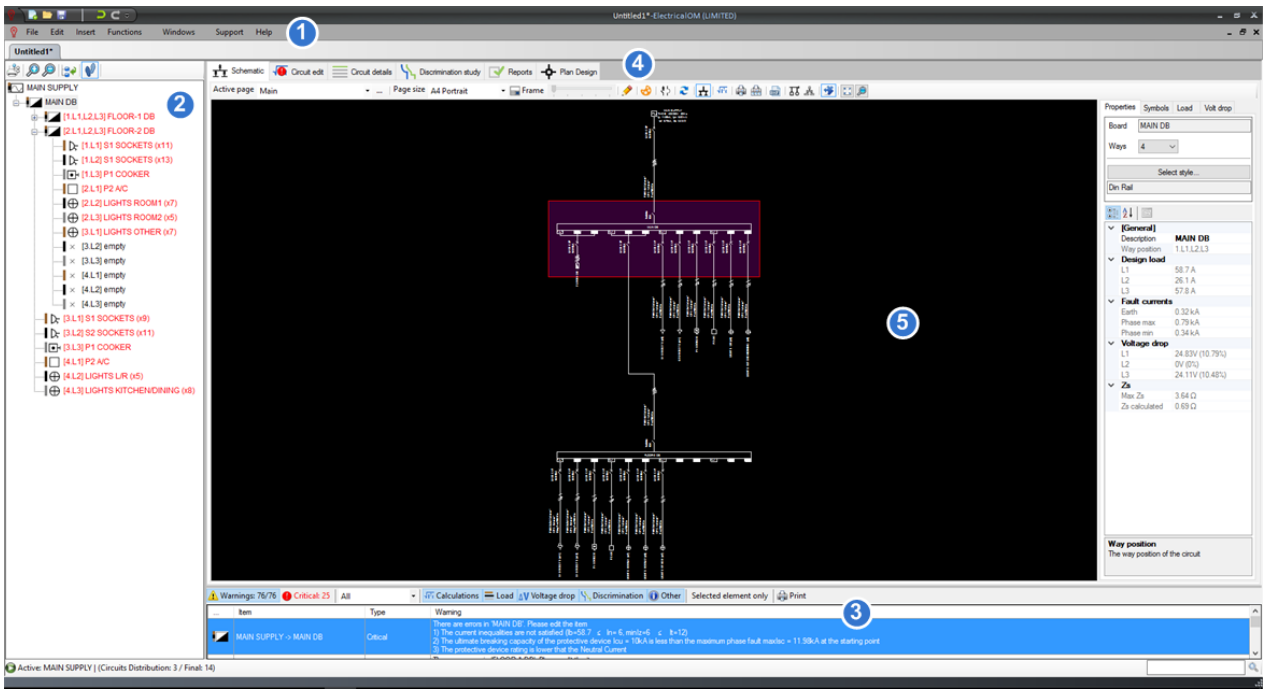
**1. Main Menu:** From the main menu, the user has access to a number of project functions. These include opening or saving project files, configuring project settings, inserting circuits, managing windows, accessing the help section of the software or requesting support.

**2. Tree Network View:** In ElectricalOM, each electrical element of the active network appears in the tree network view, the left-most panel of the application window, allowing quick access and modifications to the active network. From the tree network view the user can add or delete circuits or modify the network structure by dragging and dropping element nodes.

**3. Warnings:** During the creation of a project, calculations and checks are performed automatically with detailed error messages that appear in the warnings area. The area for warnings notifies the user when the software has found the model to be out of compliance or not to satisfy a physical constraint of the installation material. Critical warnings require that the user go back and change project settings in order to put the project into compliance with regulation, or so that the project meet the physical constraints of the installation material. Elements with warnings appear in red in the tree network view.

**4. Module Tabs:** ElectricalOM is developed using modular software development principles, allowing add-on modules to be used to extend the features of the software on demand. The modules can be popped out, to be made to appear in a different window, allowing immediate access to information during modeling.

**5. Active Module Area:** The module corresponding to the active tab (4) appears in this area, allowing the user to perform tasks and modifications.



## Basic settings

Project Information and Main Options

Setting the Schematic Environment Settings

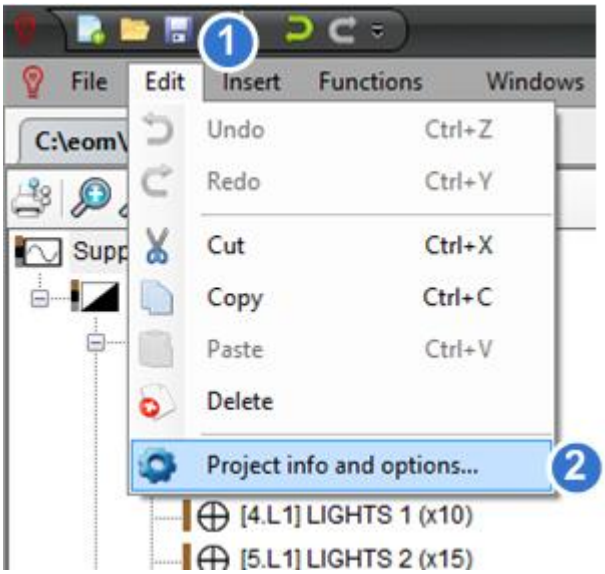
Navigating the Schematic: Pan, Zoom

Setting the Default Symbols

Creating New Symbols

### Project info and options

To configure the project from the main menu select **Edit** (1) and then **Project info and options...** (2).

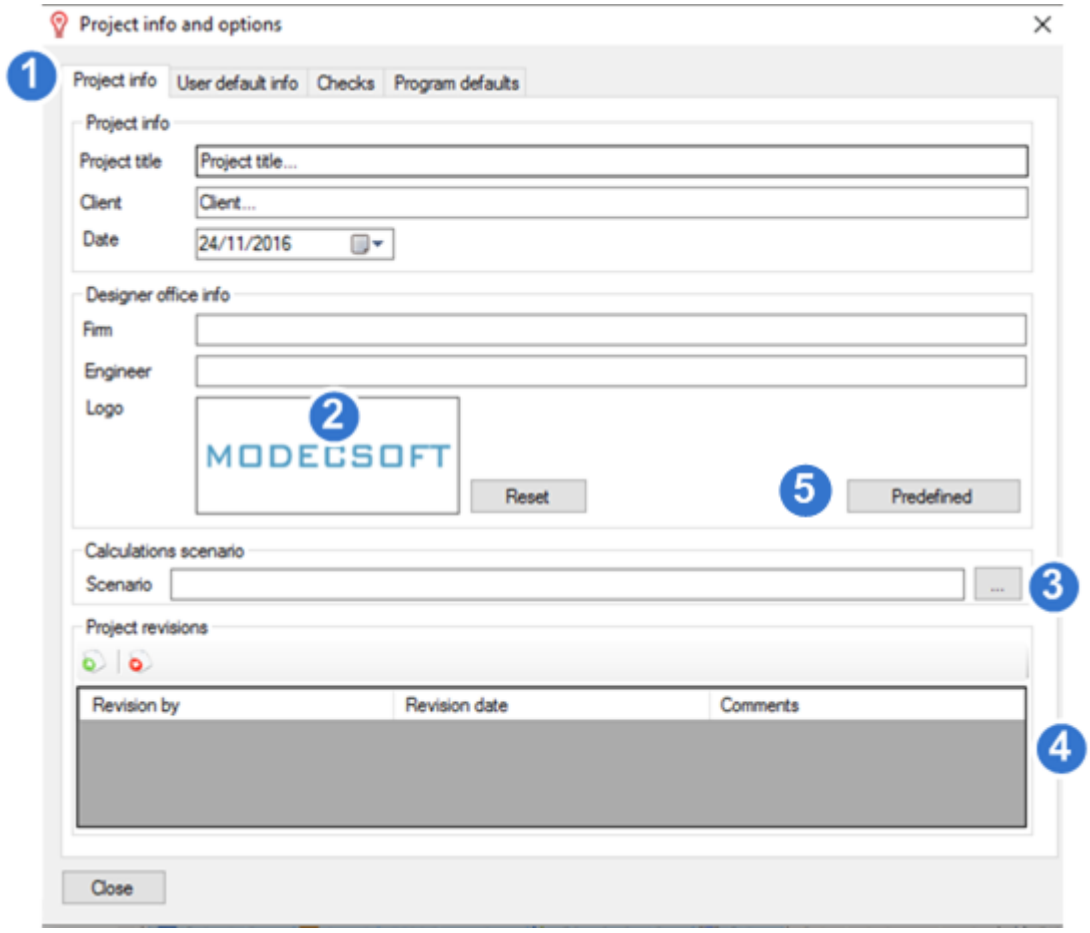



From the project information tab (1) the user can set a number of project attributes, including: the title of the project, the client, the date and also designer related information. The user may also choose to

include his or her logo by clicking the image below (2).

In case of multiple calculations scenarios the user may associate specific information with a particular scenario by describing the scenario or clicking the corresponding button (3). Project revisions (4) are also available for the user to keep track of the changes and modifications made during the project's implementation.

Project information, designer information, and the most recent revision will be displayed in the frame of each page of the schematic, and at the reports. These information are project related and should be set for every new project. The **Predefined** button (5) fills in the default user information (see below).

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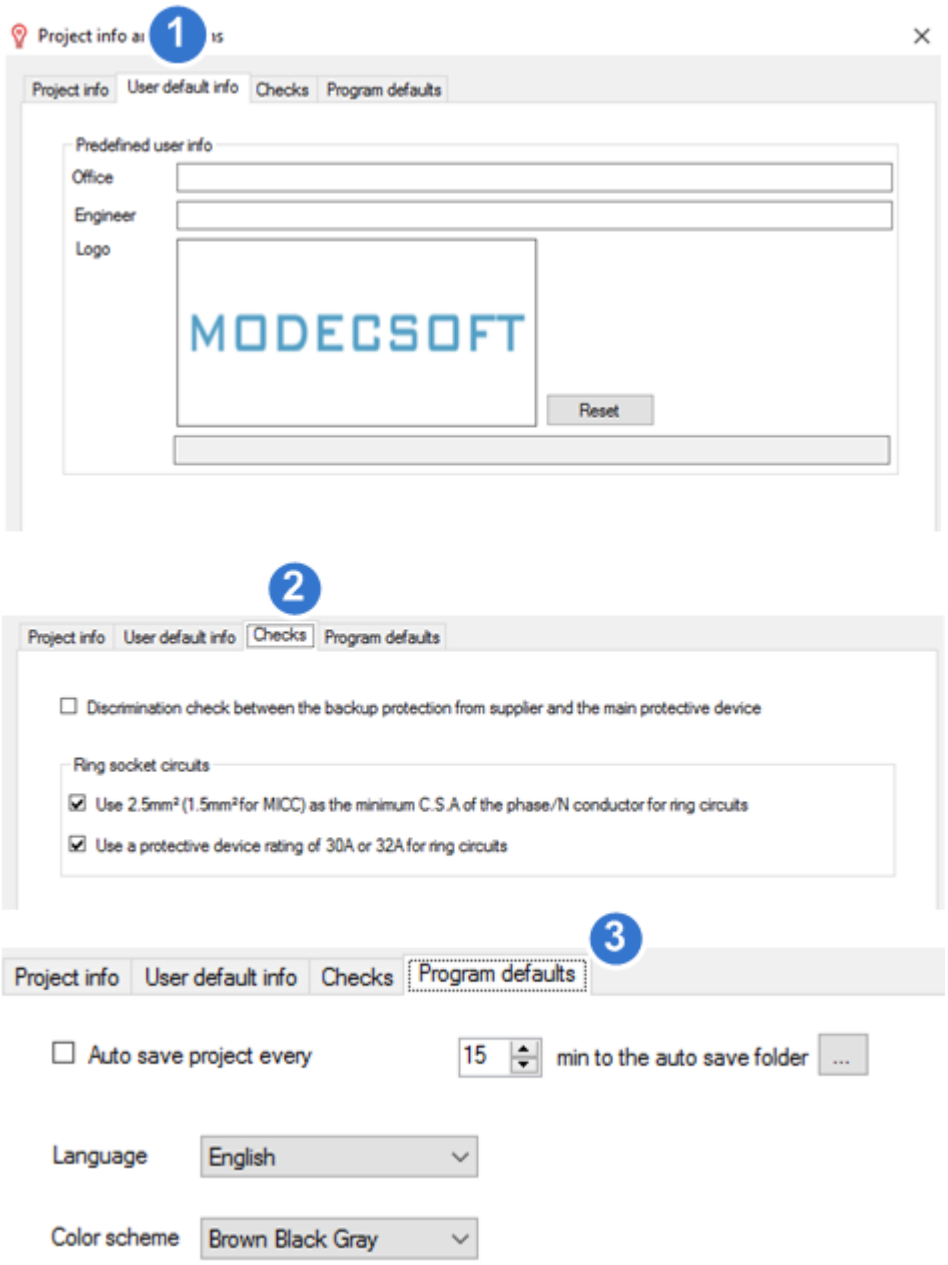
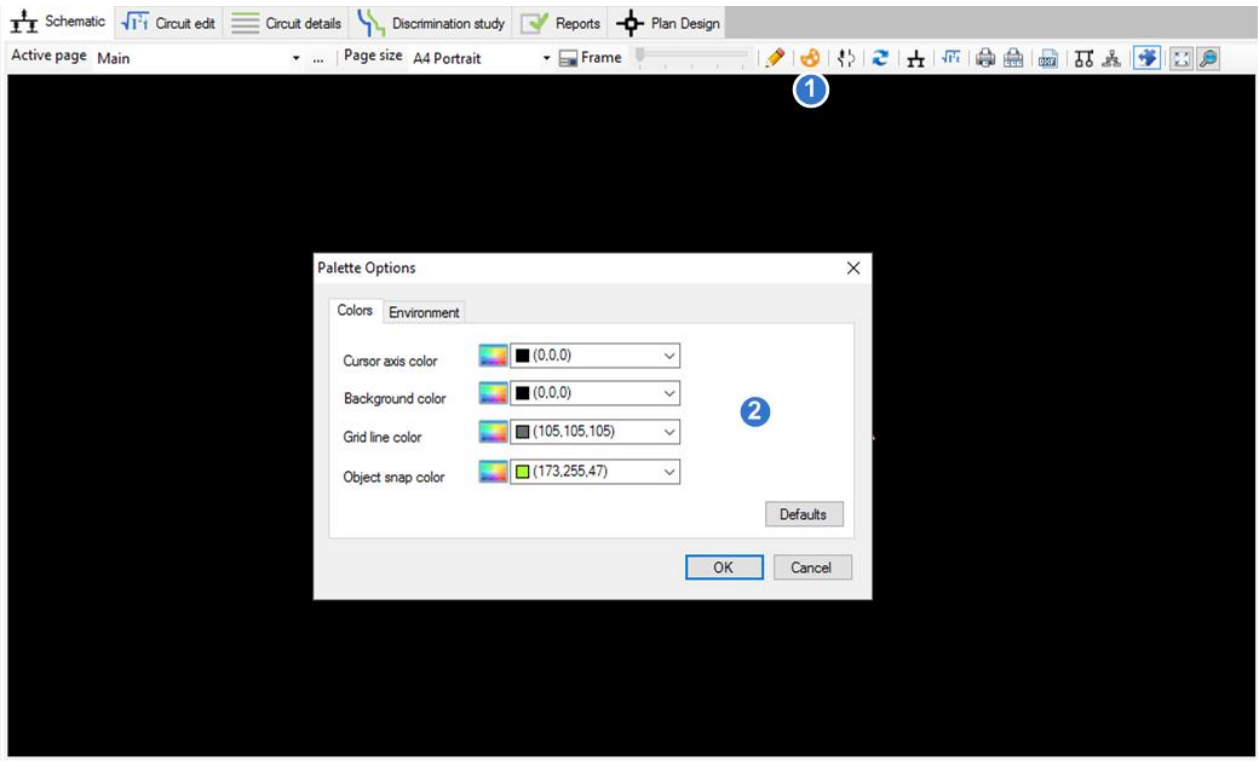
The default user information can be set from the default user information tab (1). Calculations related settings can be set from the checks tab (2) and default program options covering auto-save, language and color scheme from the project defaults tab (3). These settings are system-wide and are applied each time the software starts.




## Schematic environment

You can set the schematic environment settings by clicking on the palette options icon (1). From the palette options dialog (2) that appears, the user can control the appearance of the schematic.

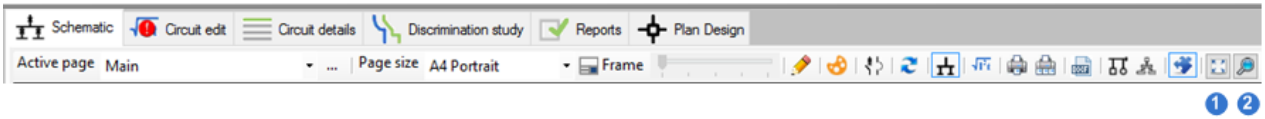



## Navigating the schematic

Pan and Zoom are used to help the user navigate their view of the schematic in order that they can more easily examine circuits of interest. In general, panning and zooming the view are accomplished by using the mouse wheel. Rolling the wheel zooms the view, while pressing the wheel and dragging pans the view. Note that the position of the cursor will affect the way that the view responds to a zoom action.


**Note:**
If you use a touch pad, you can use gestures to pan and zoom.

- **Zoom in**: Glide thumb and index finger apart.
- **Zoom out**: Pinch thumb and index finger together.
- **Pan**: Use a two-finger swipe in the direction that you want to move the view.



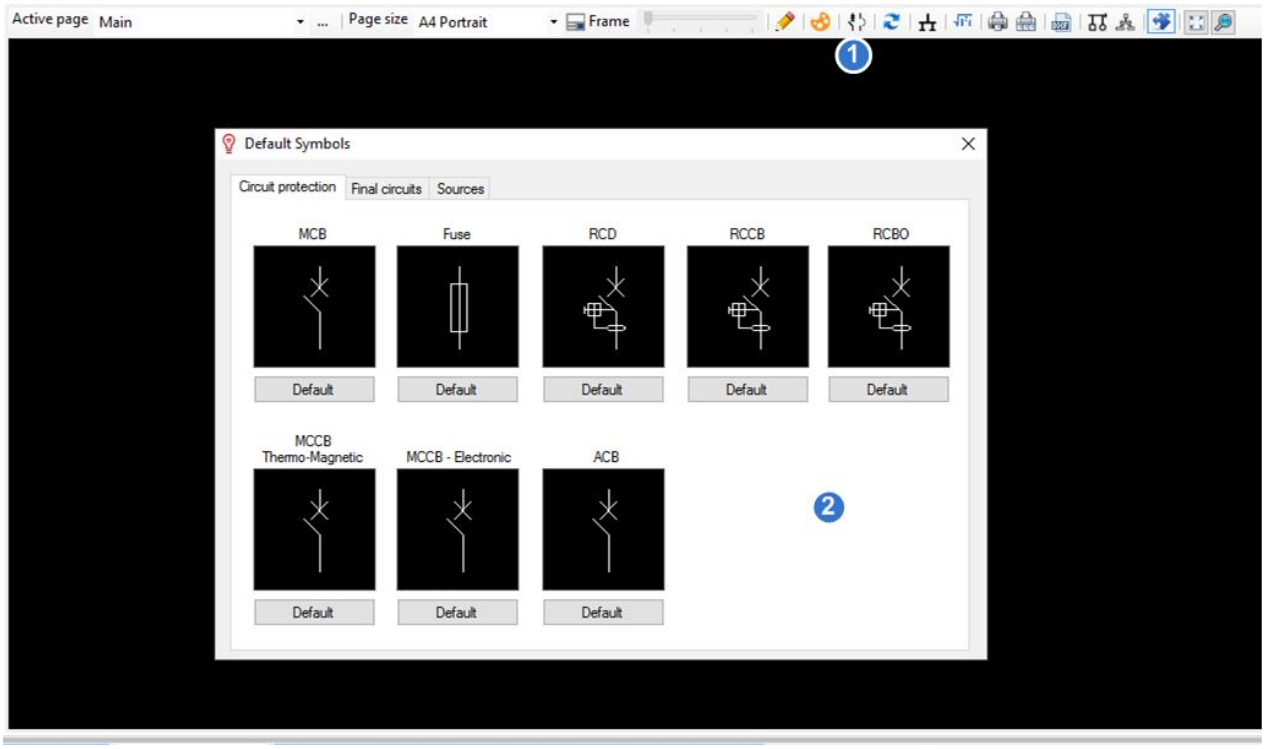

From the schematic tool bar you can also perform zoom actions.To zoom to the extents of the figures in

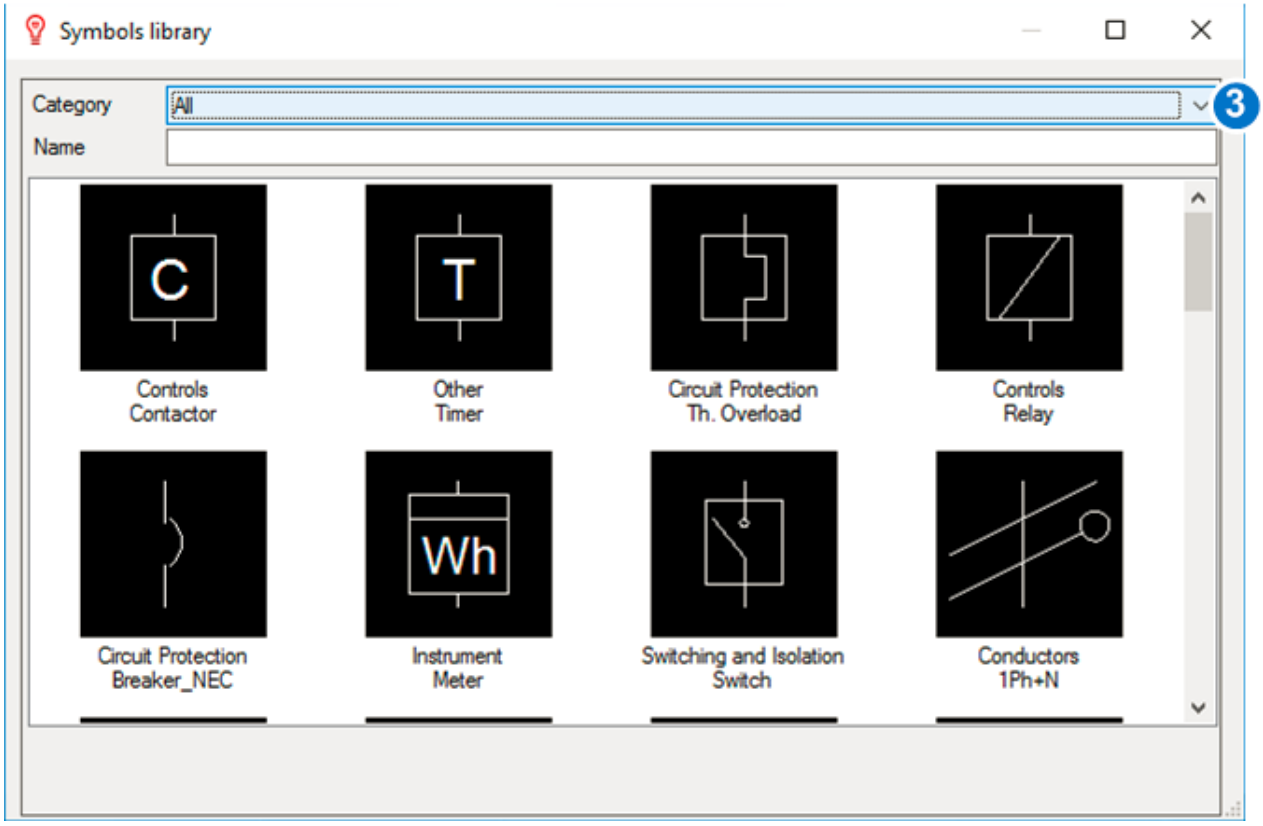
the drawing press the **Zoom All** button (1). To zoom to a rectangular area of your specification, click the **Zoom Window** button (2) and then specify opposing corners of this area.

## Default Symbols

To control which symbols are used to display devices in the schematic:

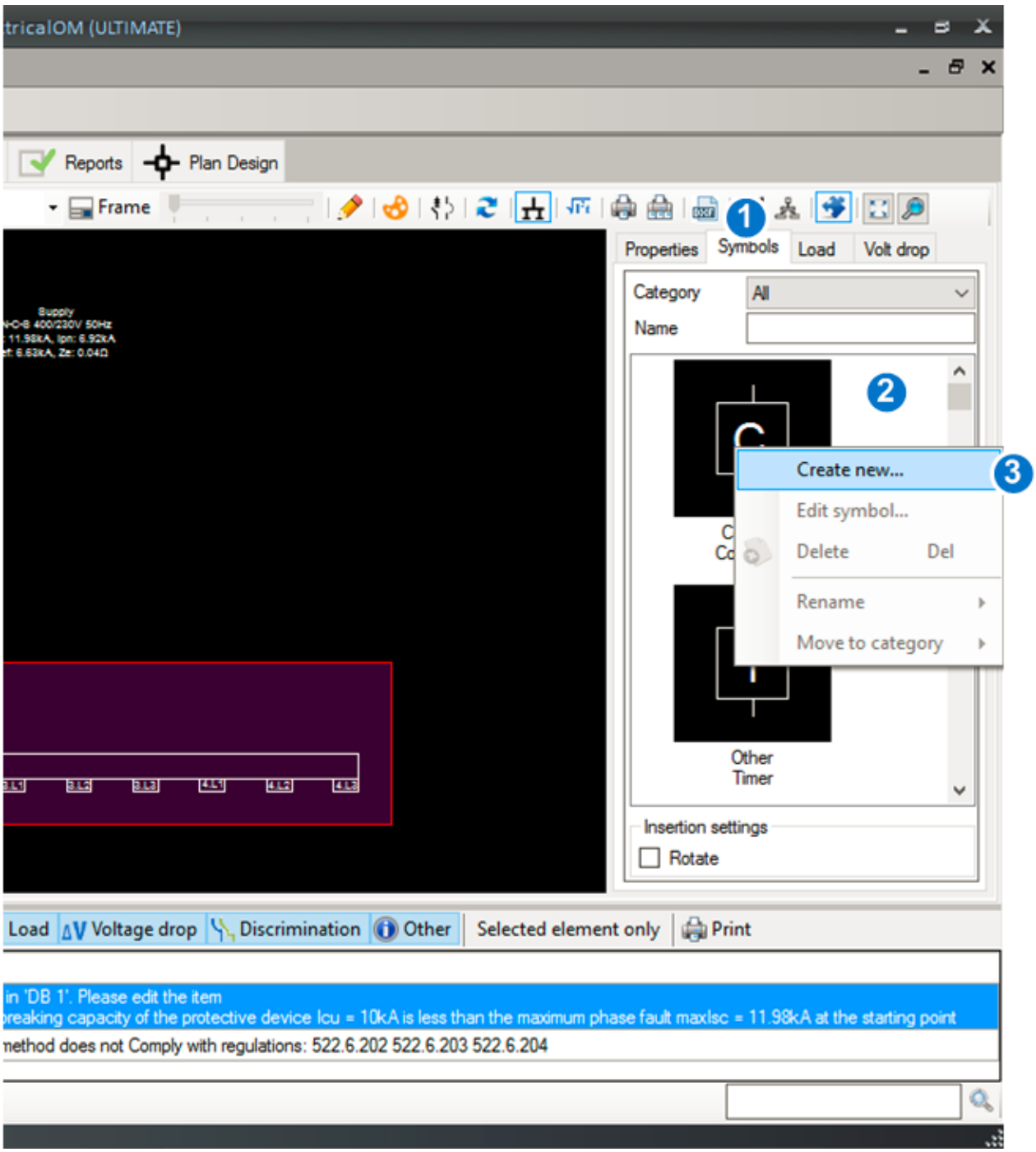
From the tool bar, click the default symbols icon(1). Make a selection from the appearing dialog by clicking on the device that you would like to configure. A dialog will appear, allowing you to choose a symbol for this device by selecting a category (3) and then double-clicking on the symbol of your choice.





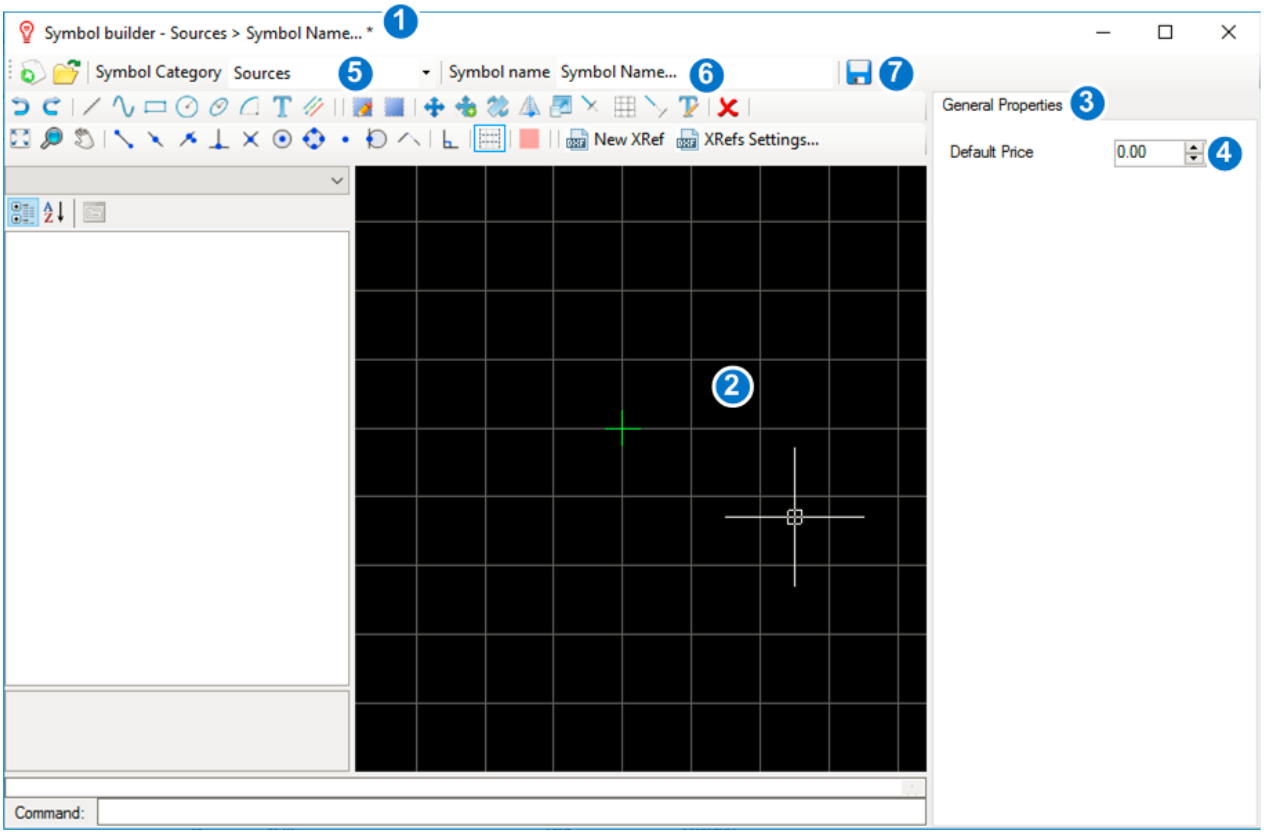

## Creating New Symbols

To create a new symbol, select the symbols tab (1) at the right panel of the schematic module. Then Right-click the symbols area list-box (2). Select **Create new...** (3) to open the symbol builder.

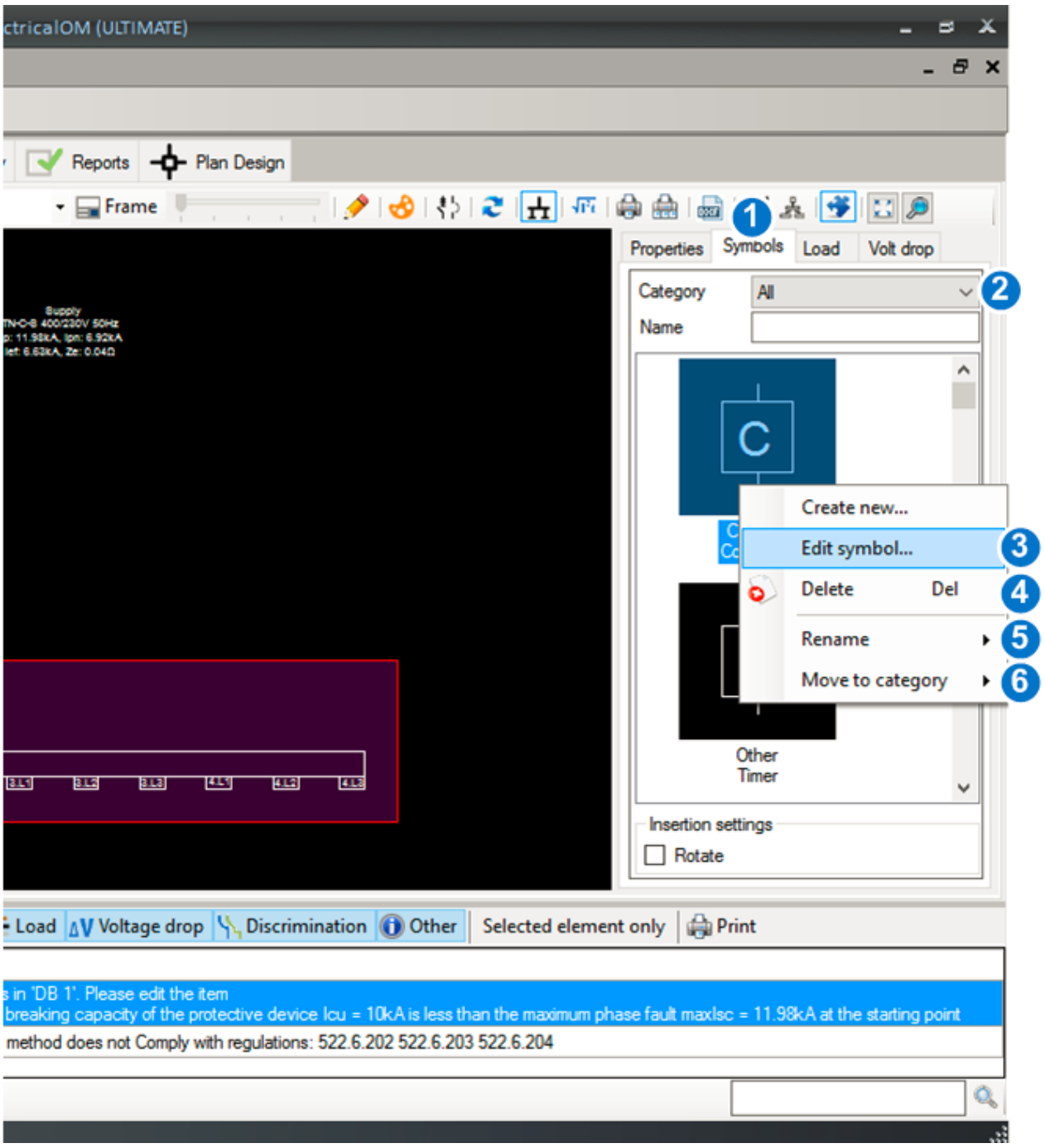



Using the symbol builder, you are able to create a symbol simply by drawing figures in the design area (2). The green cross indicates the insertion point of the symbol. The insertion point can be moved to a location of your choice.

From the general properties (3) you can set the default price (4) of the symbol, which is used in the Bill of Quantities Report. Each symbol can be placed in one of the categories (5), including Sources, Distribution Circuits, final circuits etc. A symbol name must be given (6) before saving (7).




To edit an existing symbol, select the symbols tab (1) at the right panel of the schematic module. You may filter the symbols appearing by selecting a category (2). To edit a symbol, right-click it and then choose **Edit symbol...**(3) to enter the symbol builder. You can also delete (4), rename (5) or move the symbol to another category (6).




## Example Design

The design process is typically followed as in the steps described below.

**Step 1 - Design the main structure of the installation:**

At the beginning of the design process we create the basic structure of the installation. This means setting up the distribution circuits, and final circuits downstream from them. When a circuit is added to the installation, the designer sets the type of the conductor, its installation method and its length. For final circuits, the user need specify the type of circuit, along with all of its load parameters. These parameters include the kind, number of points, watts per point or design current, power factor, third harmonic percentage and any diversity factor.

**Step 2 - Calculate the maximum demand (and apply load balancing for three phase installations)**

After completing step one, the designer is able to calculate the load demand of each distribution circuit and the maximum demand of the installation by applying diversity factors. Also if required the user can specify any spare load percentage to be considered. In case of a three phase installation, at this stage it is appropriate to make changes for load balancing starting from the downstream sub distribution circuits, and moving upstream to the Main Distribution Circuit. The designer can balance the load by moving, swapping or shifting circuits in the distribution circuit so the loads per phase are balanced.

**Step 3 - Set the protective devices and calculate the cable sizes**

Knowing the demand of each circuit and the maximum demand of the installation, the designer is able to set the appropriate protective devices and then calculate the required cable sizes, starting from the Main Distribution Circuit and moving downstream. Also at this point the designer can set correction factors for the ambient temperature, depth of lay, etc., that eventually will affect the cable size selection.

**Step 4 - Resolve warnings and discrimination problems**

At this point the user must resolve the critical warnings, and give attention to and resolve warnings related to the discrimination between the protective devices.

**Step 5 - Finalize design and print reports**

To finalize the design the user may set the frame size per page and draw details or notes.

## Example Details

In this tutorial we will design a three phase domestic installation. The installation consists of three distribution circuits, the Main Distribution Board and two sub distribution boards. The Main Distribution Board is located at the ground floor and feeds a sub distribution board to the basement and another to the floor level. The basic information required for the design are the Main Supply characteristics and the final circuits per distribution board. These are presented below:

**Main supply characteristics:**
**Type:** Three phase - Public supply
**Voltage:** 400V/230V, 50Hz
**Earthing system**: TN-C-S
**Source rating:** 500kVA with source impedance Z: 6%
**Supply cable up to the origin of the installation:**

- **Up to the building:** Al - Multicore XLPE 90oC armoured, length: 20m, cross sectional area: 16mm$^2$, installed underground
- **Up to the meter:** Al - Multicore XLPE 90oC armoured, length: 10m, cross sectional area: 16mm$^2$, installed on a surface

**Distribution circuits:**

| Name | Supplied from | Phase | Cable length (m) | Cable type and installation method |
|---|---|---|---|---|
| Main: MDB | Main supply | Three phase | 5 | Cu - Multicore XLPE 90oC armoured, in underground single way ducts |
| Basement DB- | MDB | Single | 10 | Cu - Single Core PVC 70oC non-armoured, in |

| | | | | |
|---|---|---|---|---|
| G | | phase | | conduit in a wall |
| Floor level DB-F | MDB | Single phase | 10 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |

**Main Distribution Board - MDB:**

| load kind | Installation points | Cable length (m) | Cable type and installation method |
|---|---|---|---|
| Cooker | 1 | 15 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Dish washer | 1 | 10 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Dryer | 1 | 10 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Fridge | 1 | 10 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Air conditioning 1 | 1 | 20 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Air conditioning 2 | 1 | 20 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Sockets ring | 25 | 45 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Lights 1 | 15 | 30 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Lights 2 | 15 | 25 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |

**Basement distribution board- DB-G:**

| load kind | Installation points | Cable length (m) | Cable type and installation method |
|---|---|---|---|
| Fridge | 1 | 10 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Air conditioning | 1 | 20 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Sockets ring | 15 | 30 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Lights 1 | 10 | 25 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |
| Lights 2 | 15 | 30 | Cu - Single Core PVC 70oC non-armoured, in conduit in a wall |

**Floor level distribution board- DB-F:**

| load kind | Installation points | Cable length (m) | Cable type and installation method |
|---|---|---|---|
| Air conditioning 1 | 1 | 15 | Single Core PVC 70oC non-armoured, in conduit in a wall |
| Air conditioning 2 | 1 | 15 | Single Core PVC 70oC non-armoured, in conduit in a wall |
| Sockets ring | 15 | 30 | Single Core PVC 70oC non-armoured, in conduit in a wall |
| Lights 1 | 10 | 25 | Single Core PVC 70oC non-armoured, in conduit in a wall |

## Step 1 - Design the Main Structure of the Installation

At the beginning of the design process we create the basic structure of the installation. This means setting up the distribution circuits, and final circuits downstream from them. When a circuit is added to the installation, the designer sets the type of the conductor, its installation method and its length. For final circuits, the user need specify the type of circuit, along with all of its load parameters. These parameters include the kind, number of points, watts per point or design current, power factor, third harmonic percentage and any diversity factor.

### Add and Edit the Main Supply

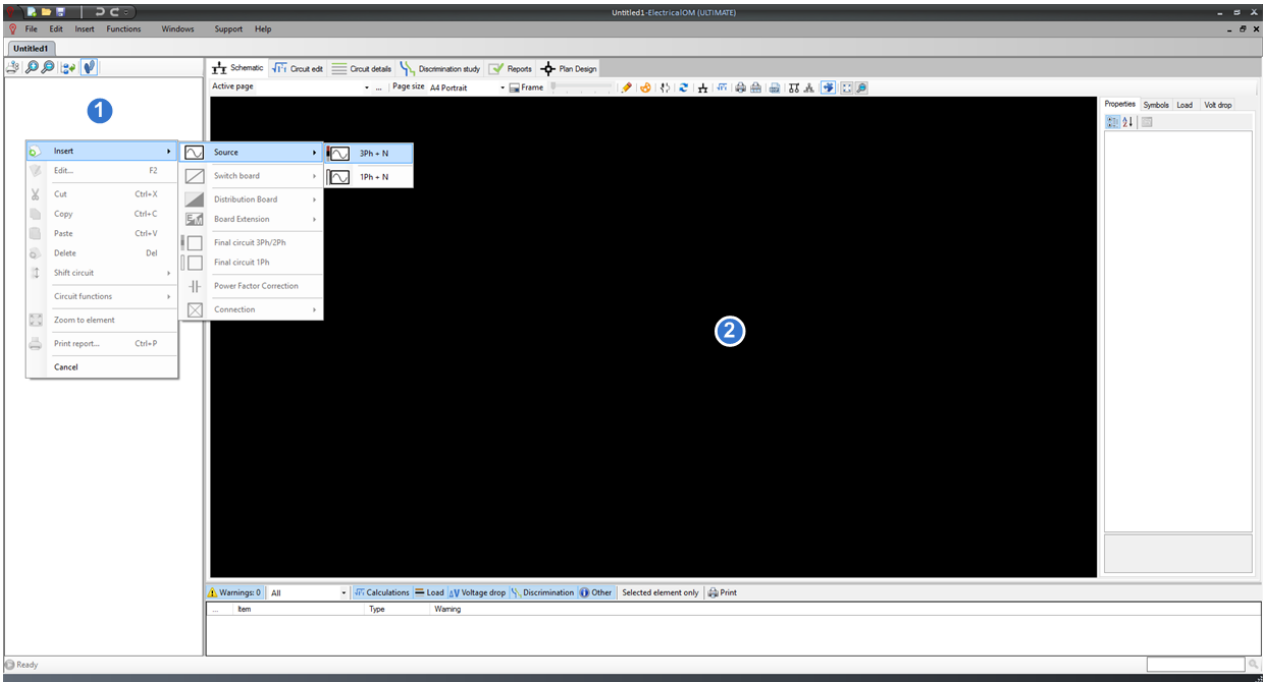
The project begins with the creation of the Main Supply

Add the Main Supply

Edit the Main Supply

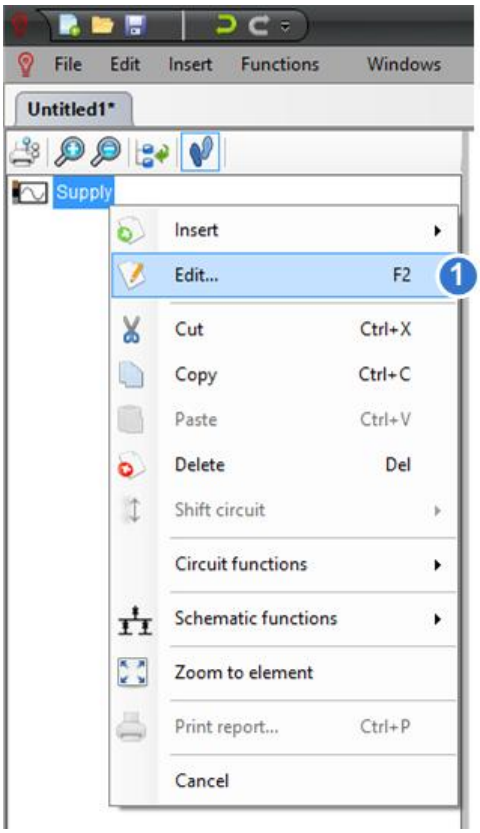
### Add the Main Supply

To add the Main Supply, right click on the tree network view (1) or on the schematic view (2). From the design menu select **Insert, Source, 3Ph+N** to insert a three phase power source.




## Edit the Main Supply

To edit the Main Supply, simply double click on it from the tree view, or select edit from the design menu, brought up by right clicking on the supply node, as shown below:

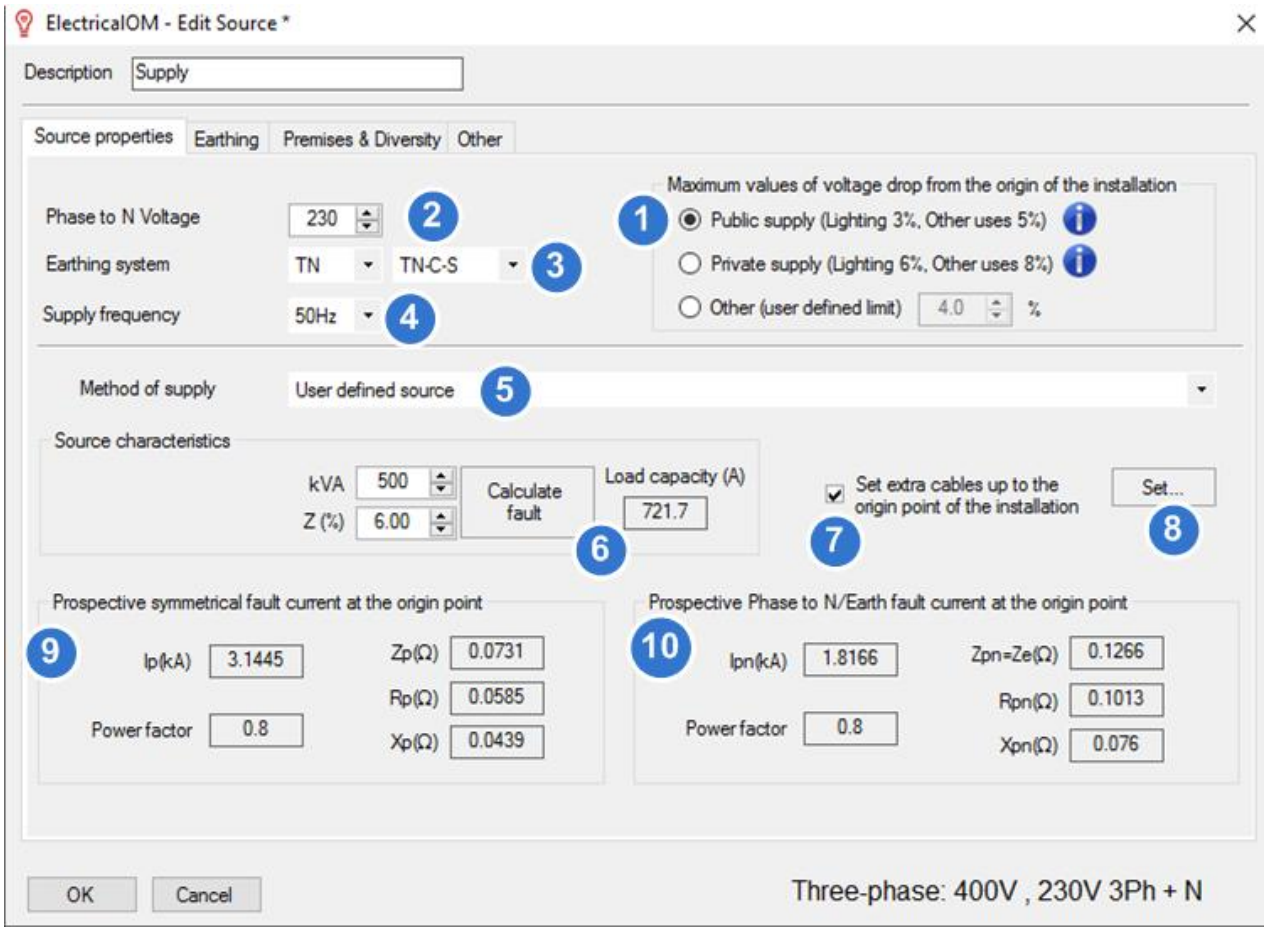



With the supply editor the user can set all of the properties of the installation up to the origin. These include the phase voltage, the earthing system and earthing arrangements, the supply frequency, the supplier's transformer rating, prospective fault current and external impedances, voltage drop settings, premises settings and touch voltage limit and other information specific to the supplier.

In our example we will set the values as shown below. Press **OK** to accept the changes.

**Type:** Public supply (1)
**Voltage:** 400V/230V (2) , 50Hz (4)
**Earthing system**: TN-C-S (3)
**Source rating:** 500kVA with source impedance Z: 6% (6)
**Supply cable up to the origin of the installation:** (7) and press "Set..." (8) to set the extra cable values.

- **Up to the building:** Al - Multicore XLPE 90oC armoured, length: 20m, cross sectional area: 16mm$^2$, installed underground
- **Up to the meter:** Al - Multicore XLPE 90oC armoured, length: 10m, cross sectional area: 16mm$^2$, installed on a surface




The resulted prospective symmetrical fault current at the origin is presented in 9 and prospective phase to N/Earth fault in 10. These values can be manually set if the user chooses not to set the extra cable up to the origin point of the installation (7)

## Add the Main and Sub Distribution Boards

After adding the main supply we will add the main and sub distribution boards of the installation.

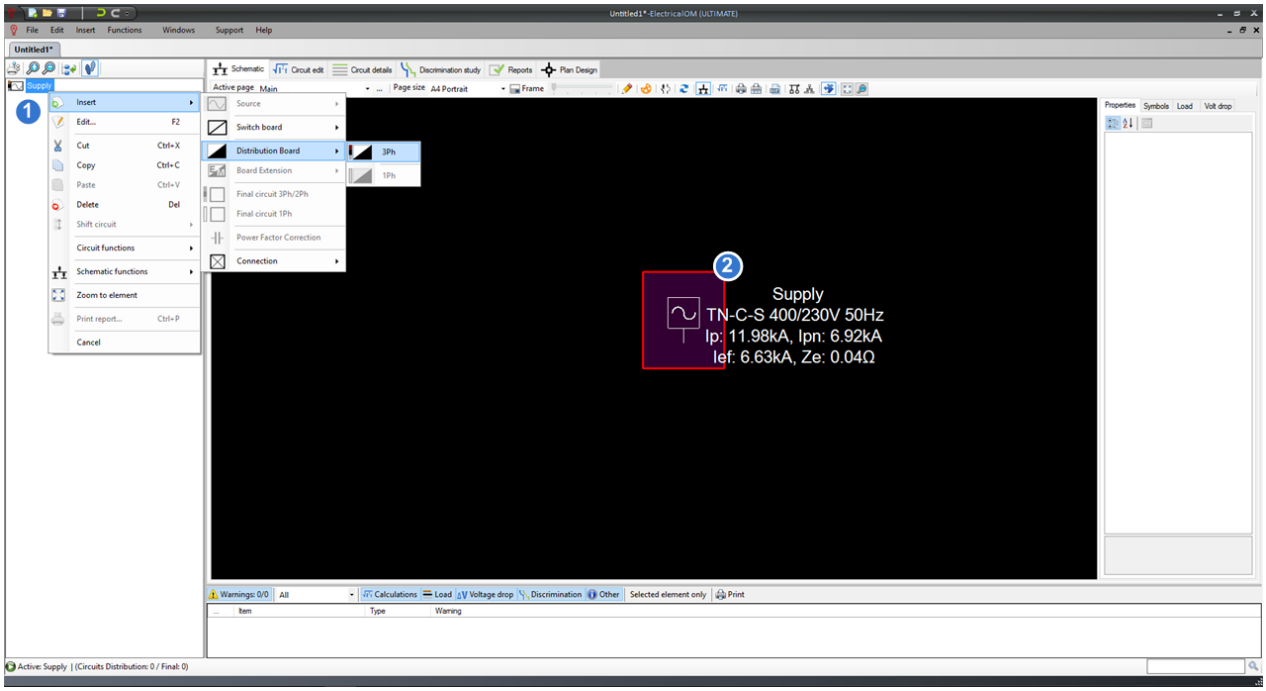
Add the Main Distribution Board

Add Sub Distribution Boards

## Add the Main Distribution Board

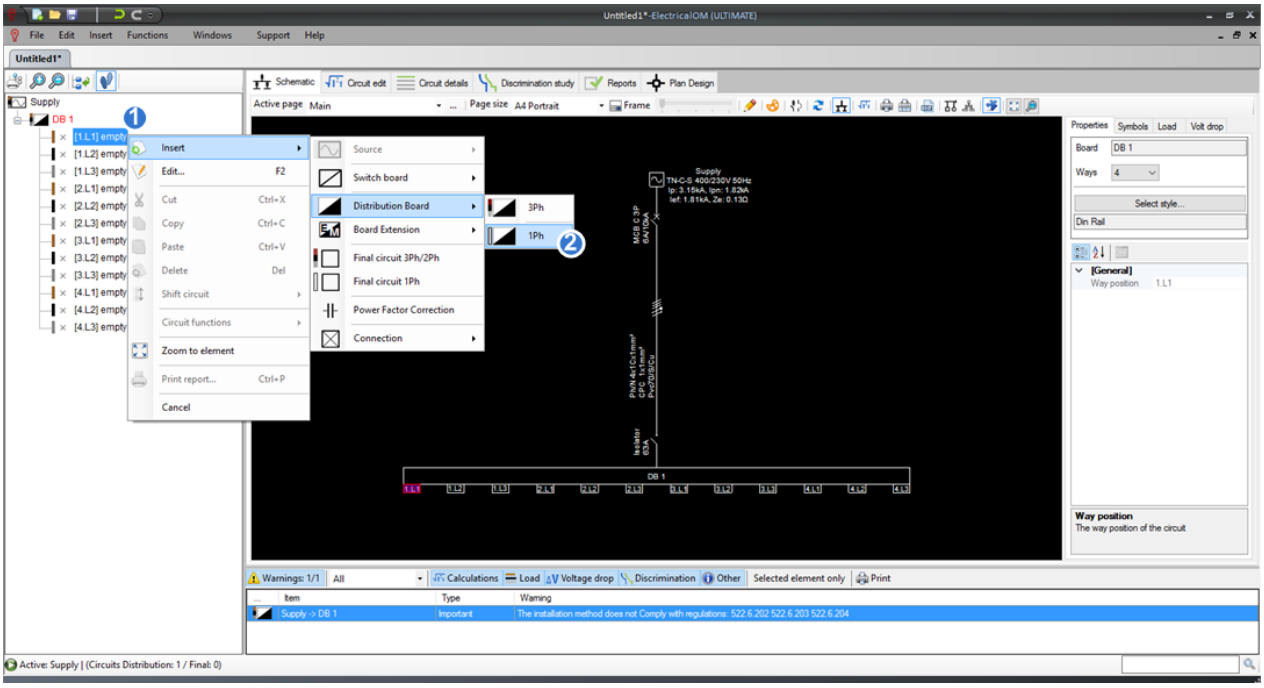
To add the Main Distribution Board, left click on the Main Supply element (1) from the tree network view or the schematic view (2) and right click to show the design menu. From the design menu select **Insert,**

**Distribution Board, 3Ph** to insert a three phase Main Distribution Board.

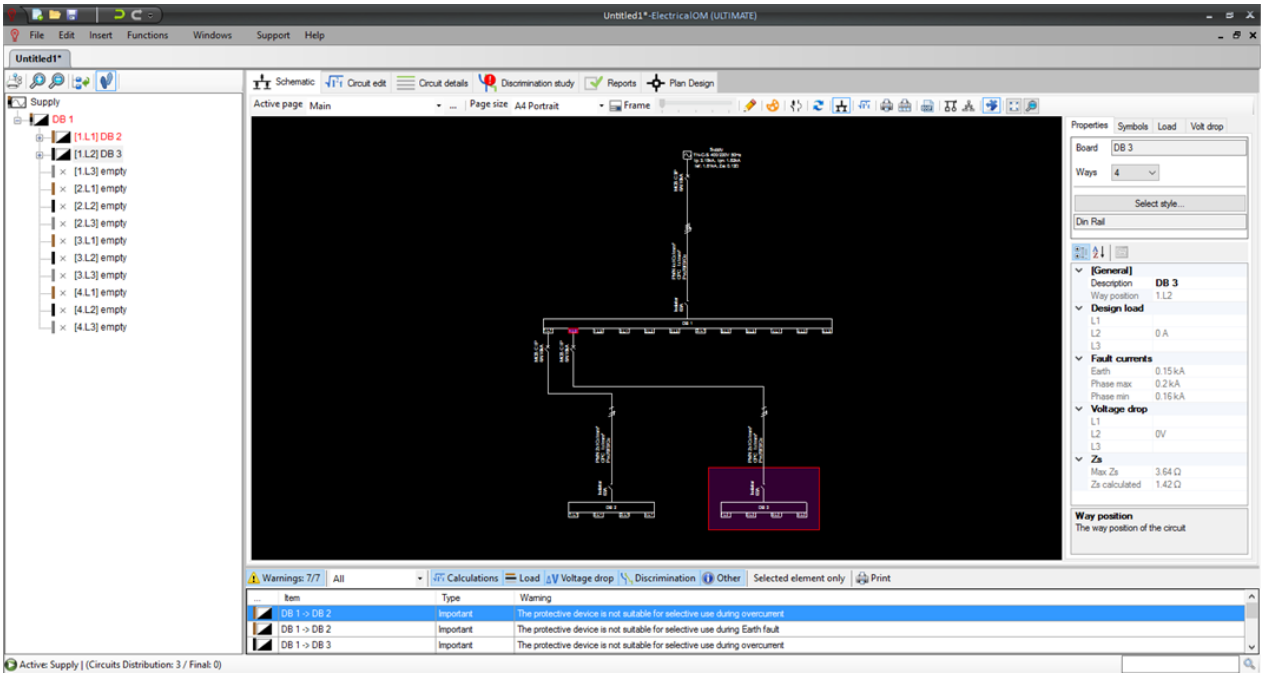



## Add Sub Distribution Boards

To add the first sub distribution board select the tree node labeled **[1.L1] empty** (1) with a left click and with a right click select **Insert, Distribution Board, 1Ph** (2).

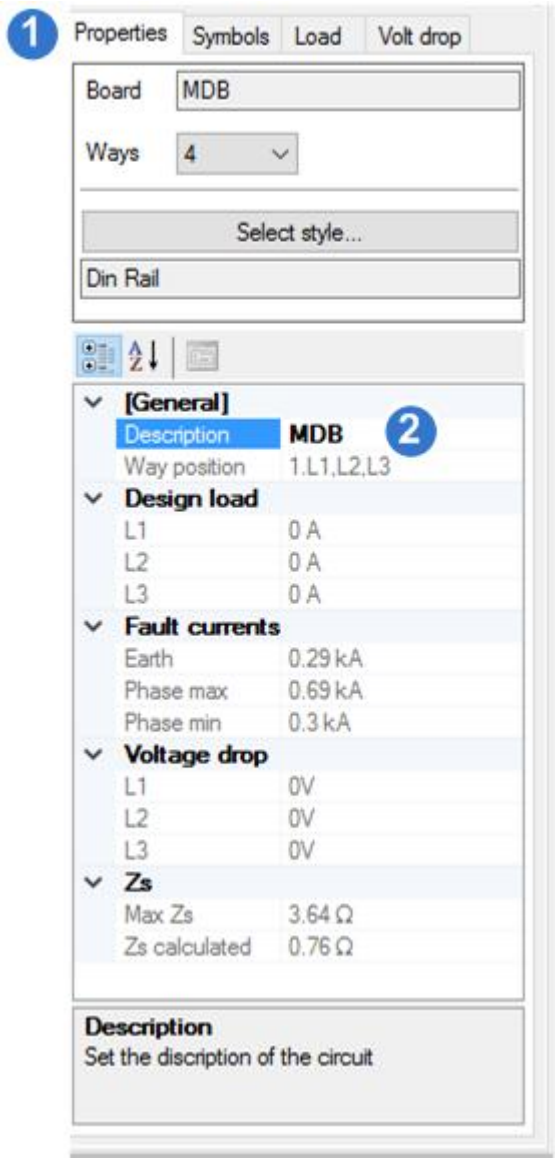


Repeat to add the second sub distribution board from 1.L2.

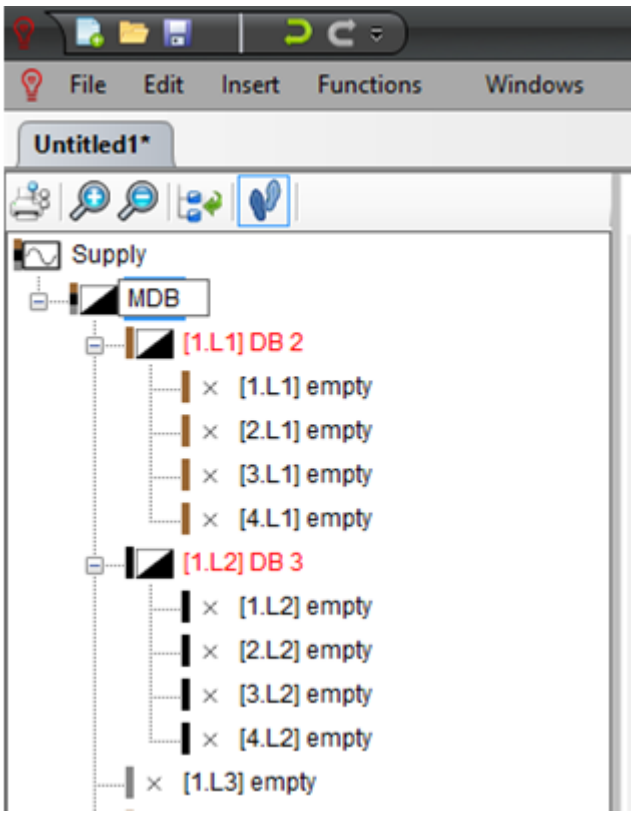



## Set the Circuit Description

You can set the description of the selected circuit from the properties tab (1), at the description field (2).




Alternatively you can set the description of the selected circuit from the tree network view by left clicking the circuit once, so that the selected node's text becomes editable. After editing the label press enter to apply the new description.

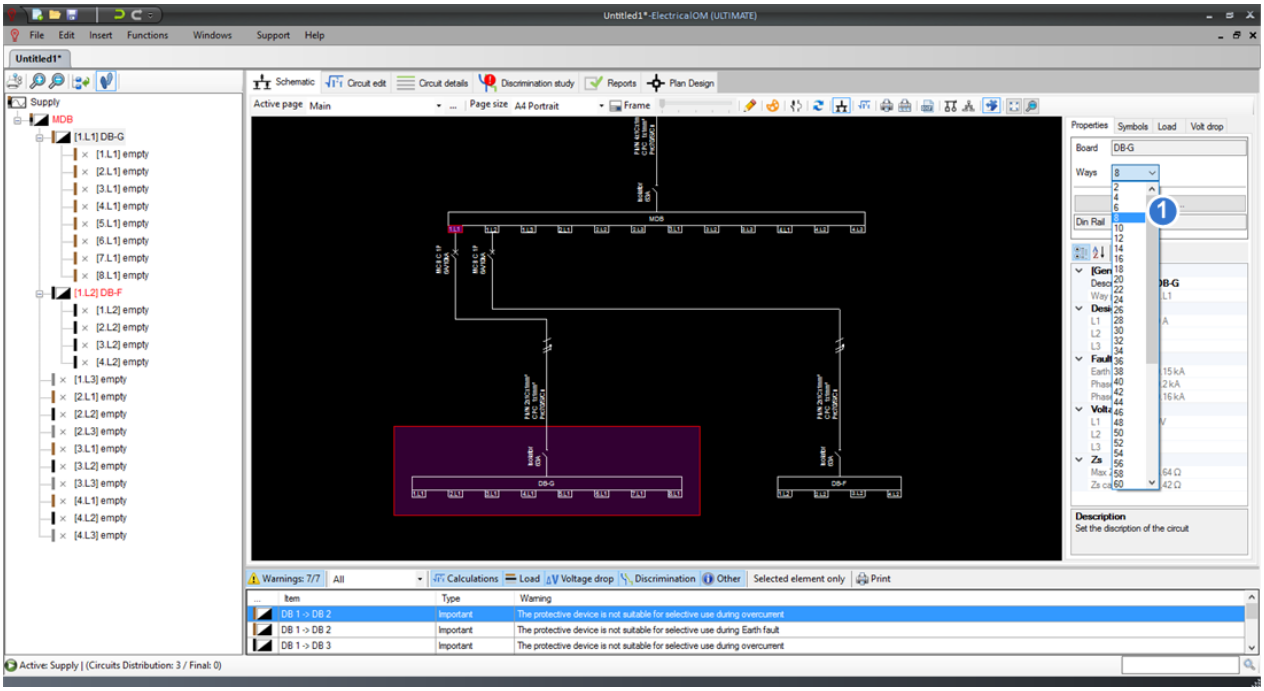



## Set the Board Ways and Style

**Board ways:**

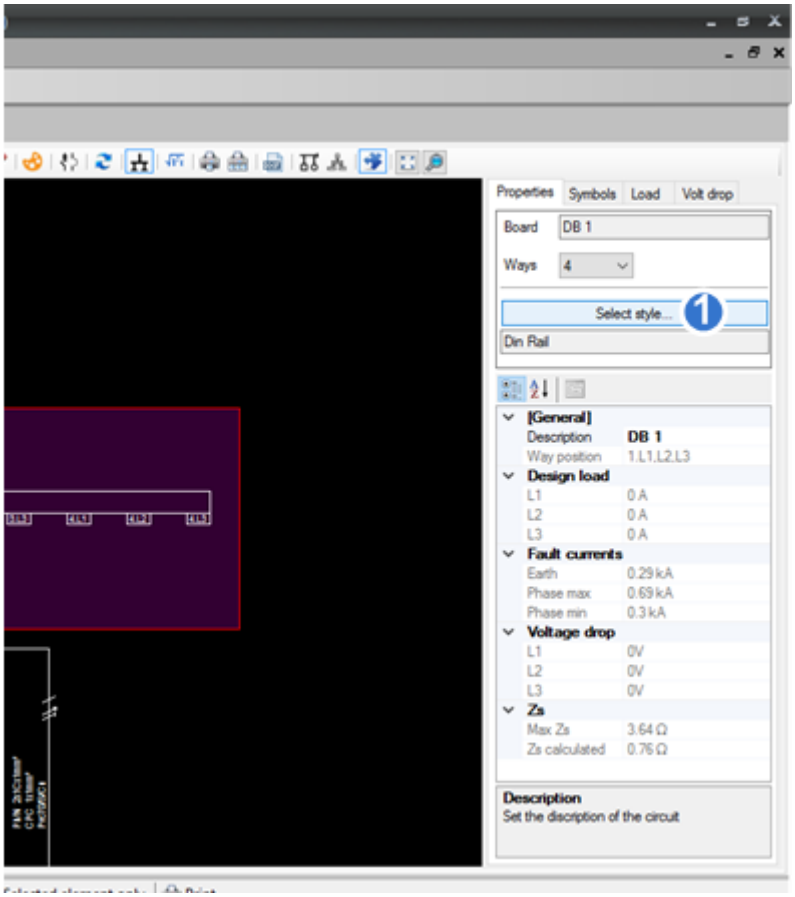
Initially the three-phase distribution boards have four ways, accommodating a total of 12 single phase circuits, and the single-phase distribution boards four single phase ways, accommodating a total of 4 single phase circuits. To increase the number of ways, select a distribution board from the tree network view or from the schematic, and from the properties tab, set the number of ways from the drop down menu (1).

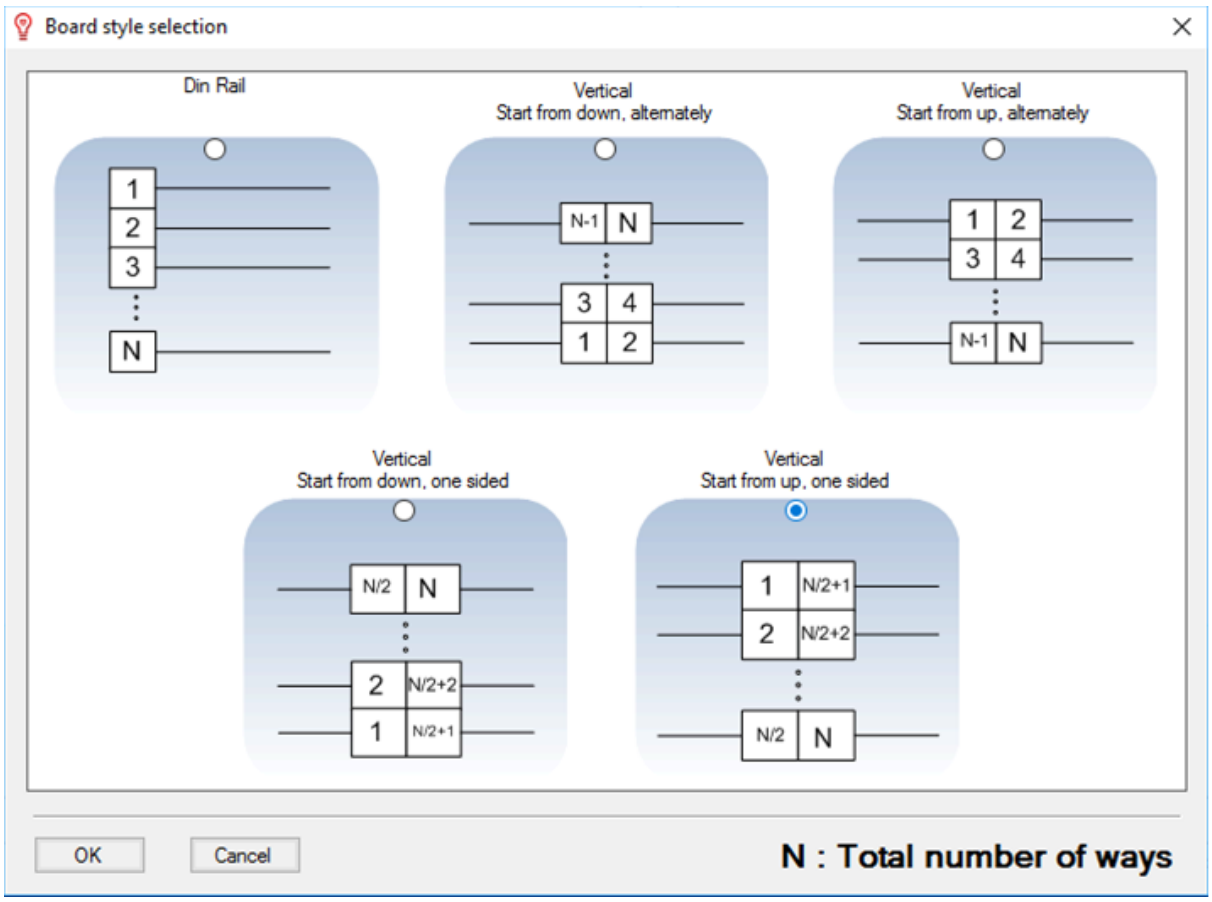
In this tutorial we need to modify the ways of the sub distribution board DB-G, and increase them from 4 to 8 as shown below:



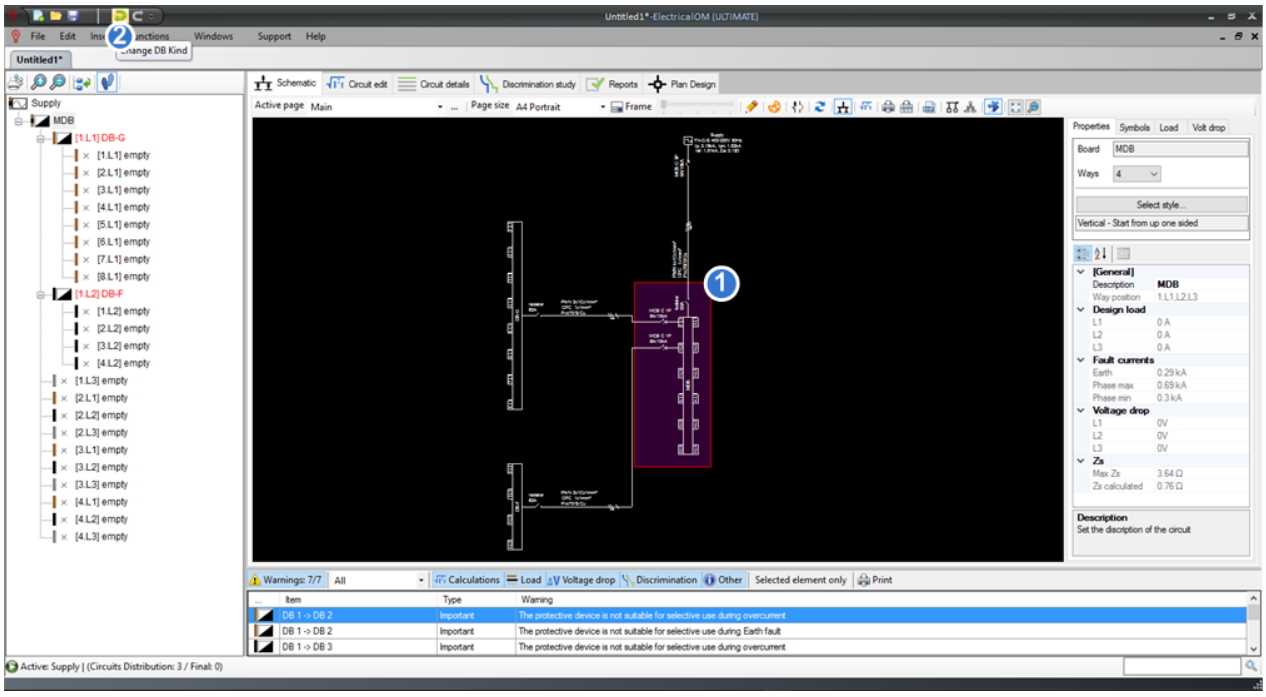
**Board style:**

Initially the style of the distribution board is Din Rail. To change the board's style select a distribution board element from the tree network view or from the schematic, and from the properties tab, click the button labeled **Select style...** (1). A pop-up window will appear, from which the style of the distribution board can be selected.






After selecting the style, the schematic will refresh to show the new distribution board, seen below (1). In this tutorial we will use a Din Rail style, so we undo the change by clicking the undo button (2).



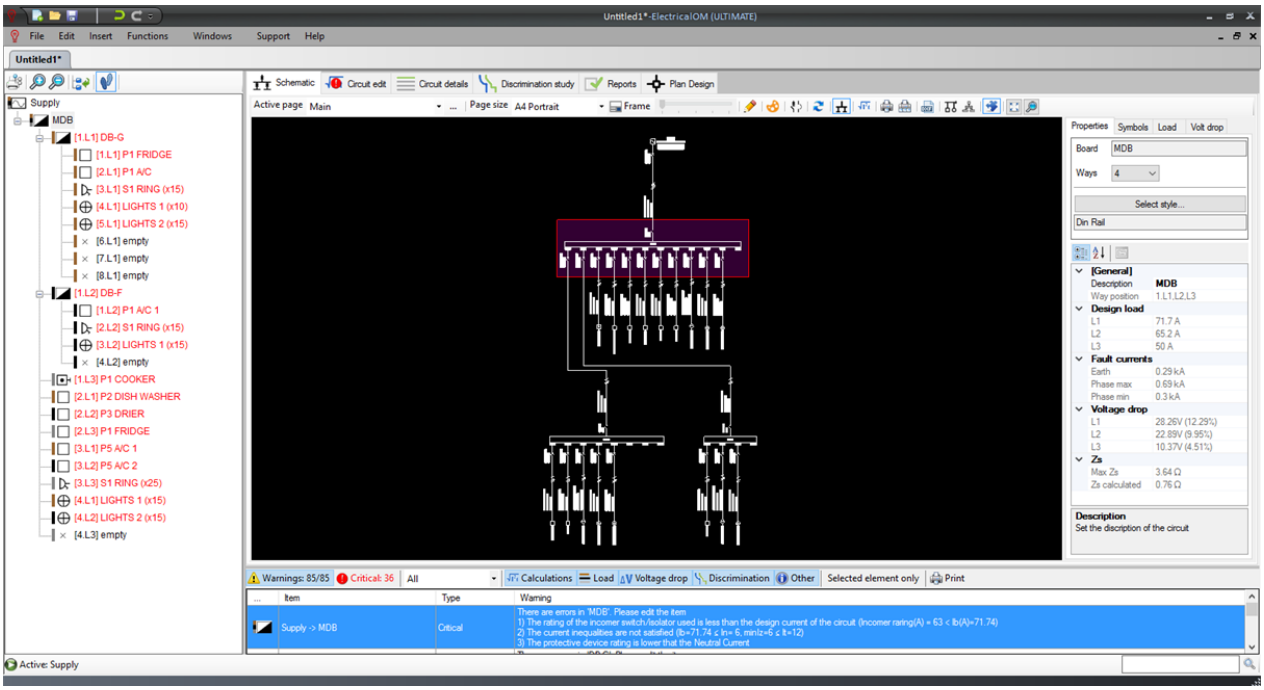
## Add Final Circuits

We will start by adding the final circuits to the Main Distribution Board and then continue with the final

circuits from the sub distribution boards.

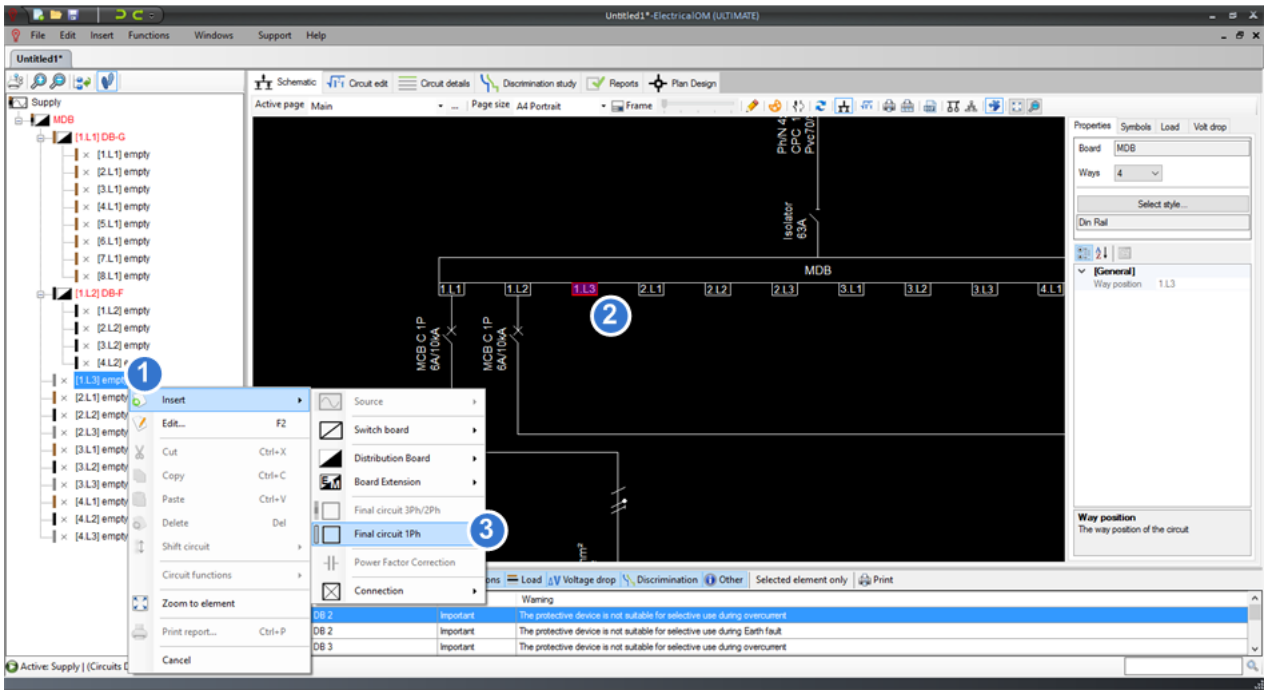
[Add a Final Circuit](#)

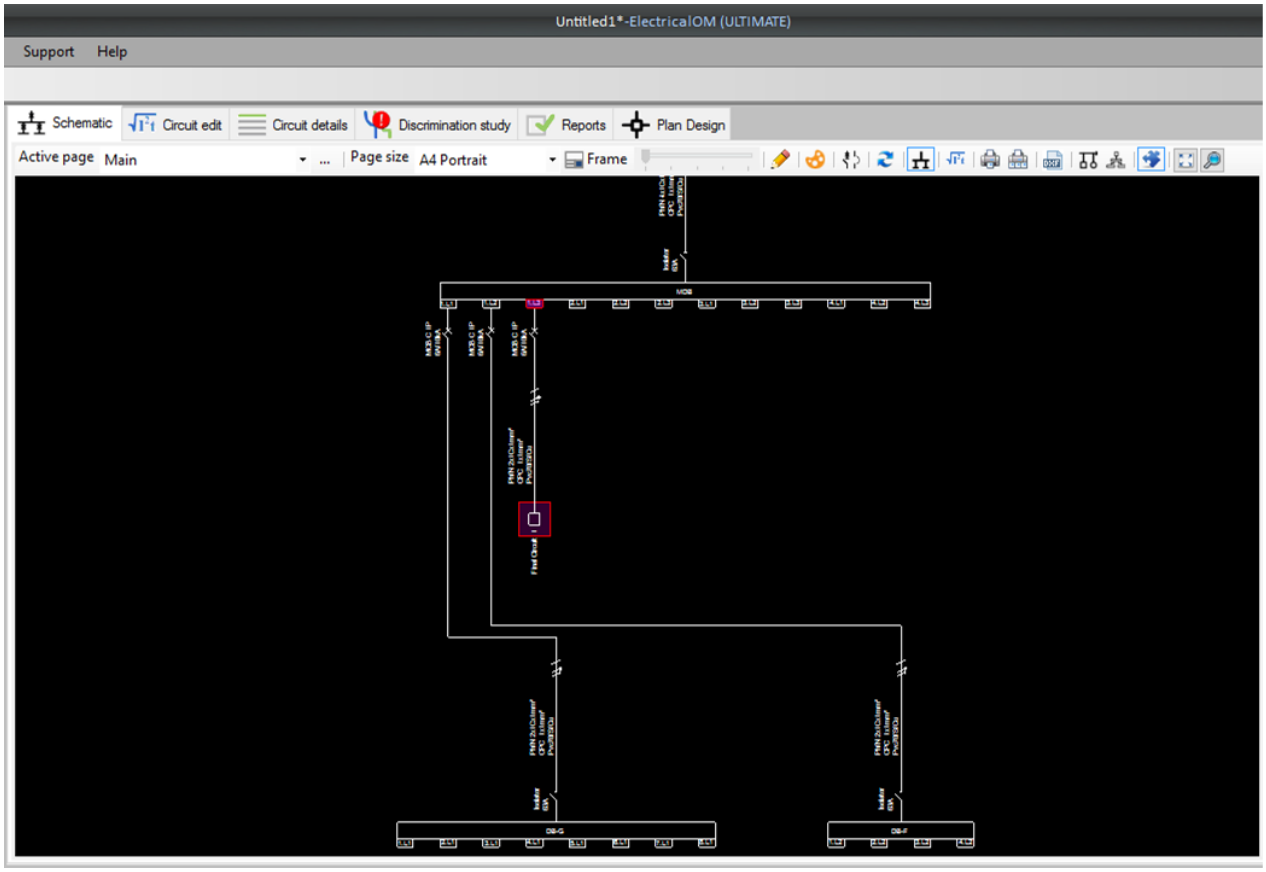
[Edit the Final Circuit's Basic Information](#)



## Add a Final Circuit

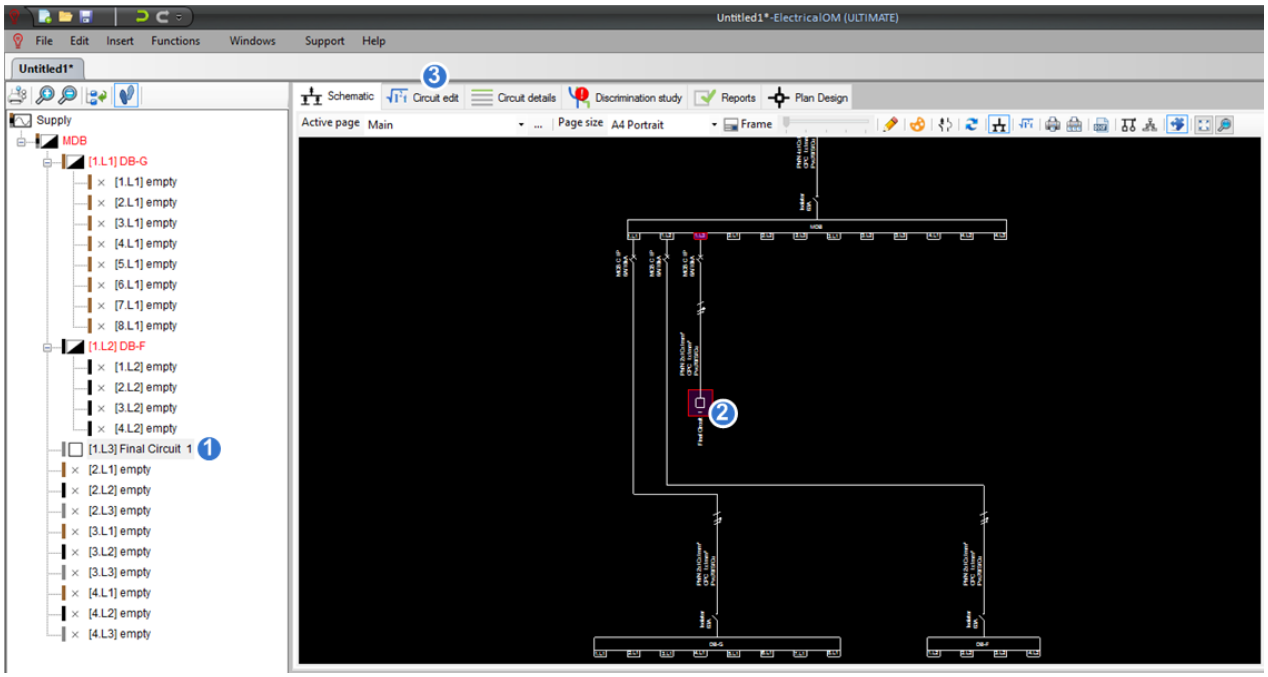
To add a final circuit at the position 1.L3, select the empty way in the tree network view (1) or at the schematic diagram (2) with a left click and then right click to show the design menu. From the design menu select **Insert, Final circuit 1Ph (3)**.






## Edit the Final Circuit's Basic Information

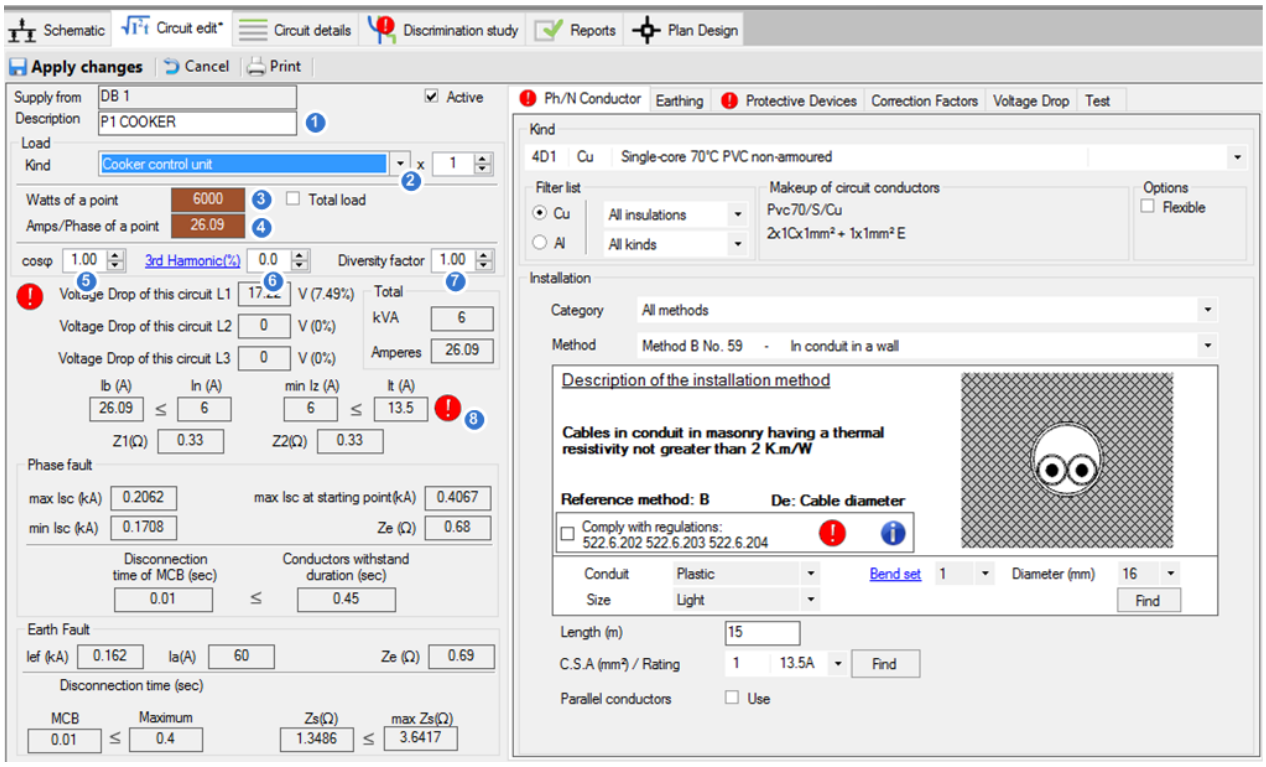
To edit the final circuit, select it from the tree network view (1) or from the schematic (2) with a left click on the symbol, and select the circuit edit tab (3).



## *Set the Description, the Kind and the Load Details*

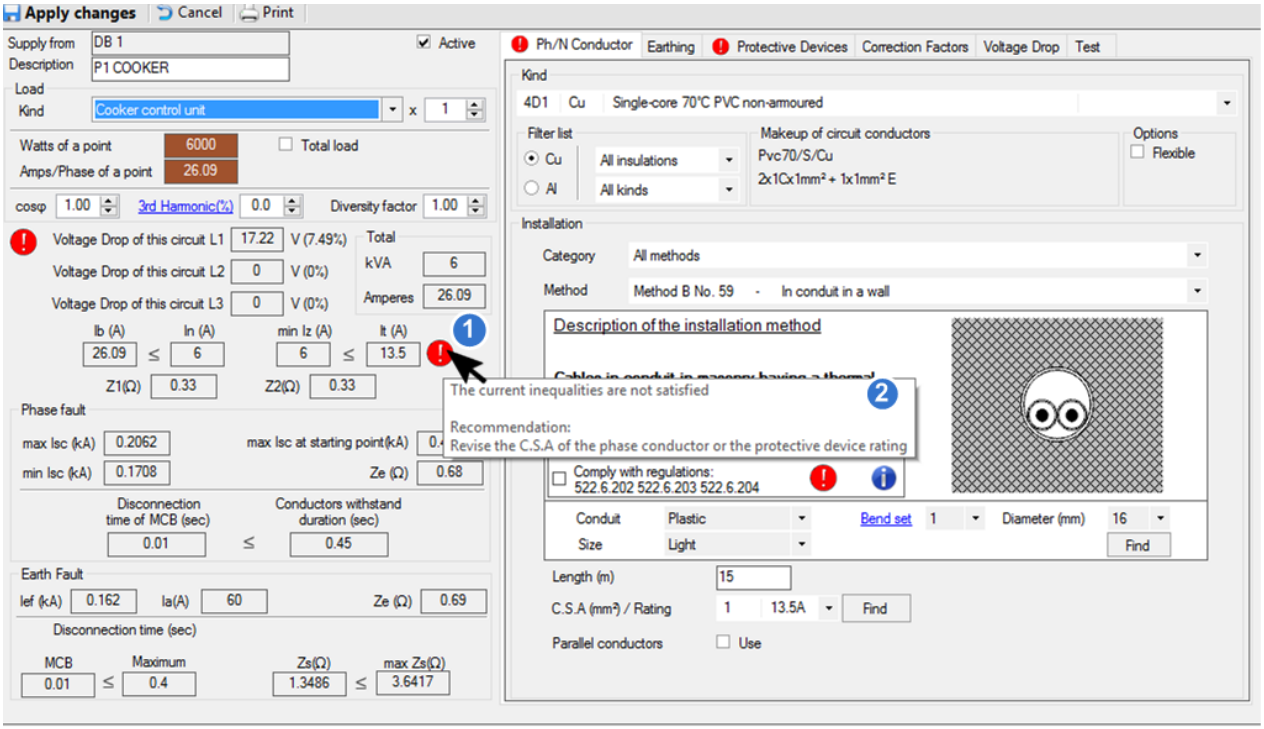
Here we are going to modify some of the parameters of a circuit from the circuit editor. To change the description of the circuit, we type the desired description into the text box labeled **Description** (1). We would like that the circuit be a cooker control unit, so we select the appropriate kind from the kind drop down menu (2). Default values for the load are automatically set according to the selected kind. To change this value, set the watts value (3) or the amperes value (4) in the corresponding field. For more detailed modeling, you can also specify the power factor (5), the third harmonic percentage (6) and the diversity factor (7). For this tutorial we will leave the default values unaffected.

Please note that the software performs calculations immediately, producing an error indication next to the offending parameter (8).



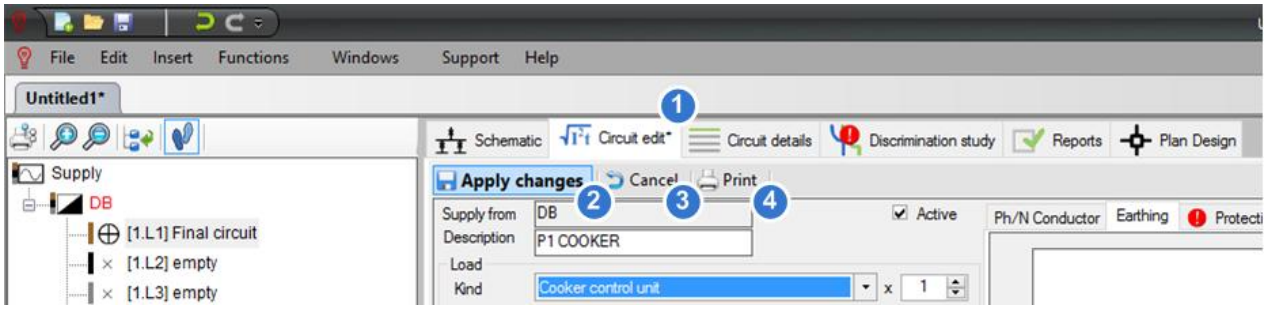
## *Display Calculation Errors and Recommendations*

Calculations are made immediately following a change to the circuit editor, producing a graphical indication of an error next to the offending parameter. The error icons (1) in the circuit editor have a tool-tip that will present details about the corresponding error and a recommendation how to fix it (2). To display the tool-tip text the user need hover the mouse cursor over the error icon as shown below. At this stage we will not try to fix any of the errors. The errors will be fixed at a later stage after we have finished configuring the distribution circuits.



### *Apply Changes*

To apply the changes and save the circuit press the **Apply changes** button (2). To cancel the changes press the **Cancel** button (3). To print the Calculations Report for this circuit press the **Print** button (4). If the tab belonging to the circuit editor (1) is marked with an asterisk, as in the screen shot below, it is an indication that the circuit has changes that have not been applied.




## Circuits Rearrangment

In order to streamline design of a network, the user might find it helpful to copy and paste circuits and/or use other functions:

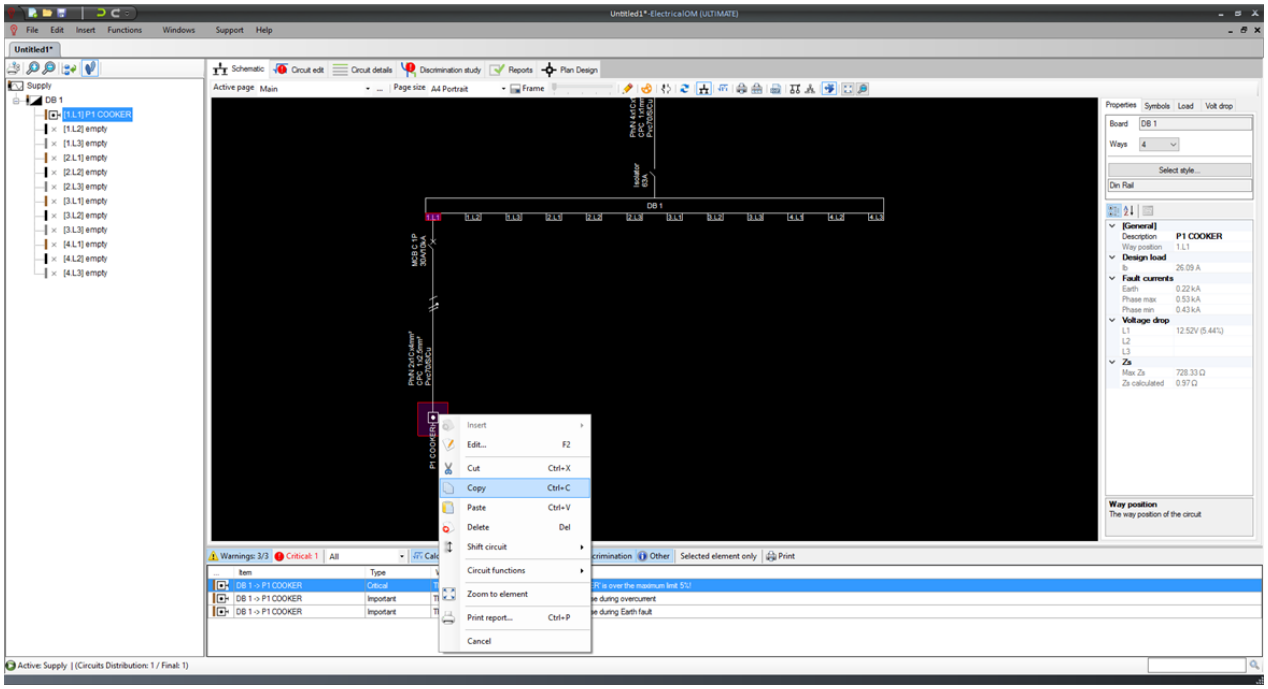
Copy / Paste

Drag / Drop

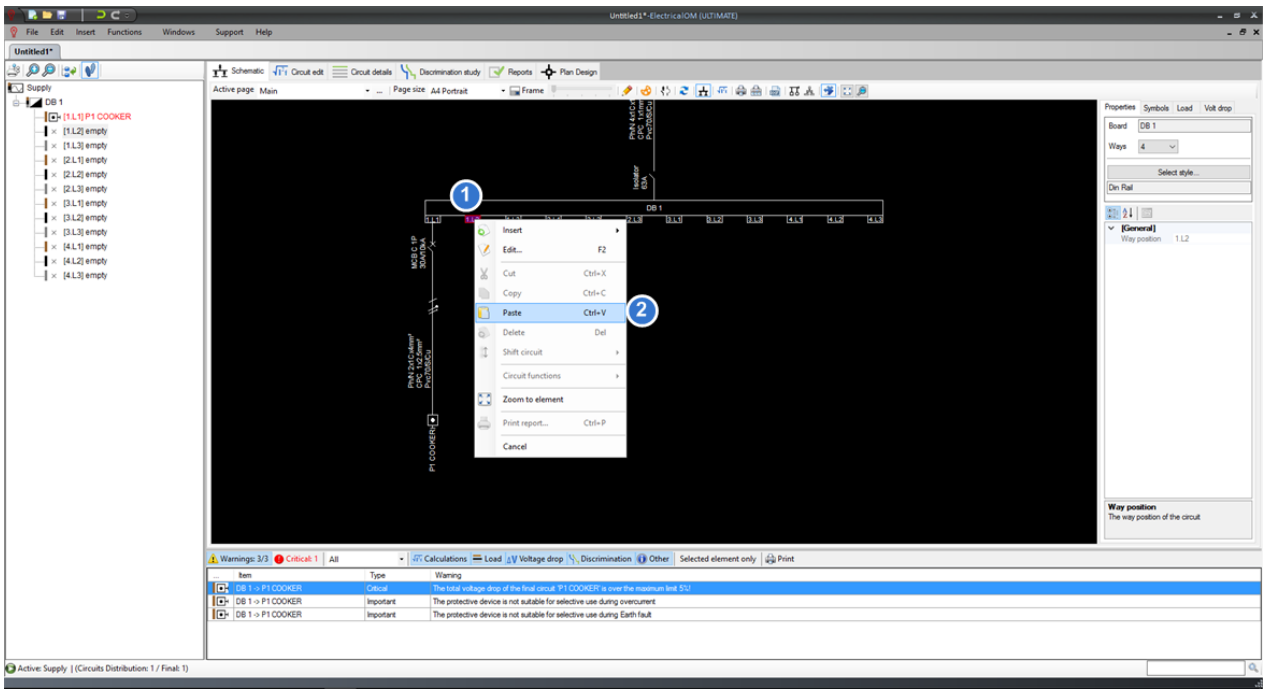
Shifting Circuits

## Copy / Paste

Bellow we will copy the cooker circuit and paste it to 1.L2. To copy the circuit, select it from the tree network view or from the schematic diagram with a left click. Then with a right click on the selected circuit select **Copy**.

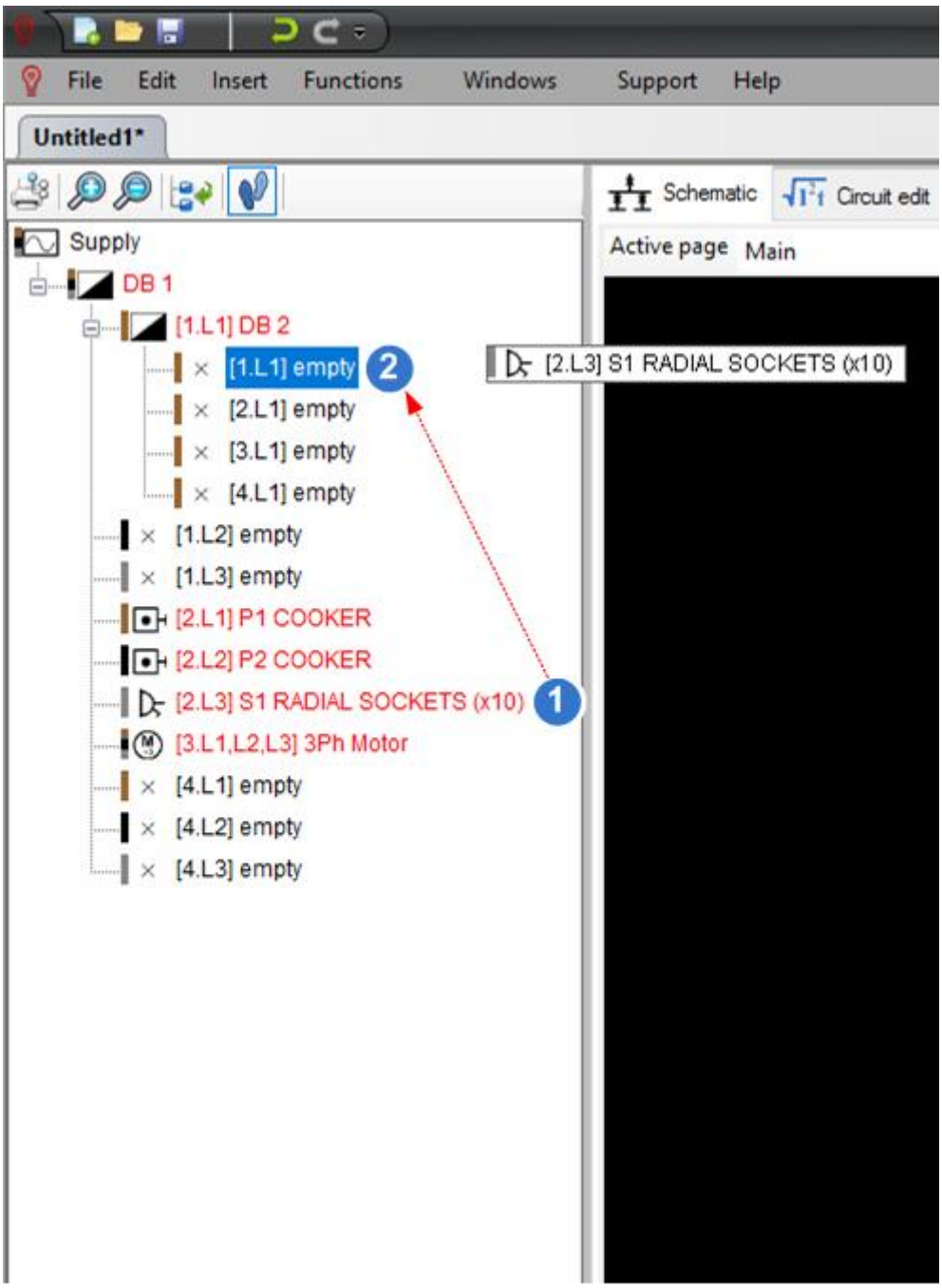



To paste the copied circuit, right click on empty way 1.L2 (1) and select **Paste** (2).



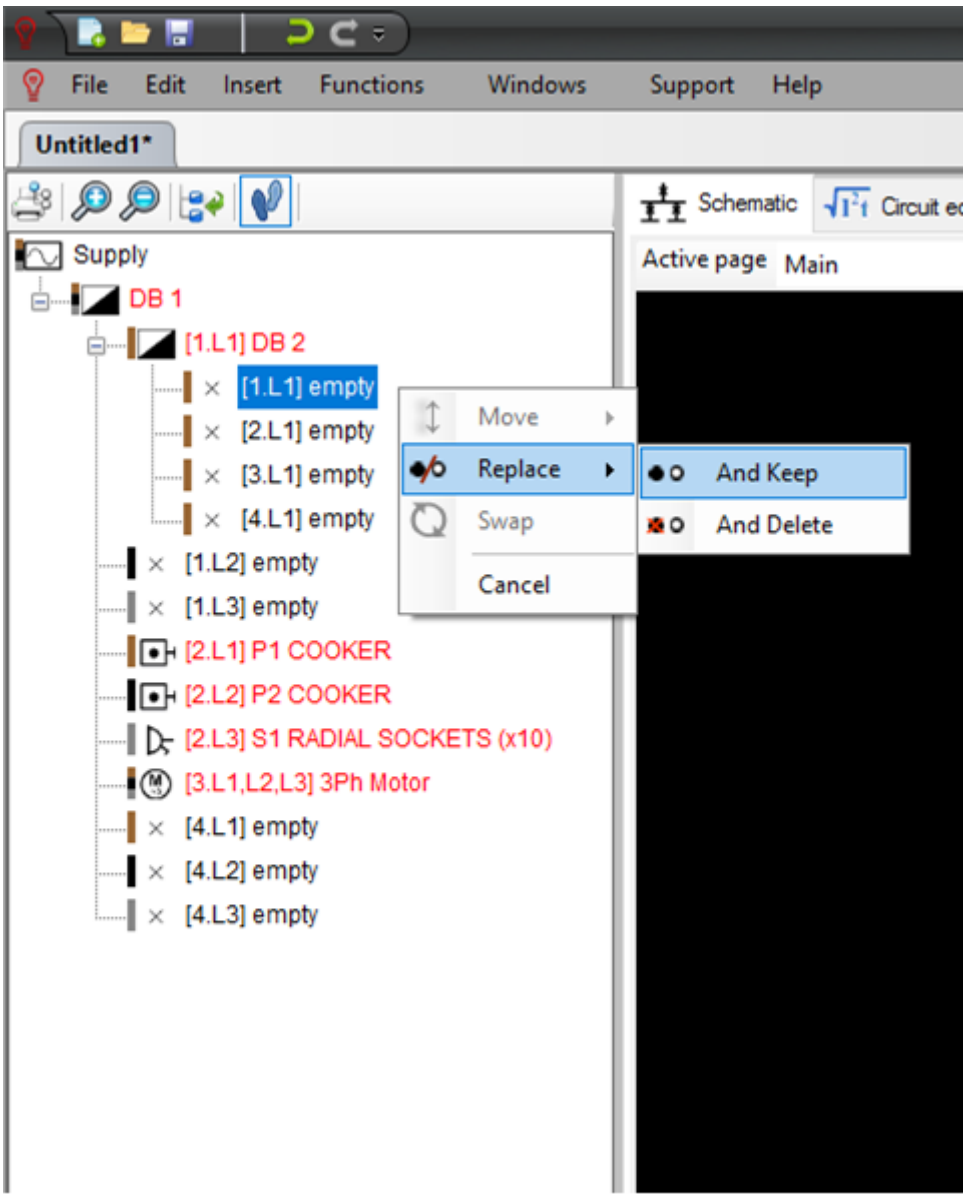

## Drag / Drop

You can drag and drop circuits in order to move or copy them to another position anywhere in the active network tree. To do this, press down with the left mouse button on the element node (1) and keep the left mouse button pressed. Then move the mouse to desired position (2). Release the left mouse button to drop the circuit.



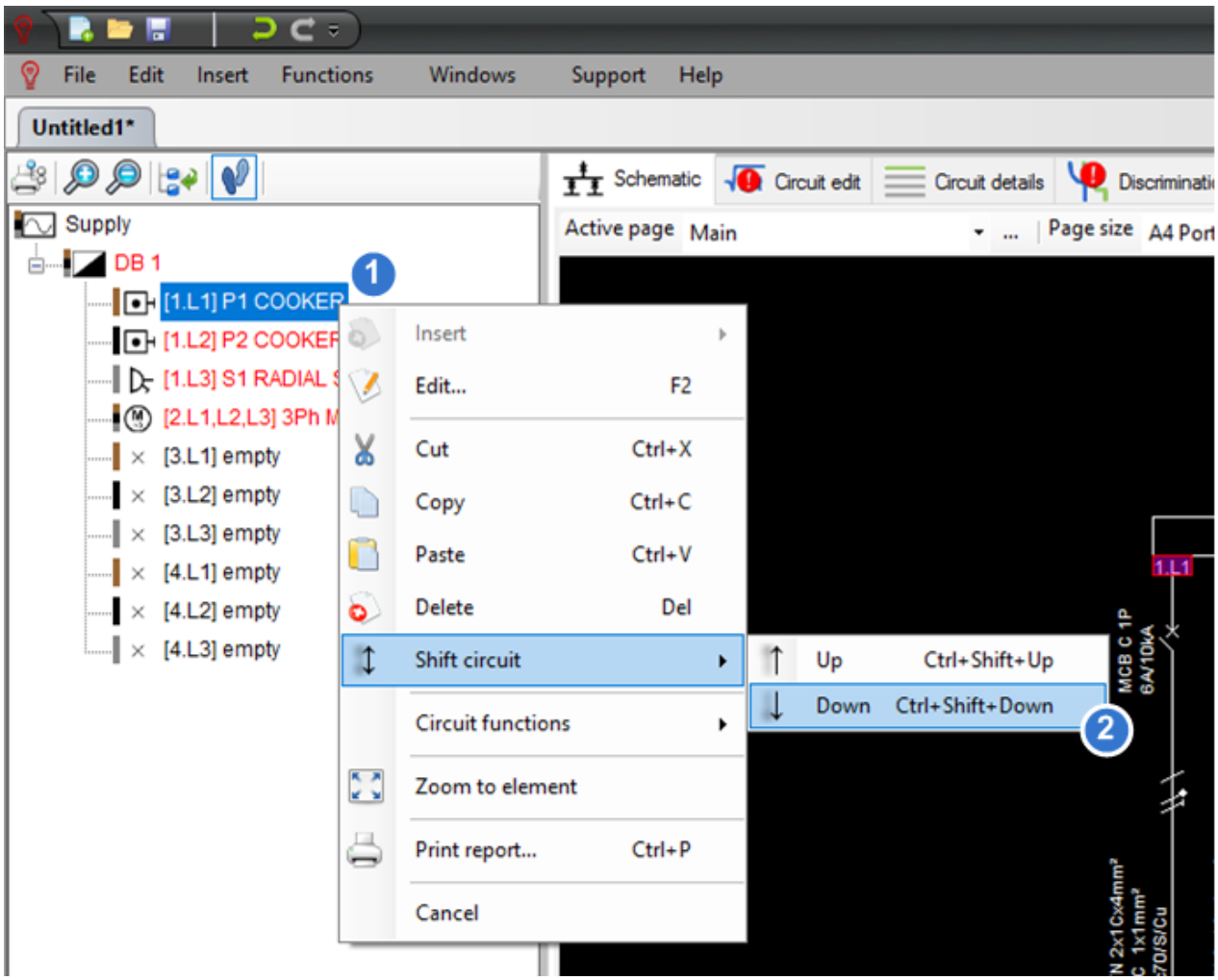

---

After dropping the circuit select **Replace, And Keep** to copy the circuit to the sub distribution board.




## Shifting Circuits

To shift circuits, select the circuit **P1 COOKER** (1) with a left click and then right click to show the design menu. From the design menu select **Shift circuit, Down** (2). Alternatively you can use the shortcut keys **Ctrl+Shift+Down**.




## Step 2 - Calculate the Maximum Demand and Apply Load Balancing

After completing step one, the designer is able to calculate the load demand of each distribution circuit and the maximum demand of the installation by applying diversity factors. Also if required the user can specify any spare load percentage to be considered. In case of a three phase installation, at this stage it is appropriate to make changes for load balancing starting from the downstream sub distribution circuits, and moving upstream to the Main Distribution Circuit. The designer can balance the load by moving, swapping or shifting circuits in the distribution circuit so the loads per phase are balanced.

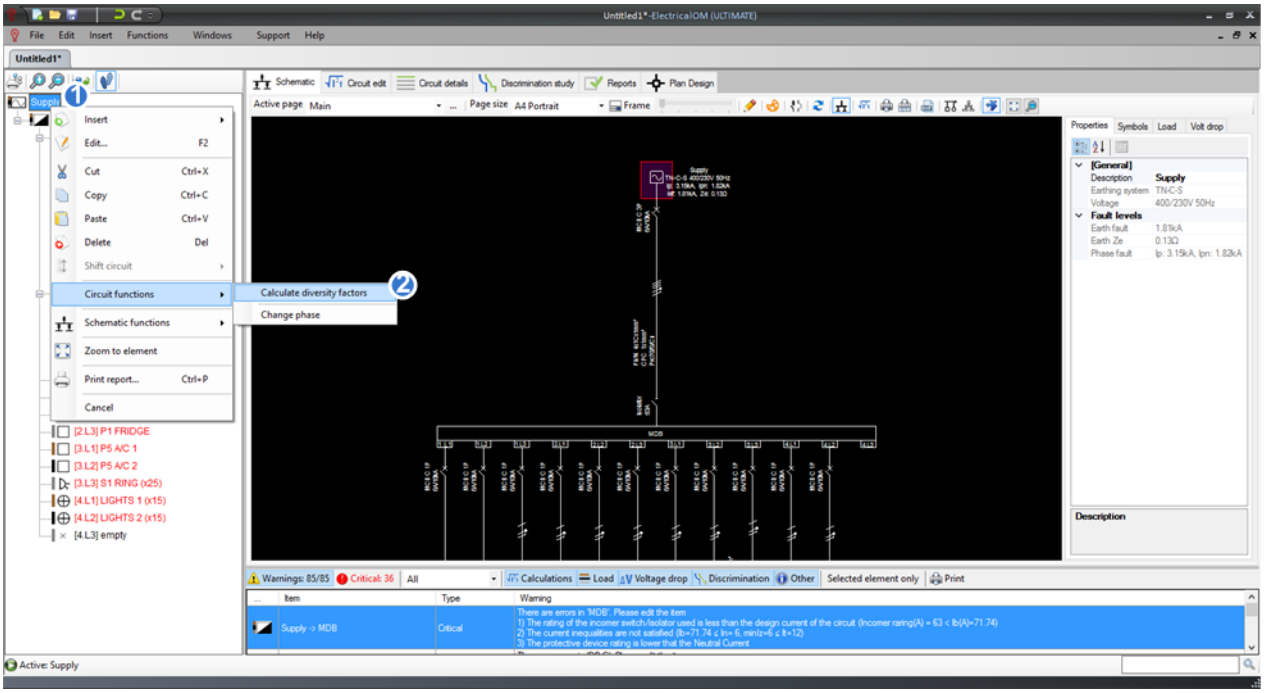
Apply Diversity Factors

Maximum Demand

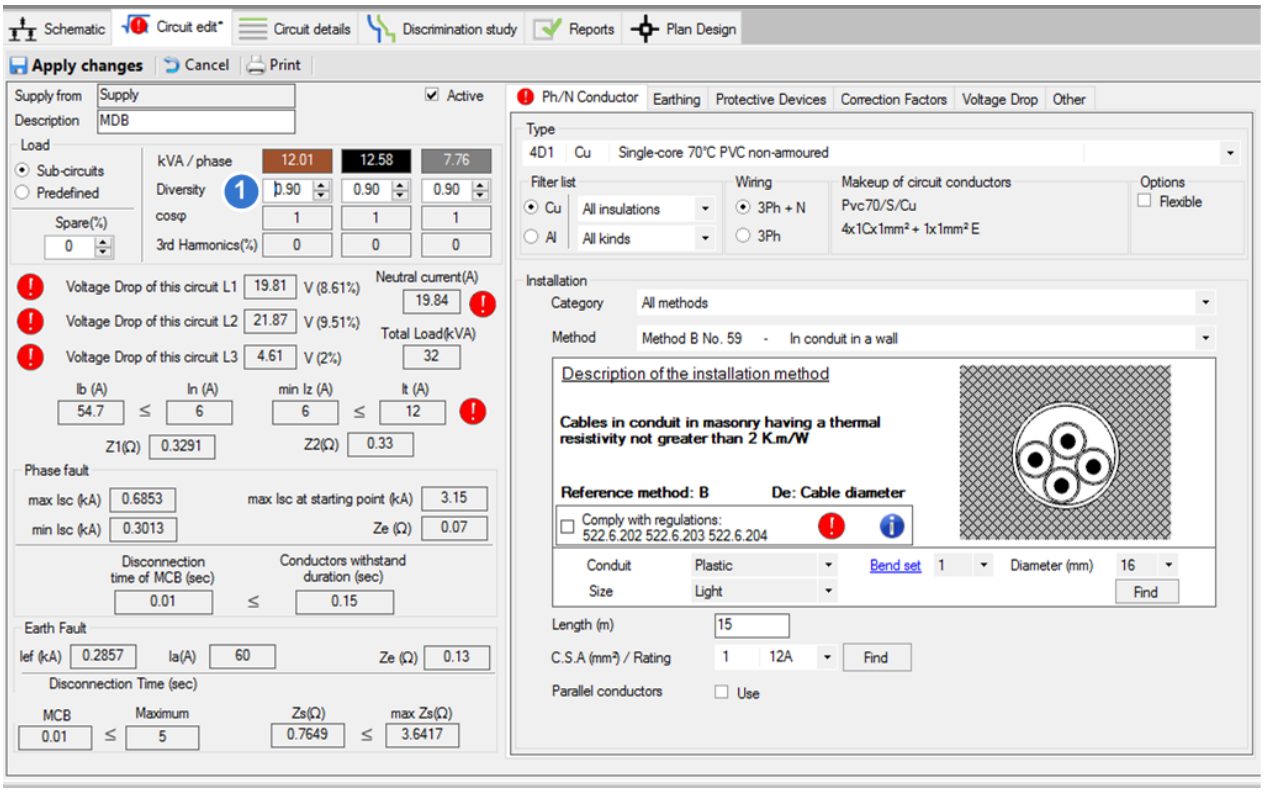
Load Balancing

### Apply Diversity Factors

At this point we have completed the first step of the work flow. The next step is to calculate the maximum demand and apply load balancing. To do this we will first apply the default diversity factors for each distribution circuit. This can be done from **Circuit functions** after right clicking on the Main Supply as shown below. This will calculate the diversity factors for all final circuits.

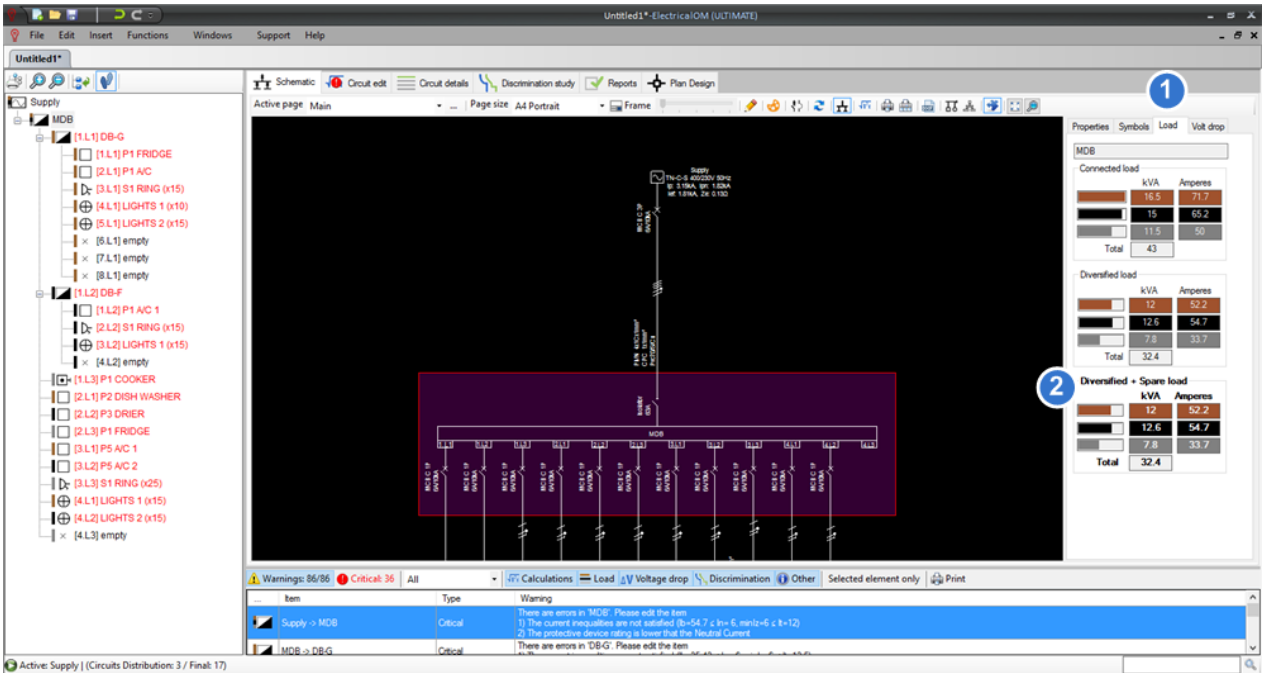



We can also apply extra diversity per distribution circuit and set spare load from the circuit editor. For this tutorial we will apply an extra diversity factor of 0.9 (1) only for the Main Distribution Circuit as shown below:



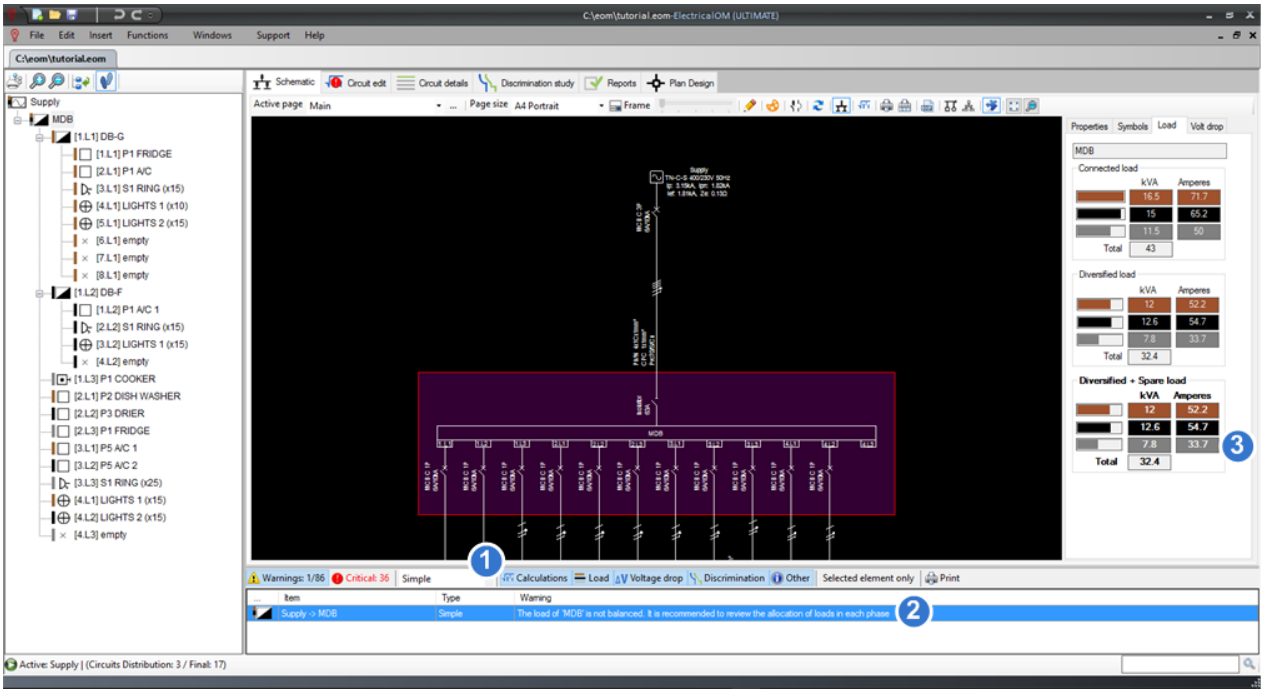

## Maximum Demand

From the loads tab (1), the loads summations results are displayed. The diversified plus spare load (2) of the Main Distribution Circuit, represents the maximum demand of the installation.

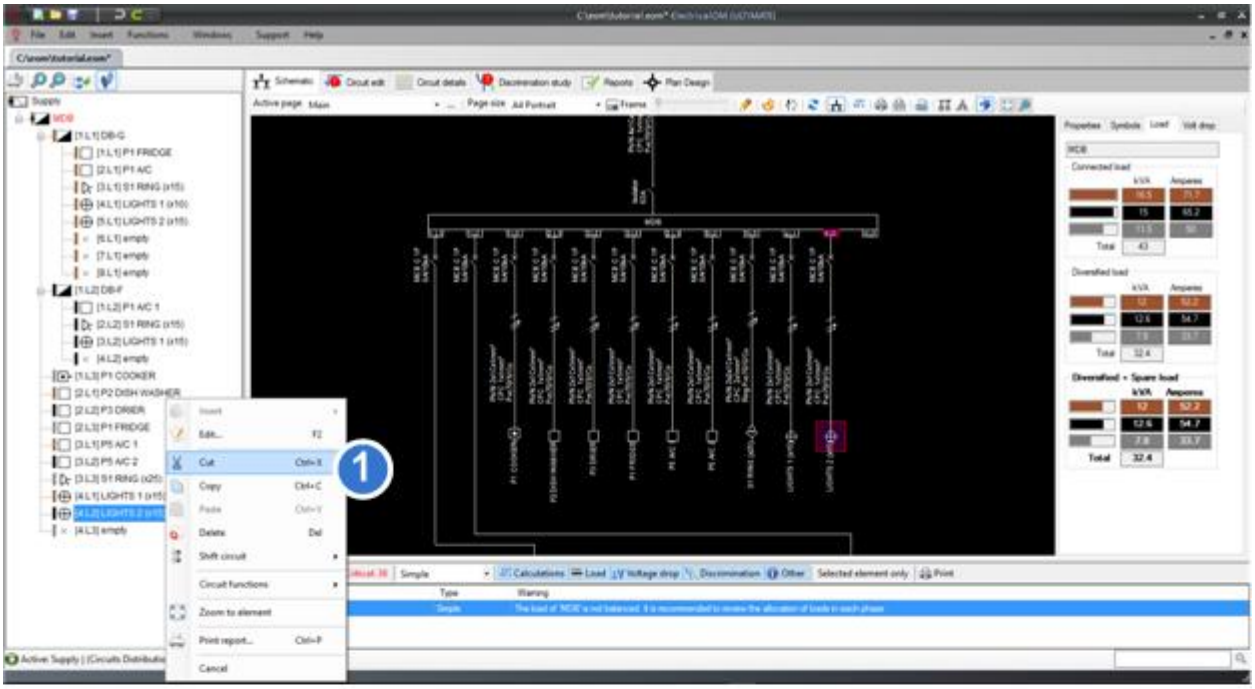


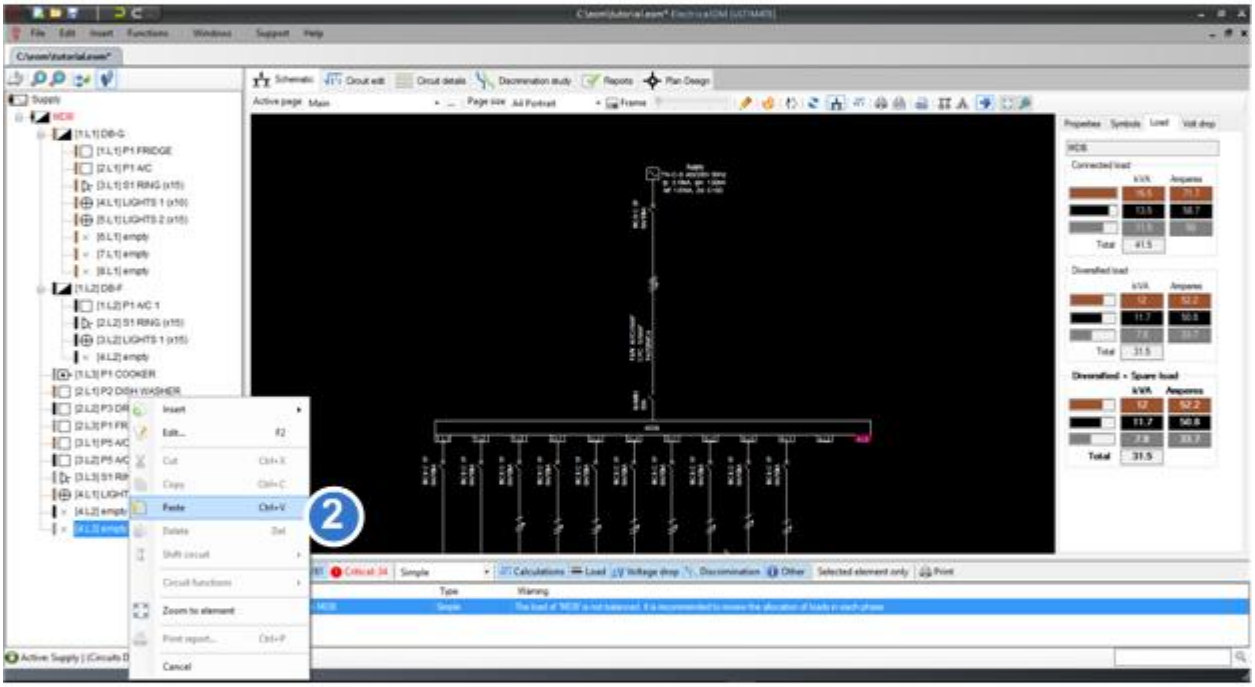
## Load Balancing

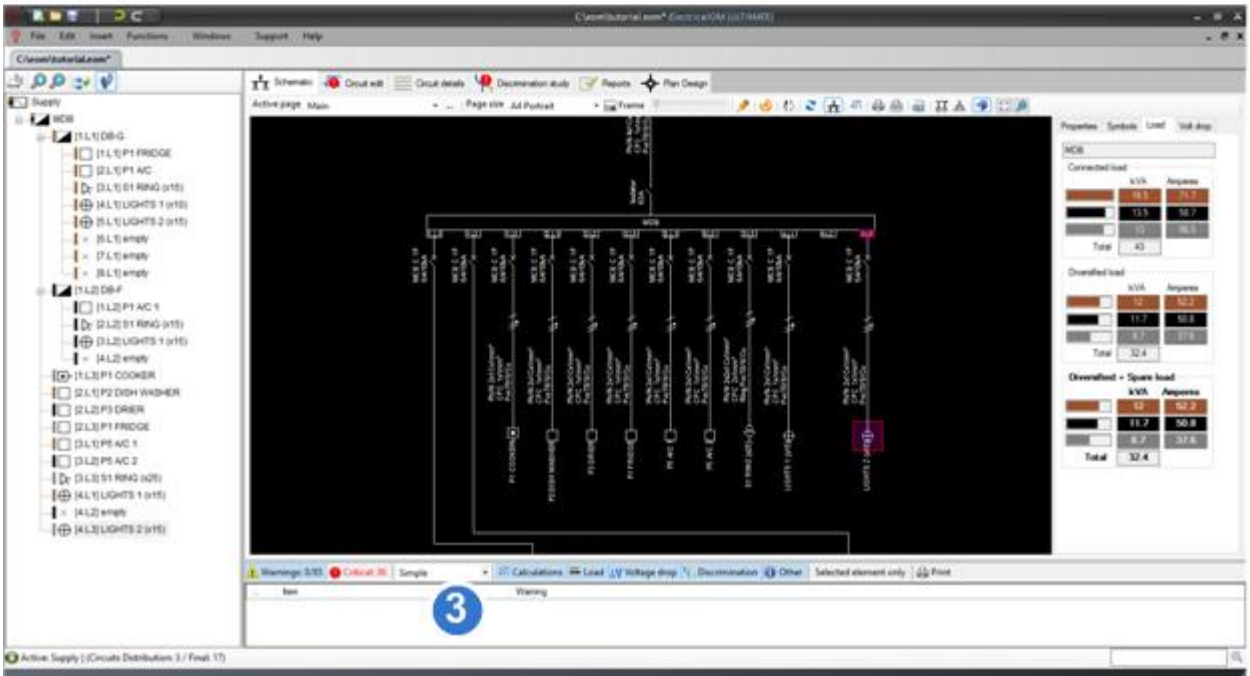
In three-phase systems we need to make sure that the load is balanced across the phases. To check this we can filter the warnings to show only the simple ones by selecting **Simple** in the warnings type filter (1), and checking for load balance warnings (2). In our case the load in MDB is not balanced, so we need to examine the loads in each of the phases (3). From the loads chart we can see that L3 (gray) is less than the other two L1 (brown) and L2 (black).



A possible solution to the load balancing problem is to move a circuit from L2 (black) to L3 (gray) to increase the total in L3 and at the same time reduce it for L2. We right click on **Lights 2** and choosing to **Cut** (1), and then **Paste** (2), the circuit **Lights 2** is moved from 4.L2 to 4.L3 causing the load to be balanced and the load balance warning to be resolved (3).


1
Cut
Copy
Delete
Shift circuit
Circuit functions
Zoom to element
Print report...
Cancel


2
Paste
Zoom to element
Cancel


3

## Step 3 - Set the Protective Devices and Calculate the Cable Sizes

Knowing the demand of each circuit  and the maximum demand of the installation, the designer is able to set the appropriate protective devices and then calculate the required cable sizes, starting from the Main Distribution Circuit and moving downstream. Also at this point the designer can set correction factors for the ambient temperature, depth of lay, etc., that eventually will affect the cable size selection.

### Set the Protective Devices

Here we will show how to set the main over-current protective device (the protective device of the Main Distribution Circuit) and the main incomer disconnector/isolator. Following the same procedure you can modify and set the protective devices of the sub distribution and final circuits.

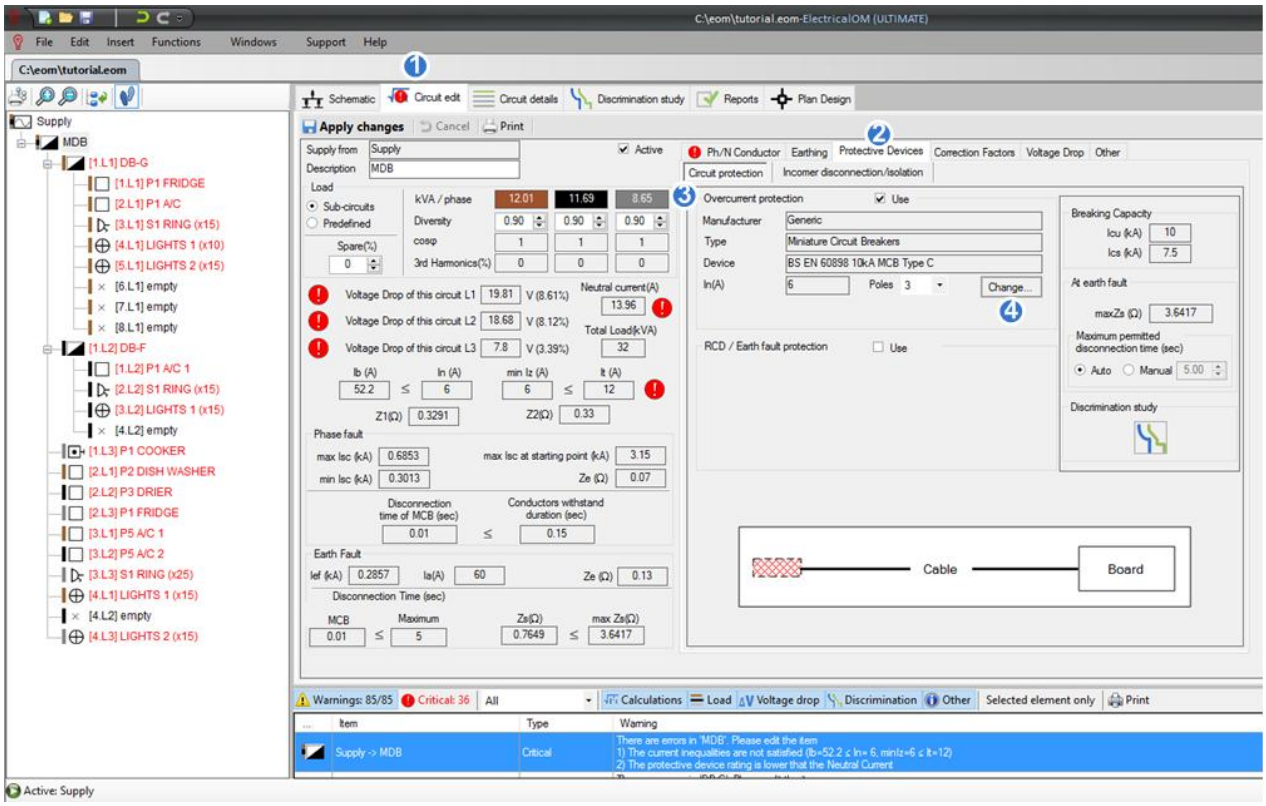
Circuit Protection

Incomer Disconnection/Isolation

Use of RCD

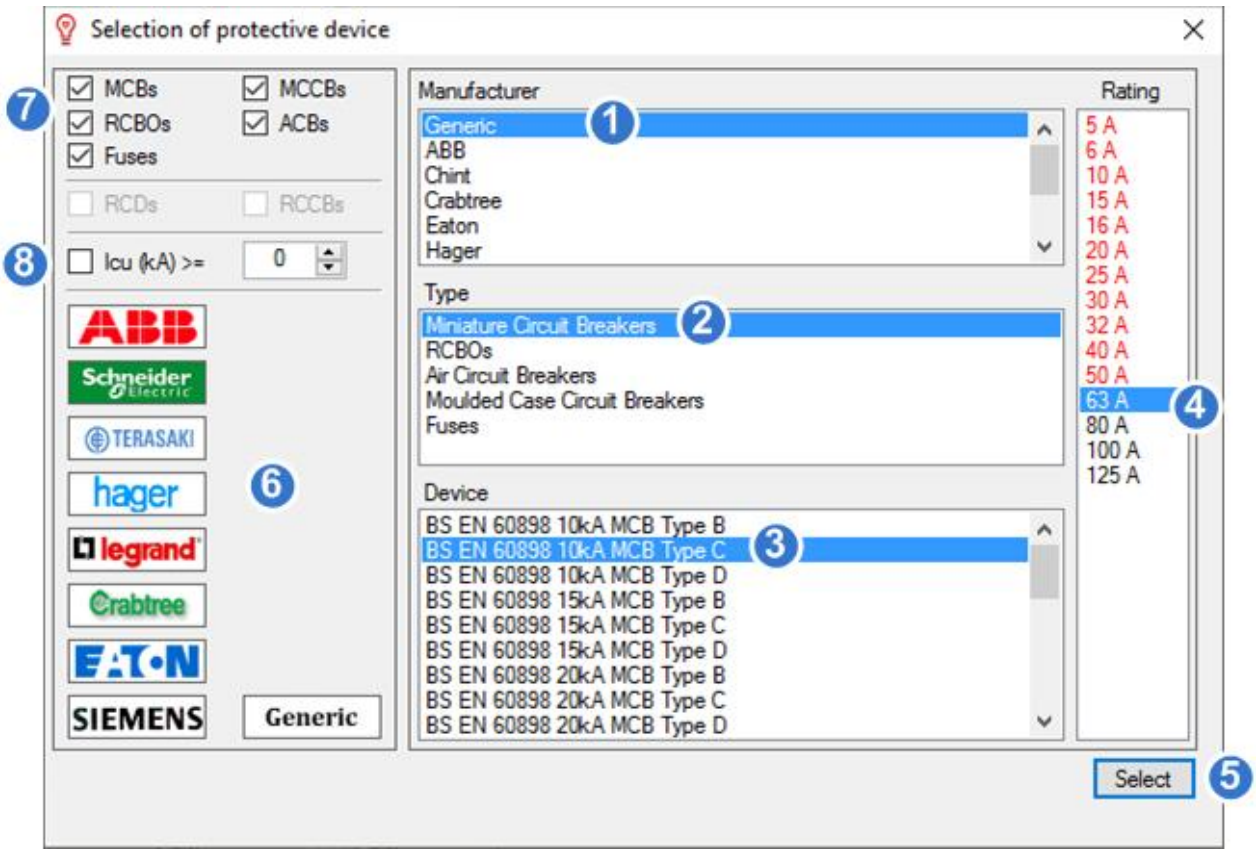
### Circuit Protection

From the circuit editor (1) select the protective devices tab (2) and then under the circuit protection tab (3) click the button labeled **Change...** (4) to make a selection from a table of manufacturers.

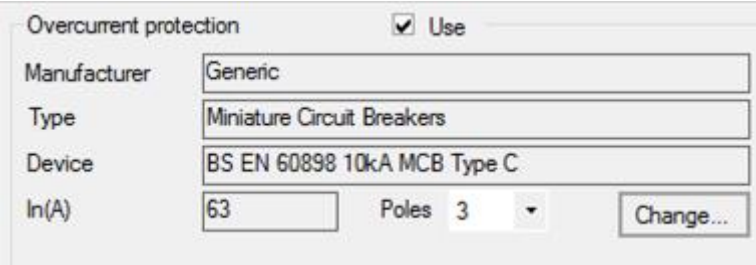



To select a protective device select the manufacturer (1), the type (2), the device family (3) and the device rating (4). Red colored ratings indicates that a particular rating selection is not acceptable because of the circuit's load. To submit the selection press the **Select** button (5).

To help you finding the desired device, you can click on the device-manufacturer icon (6) and also filter the results based on the device type (7) and ultimate breaking capacity, Icu (8) .

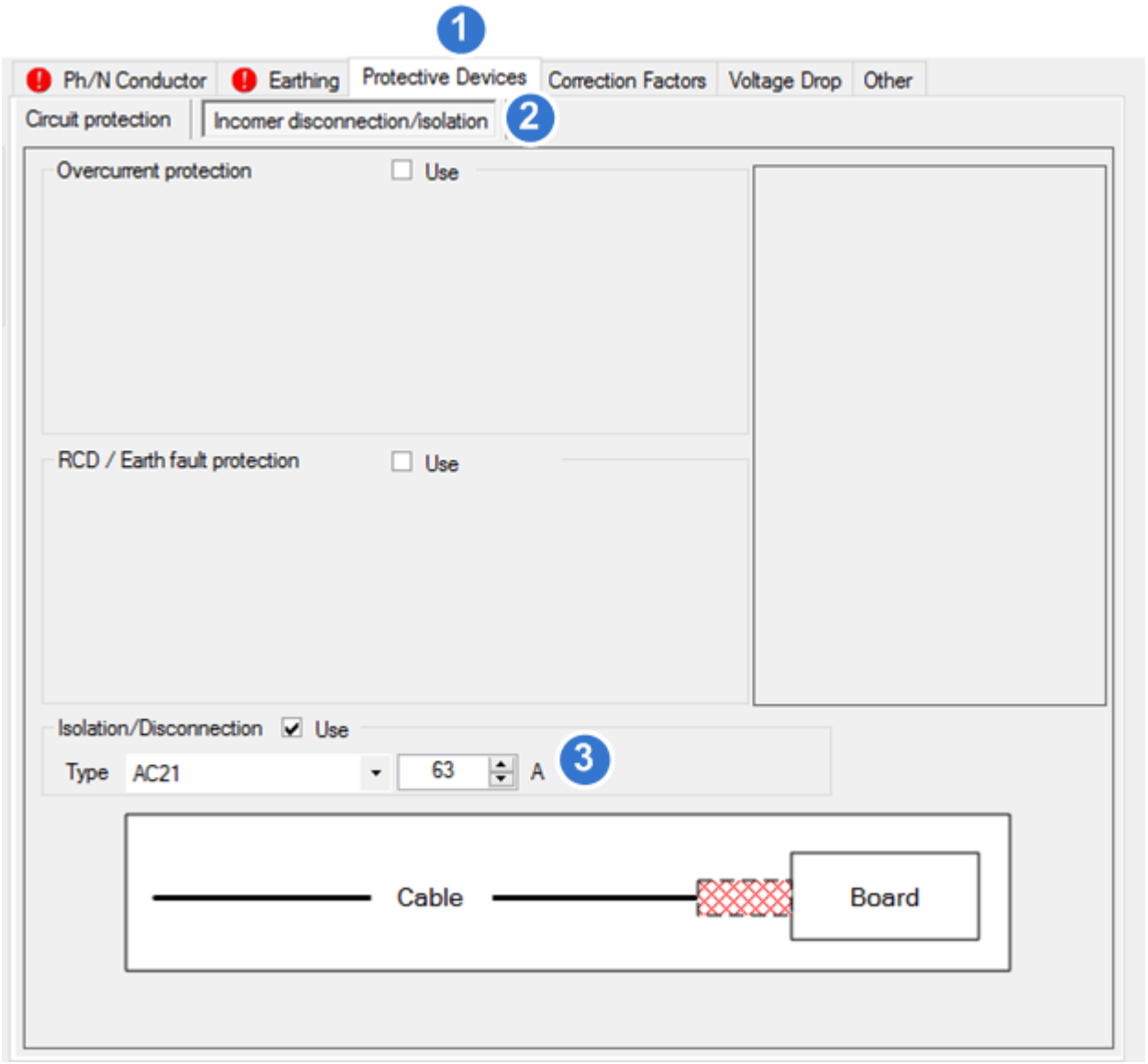



For the Main Distribution Circuit we will choose a 3-Pole MCB Type C 63A with Icu = 10kA as shown below:




## Incomer Disconnection/Isolation

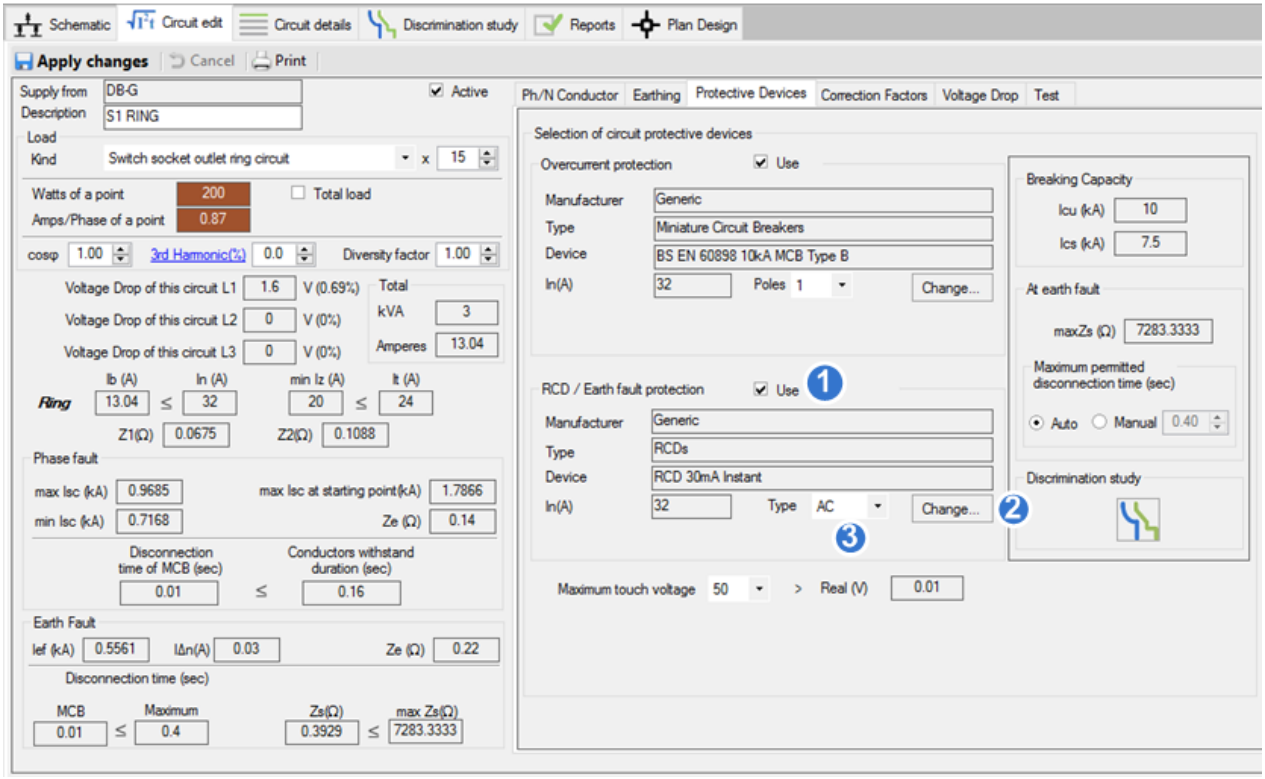
Incomer disconnection/isolation devices can be set only for distribution circuits. To set the incomer disconnection/isolation device, select the protective devices tab (1) and then the incomer disconnection/isolation sub-tab (2). The engineer can choose to use an overcurrent protection device and/or an RCD device and/or and isolation/disconnection device. For this example we will use the default isolation/disconnection device AC21 at 63A (3), as shown below.




## Use of RCD

Where required the engineer can choose to use an RCD device by checking the corresponding box (1) and then by clicking the button labeled **Change...** (2) to select the protective device from a table of manufacturers. The user also can select the type of the RCD device from the list (3).

The screen shot below shows an example where an RCD is in use for a sockets circuit:




## Set the Cable Size

After setting the protective device we are ready to calculate the cable size of the Main Distribution Circuit.

[Minimum Conductor Sizes]

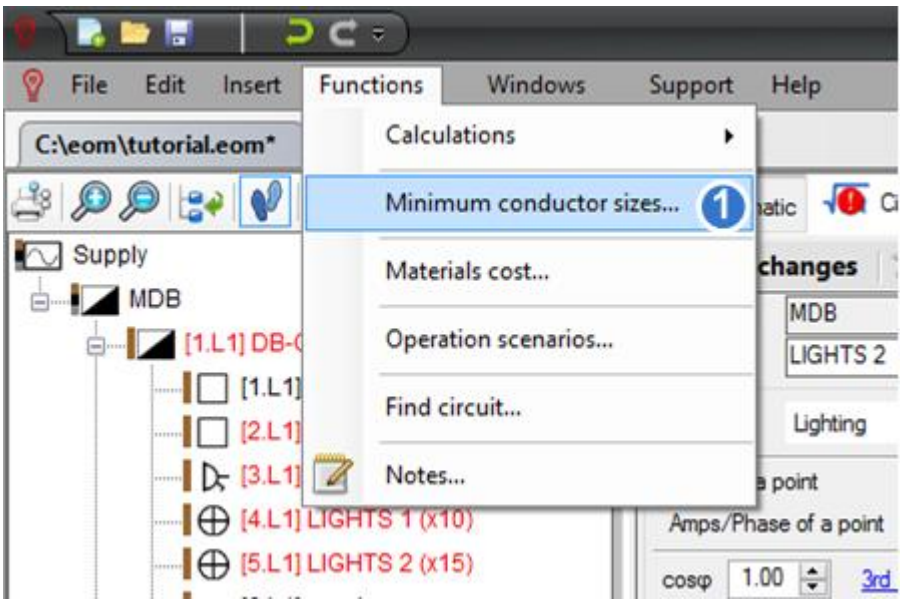
[Phase/Neutral Conductor]

[Circuit Protective Conductor (CPC)]

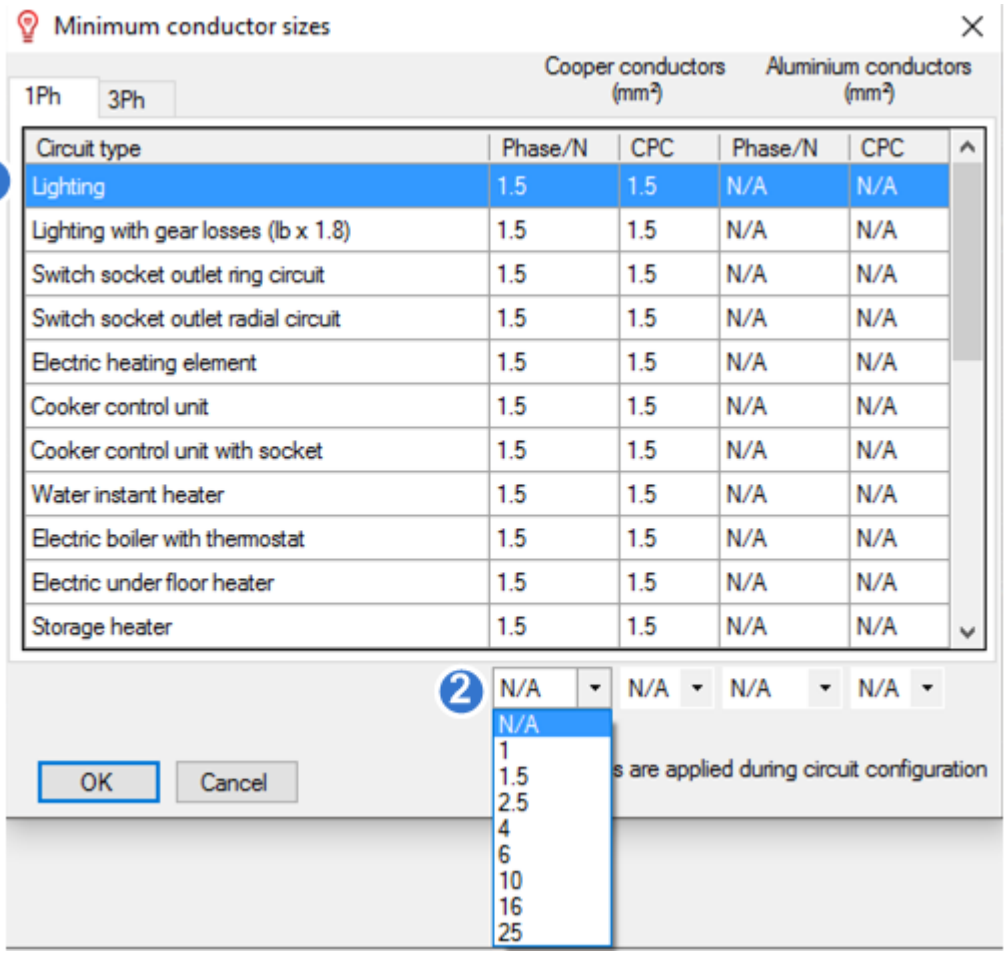
[Correction Factors]

### Minimum Conductor Sizes

In some cases it is required that the selected conductors are over a default minimum size. To set the minimum conductor sizes go to **Functions** from the main menu and choose **Minimum conductor sizes** (1).




From the minimum conductor sizes dialog the engineer can choose the minimum conductor size per circuit kind. In our example we have chosen 1.5mm$^2$ for all kinds of final circuit. To do this we select the circuit kind (1) and from the list (2) we choose the minimum size. Note that submitting the minimum conductor sizes does not affect existing circuits. The minimum sizes are applied to newly added circuits or after applying changes to existing ones, during circuit editing.



## Phase/Neutral Conductor

To set the phase and neutral conductor, go to the phase/neutral conductor tab (1) of the circuit editor. From the conductor type menu (2), you can change the type of the conductor. The list is broken into a number of columns to help the user make a selection. The first column contains a reference to the corresponding conductor in the BS 7671. The second column presents the material of the conductor. The third column shows the description of the conductor and the fourth column indicates the armour or sheath material.

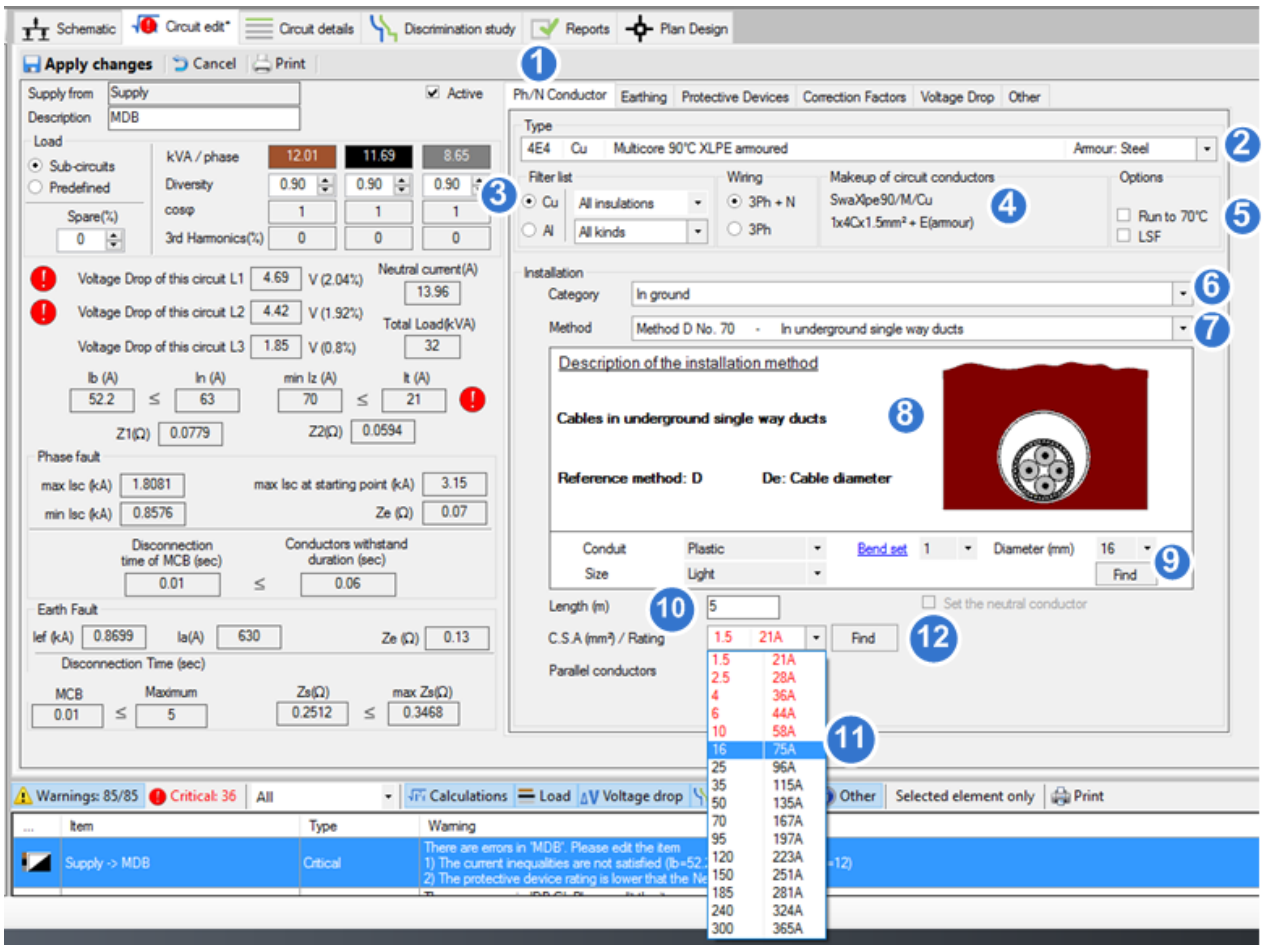
To filter the list of available conductors use the filtering options (3). The make-up of the conductor is shown below (4) the drop-down. Conductors can also accept special options (5).

For the Main Distribution Board we will select the second conductor type from the list, making its conductor a copper multicore 90oC XLPE armoured cable.

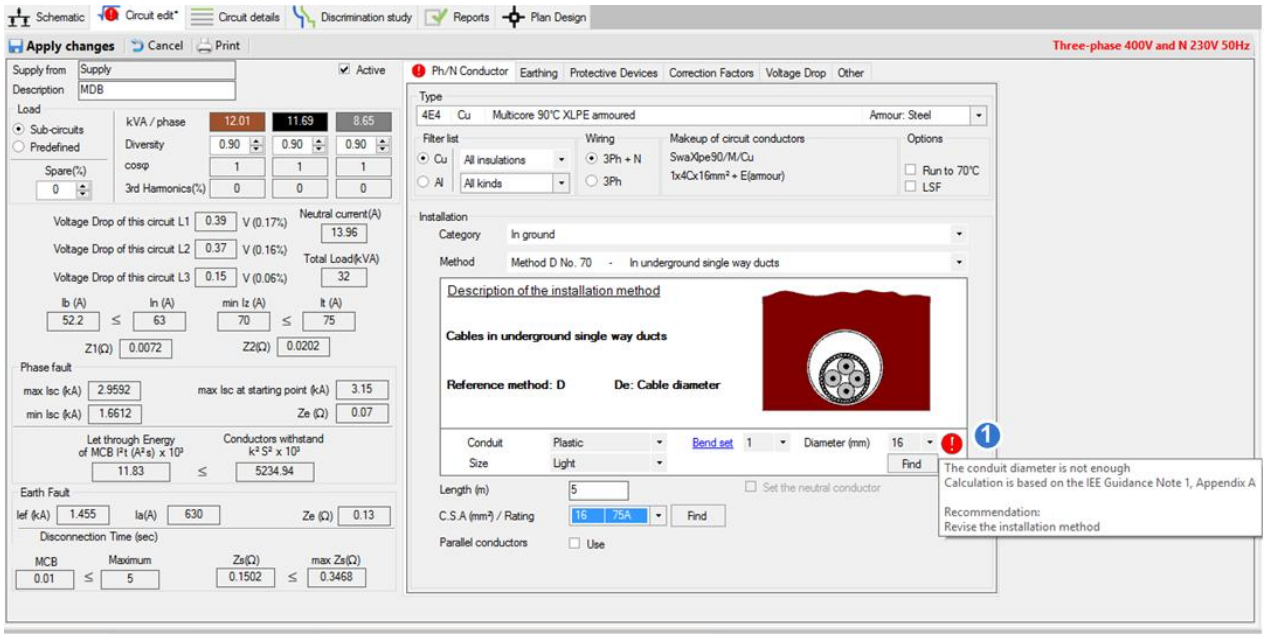
After selecting the type of conductor we must now set the installation method (7). The installation methods are categorized (6). In this example we will choose Method D No. 70, which corresponds to underground single way ducts. The description of the installation method (8) helps the user identify whether the selected installation method is the correct one.

Some installation methods require special care in order to keep in compliance with the regulations of BS 7671, because they require additional information. For example, the method that we have chosen incorporates ducts, so the user must include information about the conduit type and size (9).

Finally, we set the length (10) of the cable to 5m and the cable's cross sectional area / rating from the drop-down (11) to 16mm$^2$ / 75A. The **Find** button (12) helps the user find the minimum cable size required. *Please use this function with caution because it can select wrong sizes if the upstream circuits have not yet been finalized.*




At this stage note that all previous errors have been resolved and the error indications have disappeared. A new error (1) appears due to the conduit's not being large enough to accommodate the conductor after having selected a larger cable size. To take care of this, click the find button below the conduit diameter to select a 32mm conduit diameter.



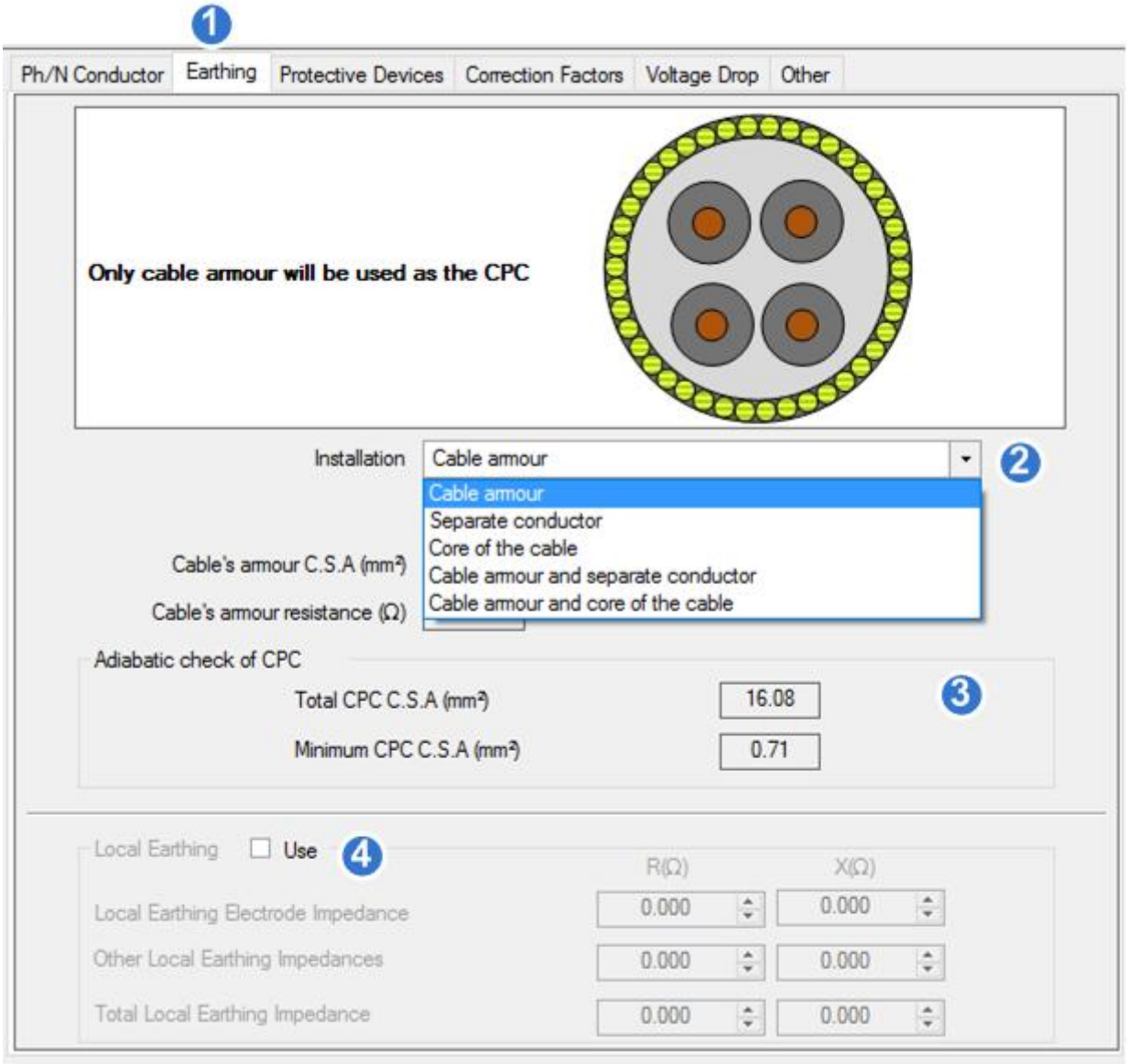

## Circuit Protective Conductor (CPC)

[Armour as CPC]

Separate Conductor

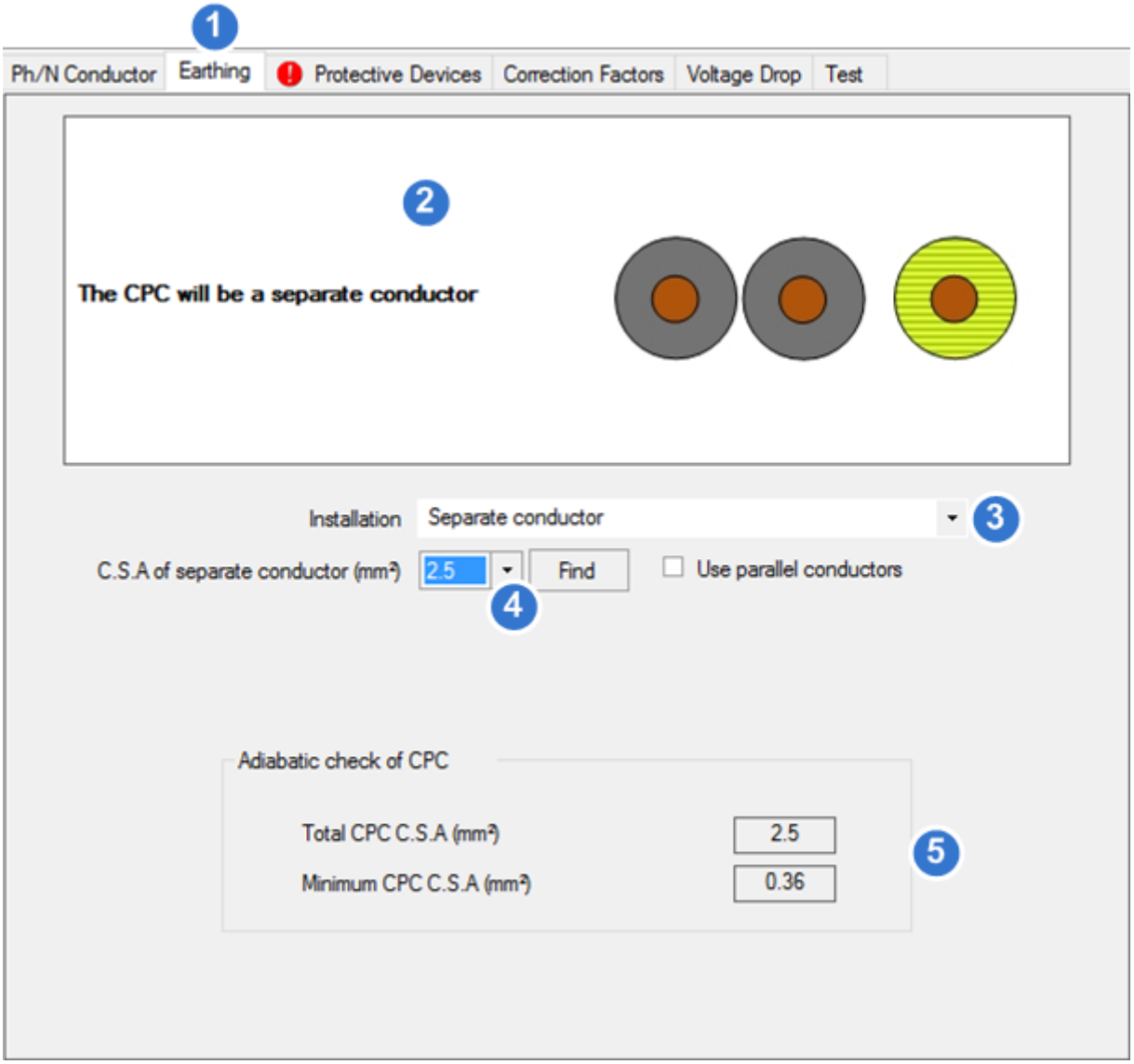
### *Armour as CPC*

To set the circuit protective conductor (CPC) of the circuit, choose the earthing tab (1). The properties of the CPC depend on the cable being passed. In our case, during the configuration of the circuit protective conductor, special settings are provided for armoured cable arrangements (2). The adiabatic check (3) indicates the minimum size of the CPC. For distribution circuits the engineer may choose to use extra local earthing to reinforce the earthing of the installation (4). For the Main Distribution Circuit we will choose the first option, **Cable armour**.



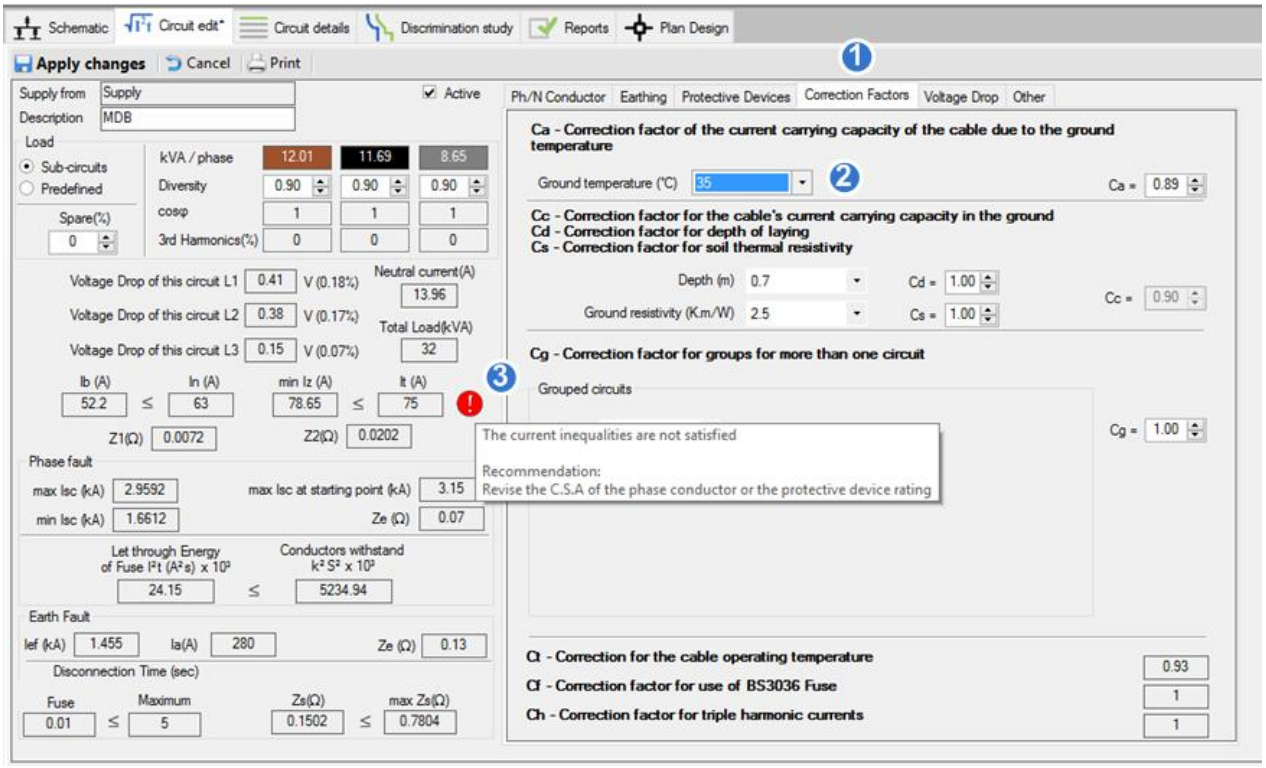
### *Separate Conductor*

To set a separate conductor as the circuit protective conductor, select the earthing tab (1). Here the engineer can specify how the CPC will be installed (3) and the size of the CPC (4). When setting the CPC make sure that the earth fault adiabatic check (5) is satisfied. The image (2) shows a typical diagram of the CPC installation.




## Correction Factors

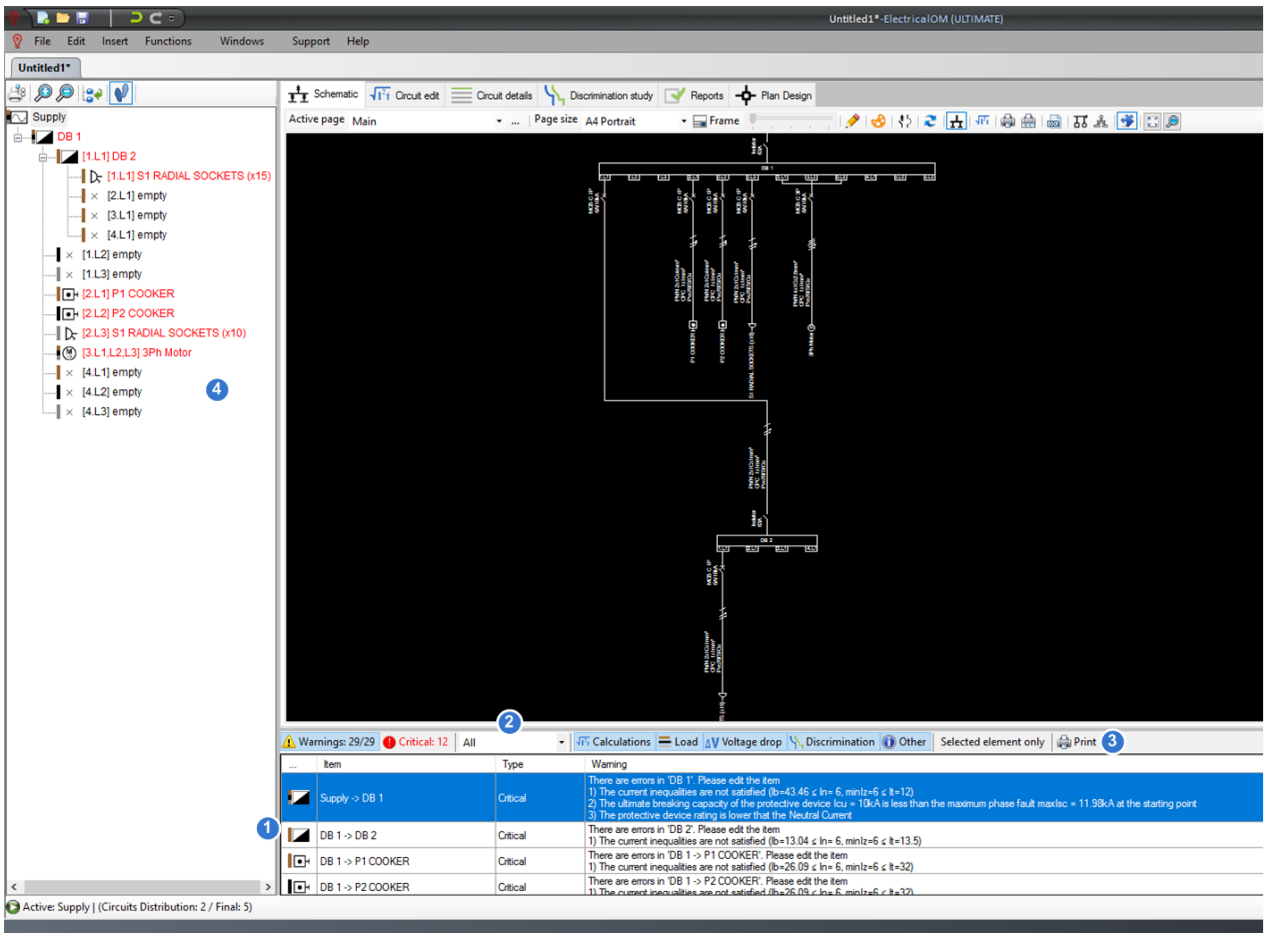
Correction factors affect the cable size selection. The engineer must set the correct factors in order to make sure that the design is appropriate for the conditions of the installation. The correction factors can be set by choosing the correction factors tab (1) at the circuit editor. The image below shows an example where the ambient temperature correction factor (2) brings about a violation of a constraint (3). In this tutorial we will leave all correction factors to the default values.




## Step 4 - Resolve Calculation Warnings and Discrimination Problems

After inserting and editing all the parameters of the installation the user must resolve warnings that have put the network out of compliance with regulation. The warnings can be examined from the warnings area (1) and can be filtered based on their importance (critical, important, simple) and/or the type (load, voltage drop, discrimination, other) (2). Warnings can be printed by clicking on the print button (3). An element that has a warning associated with it is marked in red (4) in the tree network view.

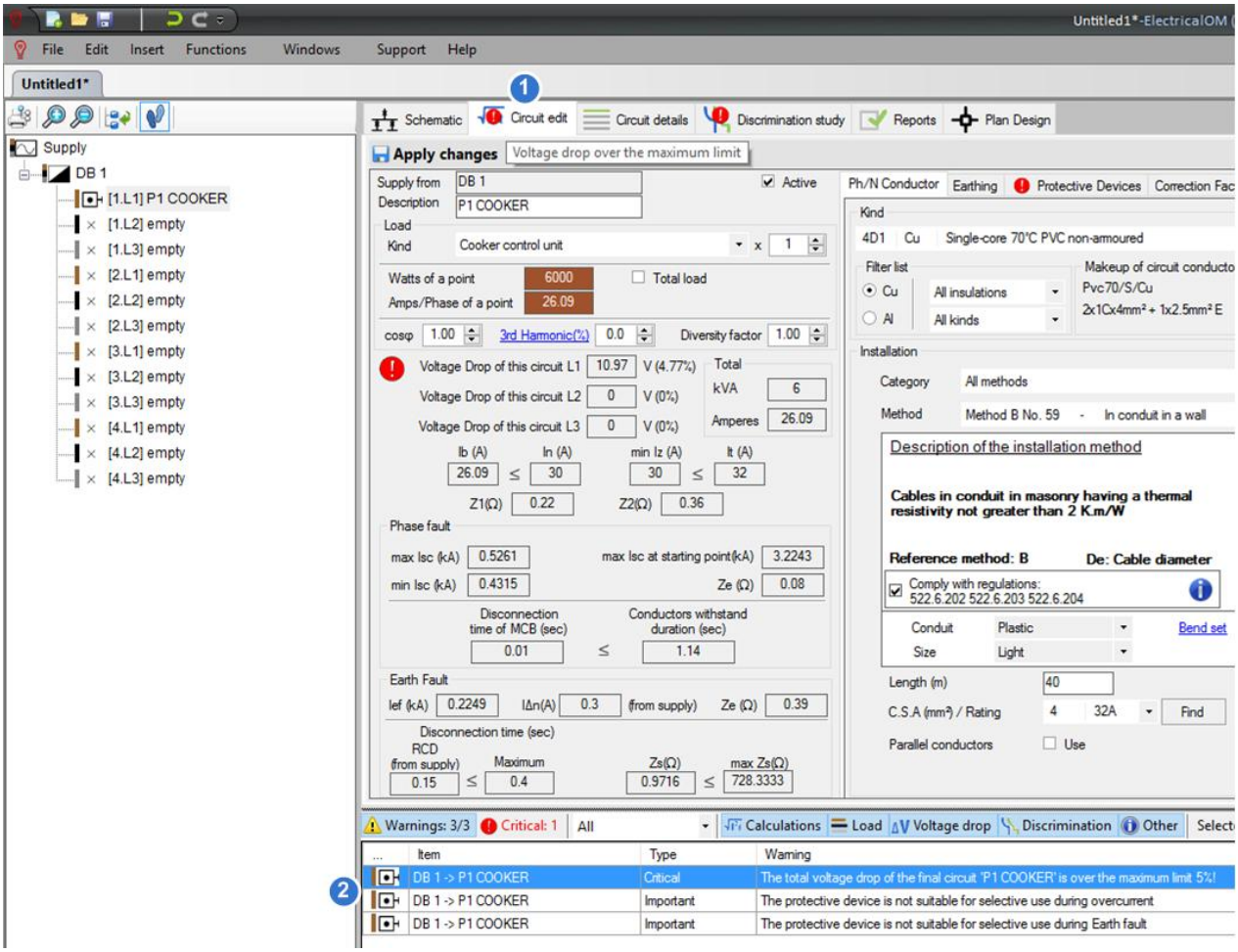
Extensive documentation about the warnings presented in ElectricalOM can be found in section **"ElectricalOM Calculations Warnings and Checks"**




## Circuit with Critical Errors

When a selected circuit has critical errors, the circuit edit tab is marked with a red icon (1) indicating the error. A tool tip with the description of the critical error is present when the user hovers the mouse over the tab. All warnings are presented in the warnings area (2).

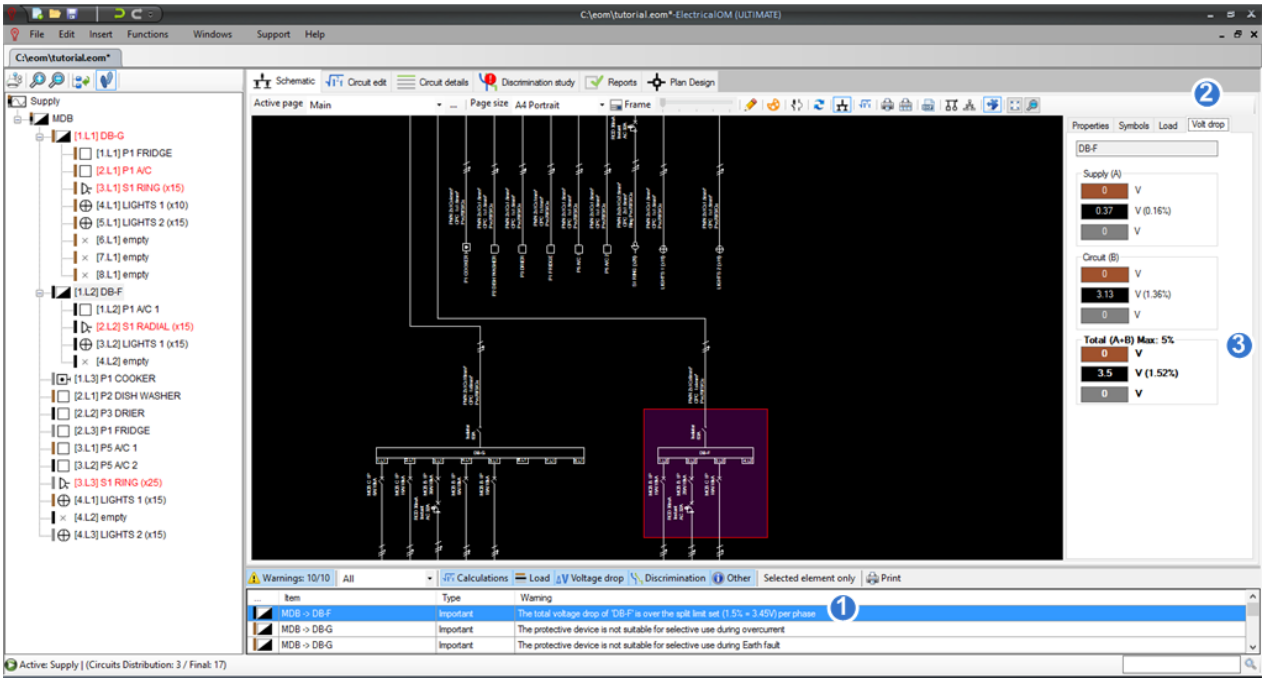
Even if in the circuit editor there are no critical warnings, the circuit might still be associated with critical warnings due to circuits upstream. In this example the voltage drop limit is affected by the conductor belonging to the Main Distribution Board, which has been left to its default size 1mm$^2$, causing high voltage drops in the downstream circuits. We will take care of this error when we set the Main Distribution Board's conductor.




## Voltage Drop Errors

Voltage drop errors are displayed in the warnings area (1). By clicking on the warning the affected circuit is selected. Detailed voltage drop calculations are available for each circuit through the voltage drop tab (2). The voltage drop area displays the voltage drop from supply, from circuit and the total (3).

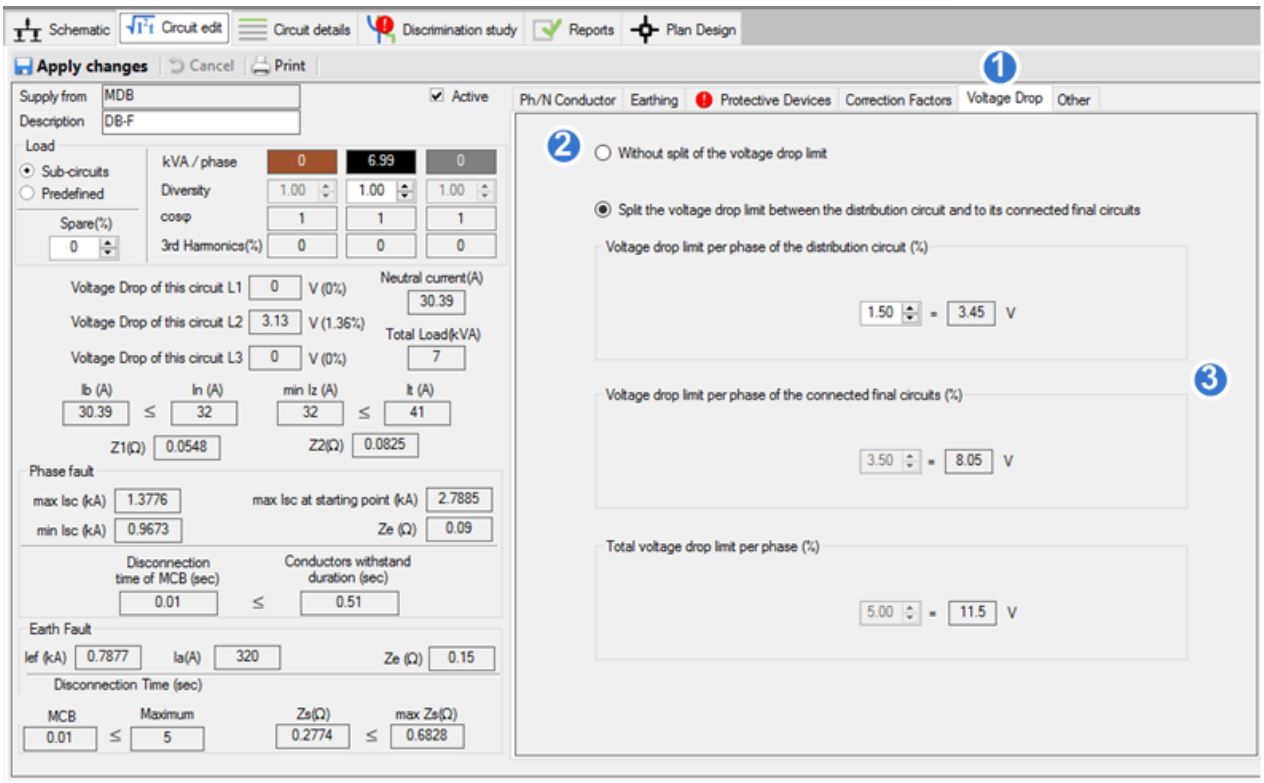
In our tutorial, the distribution circuit DB-G has a voltage drop warning because of the split limit set. To take care of this and eliminate the warning we will increase its conductor size from 6mm$^2$ to 10mm$^2$. After applying the change to the circuit editor the warning disappears.




## Voltage Drop Limits

The voltage drop limits are defined when editing the Main Supply. The engineer may also alter the voltage drop limits of an individual circuit from the circuit editor under the voltage drop tab (1).

For distribution circuits there is an option to split the voltage drop limit between the distribution circuit and its final circuits. This split limit is not a regulation requirement but is set by the designer to warn him or her about circuits exceeding the specified voltage drop percentage value, allowing for finer control of the voltage drop across circuits. By default the split limit is enabled and this can be disabled by selecting the option **Without split of the voltage drop limit** (2). For this tutorial we will leave the split limit to 1.5% per phase of the distribution circuit and the remaining 3.5% to the connected final circuits (3).




## Protective Devices Discrimination Problems

The purpose of discrimination is to disconnect only the faulty circuit from the distribution network while maintaining the upstream electrical installation active.
Discrimination can be either total or partial. Discrimination is said to be total if discrimination between the upstream and downstream protective devices is provided up to the value of the maximum prospective short-circuit current at the downstream protective device.

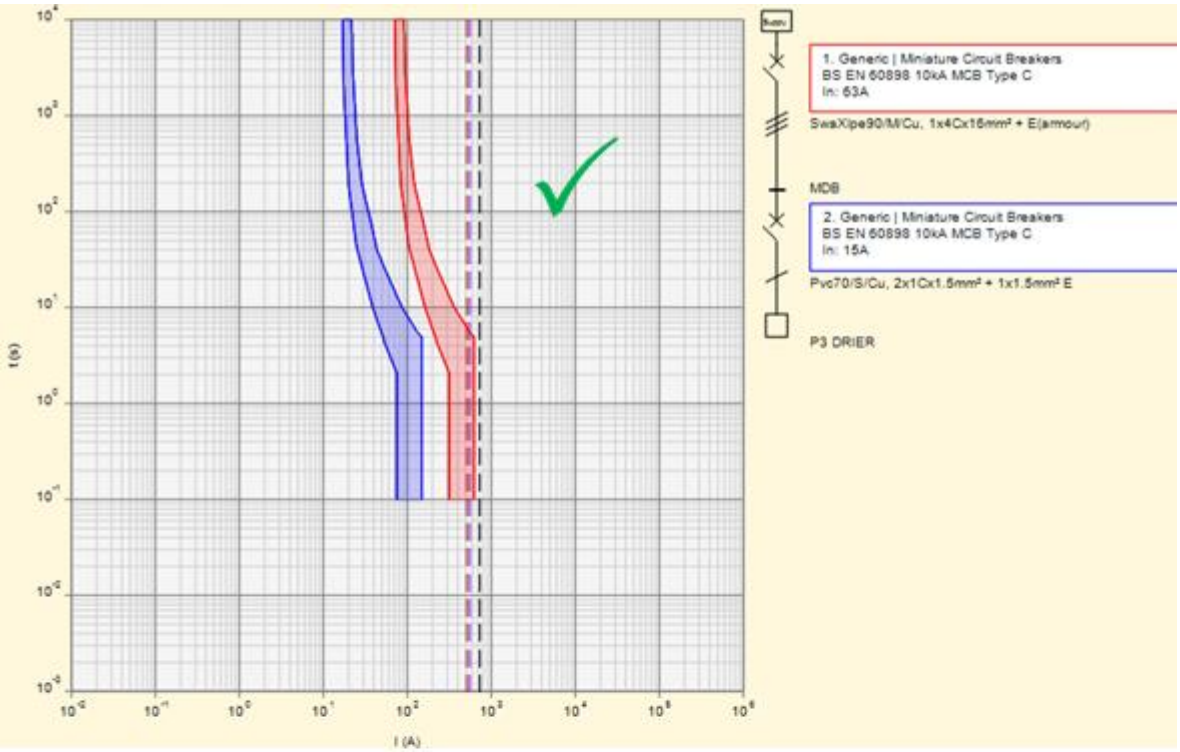
Protective devices discrimination problems are tricky to resolve and sometimes may require a change to the design parameters, eventually affecting the cost of the installation. In some cases the engineer may decide to skip some of the checks and accept that the design will contain discrimination problems. According to regulation, discrimination (or selectivity) is demanded when it is necessary to prevent danger or when it is required for proper functioning of the installation.

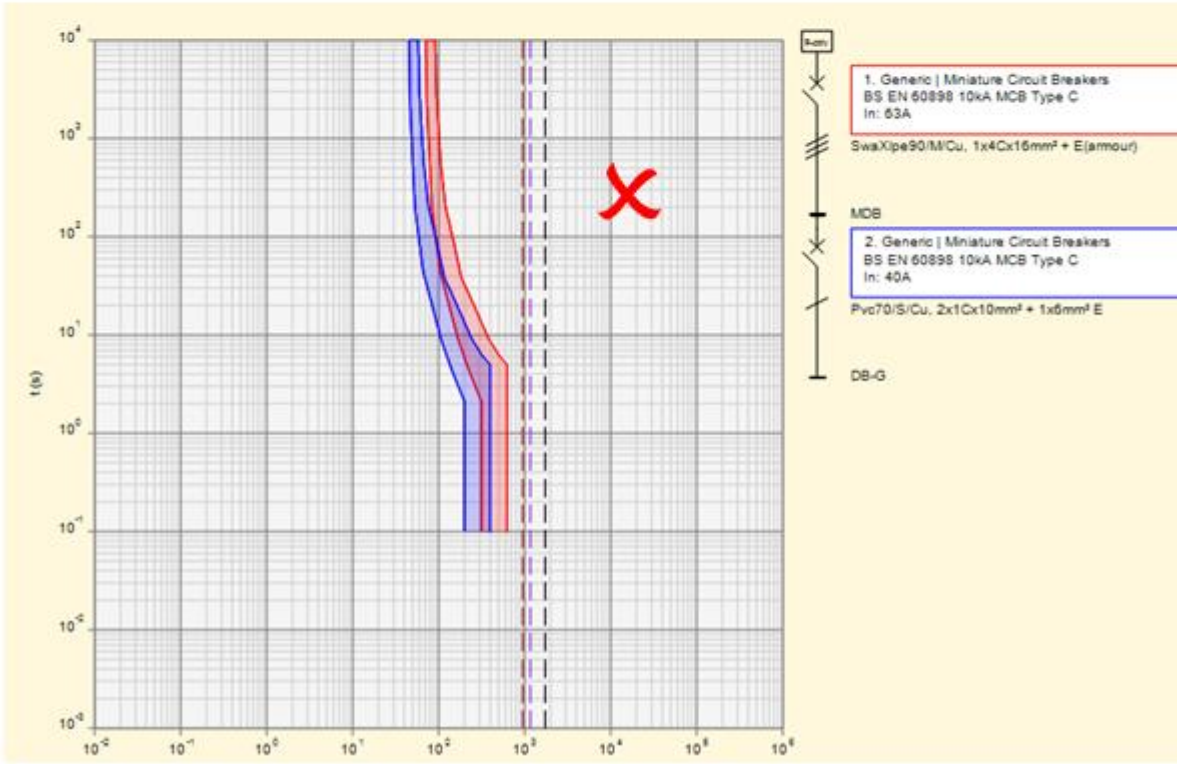
ElectricaOM performs discrimination checks between the time-amperes curves of the protective devices, where overlapping curves indicate a discrimination problem. When the manufacturer's energy-based discrimination data are available and the fault condition is causing operation of the protective device below 0.1 sec, the checks are performed based on the manufacturer's discrimination tables.

In this tutorial we are using  generic protective devices.

The images below show two cases. The first is a successful discrimination study, with no overlapping between the curves. The second study fails, with the curves overlapping.

Fixing Discrimination Problems



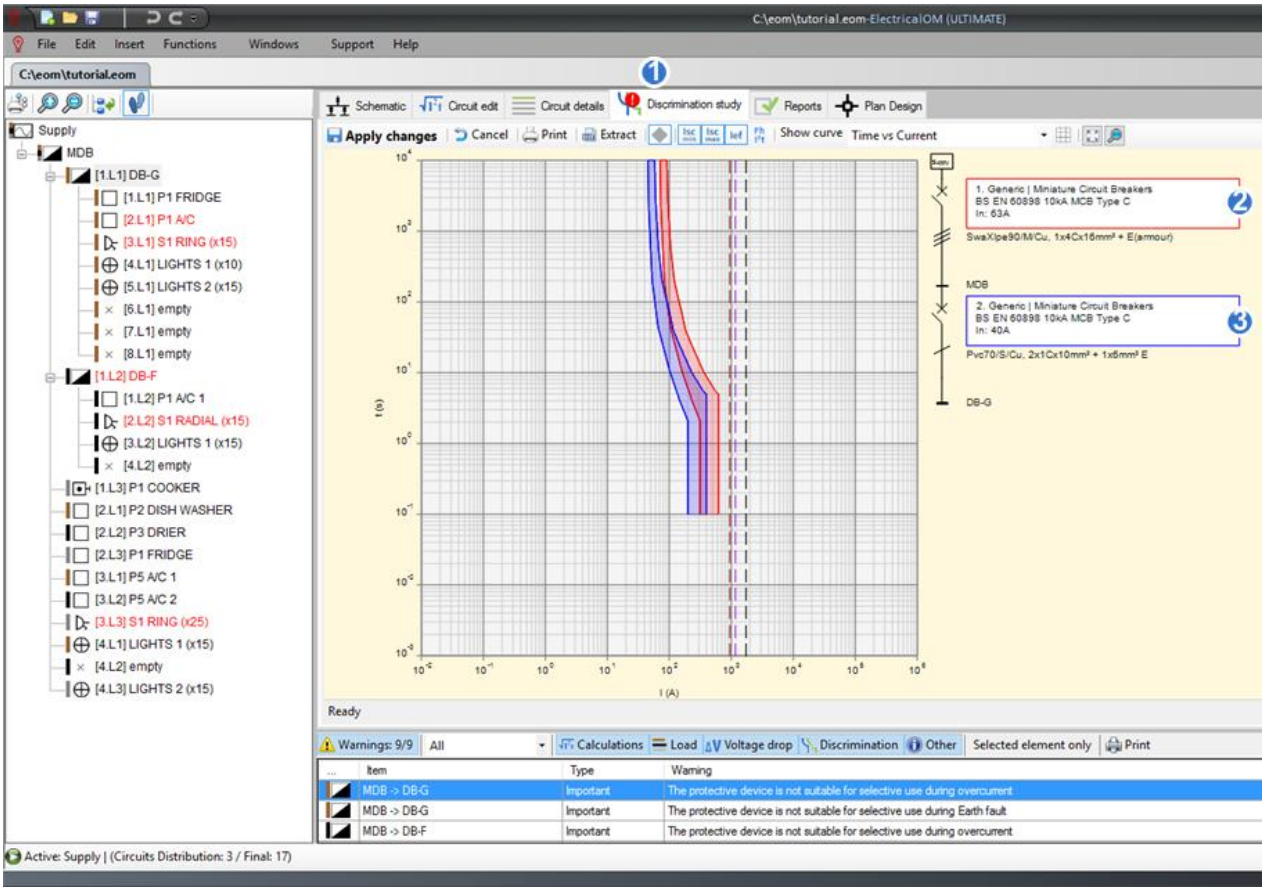




## Fixing Discrimination Problems

To resolve problems with discrimination the engineer must make sure that the time-current curves of the protective devices are not overlapping, or where manufacturer data are available, it can be done through the energy-based discrimination check. Please note that energy-based discrimination checks are performed only when the operating time of the device under study is less than  0.1 sec.

From the discrimination study module (1), the engineer can inspect the selected circuit's protective devices behavior against those of the circuits upstream. In this tutorial we have chosen a 63A Type C MCB

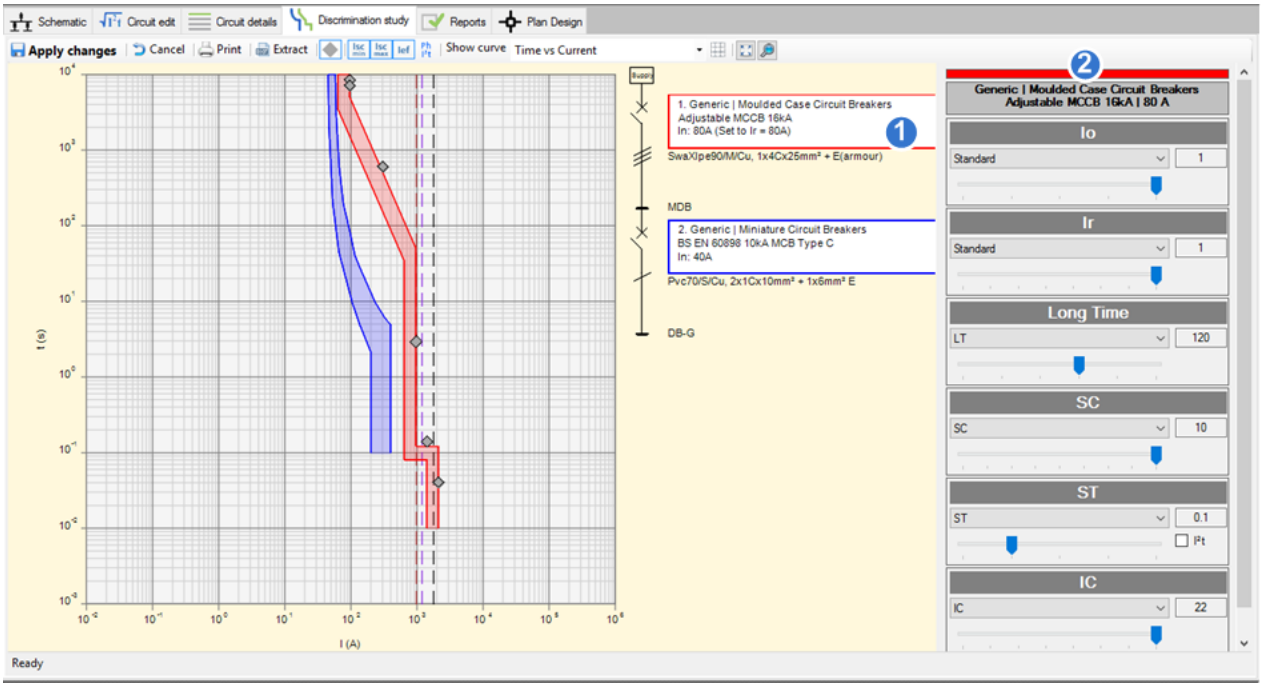
for the MDB (2) and  a 40A Type C MCB for the DB-G (3). This arrangement is causing a discrimination problem due to the overlapping of their time-current curves.




To resolve the above problem we need to choose a larger device for the MDB. At this point the engineer needs to choose a suitable device. If we select a 125A Type C MCB to resolve the discrimination problem, it will lead to an increase in cable size from 16mm$^2$ to 70mm$^2$ for the Main Distribution Circuit, which is not a good design for a domestic installation.

An alternative path is to choose an adjustable MCCB device that will be adjusted so that its time-amperes curve will not overlap with the downstream device.

To do so, click in the legend area of the main MCB (1). The overload setting of the MCCB device adjusted to the rated current 80A (Ir = 80A), leads from a 16mm$^2$ to a 25mm$^2$ cable size for the Main Distribution Circuit, which is acceptable for a domestic installation.




## Step 5 - Finalize Design and Print Reports

After taking care of the warnings and applying the required fixes we are ready to finalize the design by adding additional symbols and choosing to show calculation results on the schematic. Finally, for each of the pages of the schematic, the page size and frame adjustments should be configured before printing.

Add Symbols to the Schematic

Show Calculations in Schematic

Create New Schematic Page

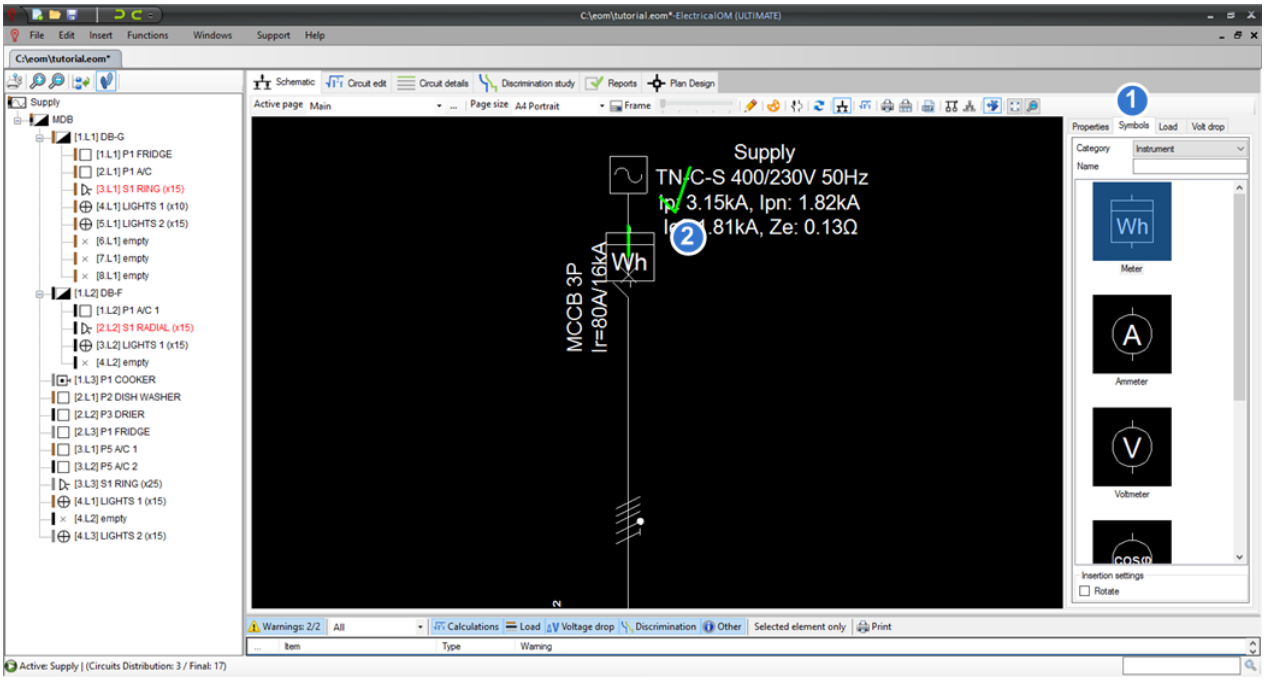
Set Page Size and Add Frames

Print and Export Results

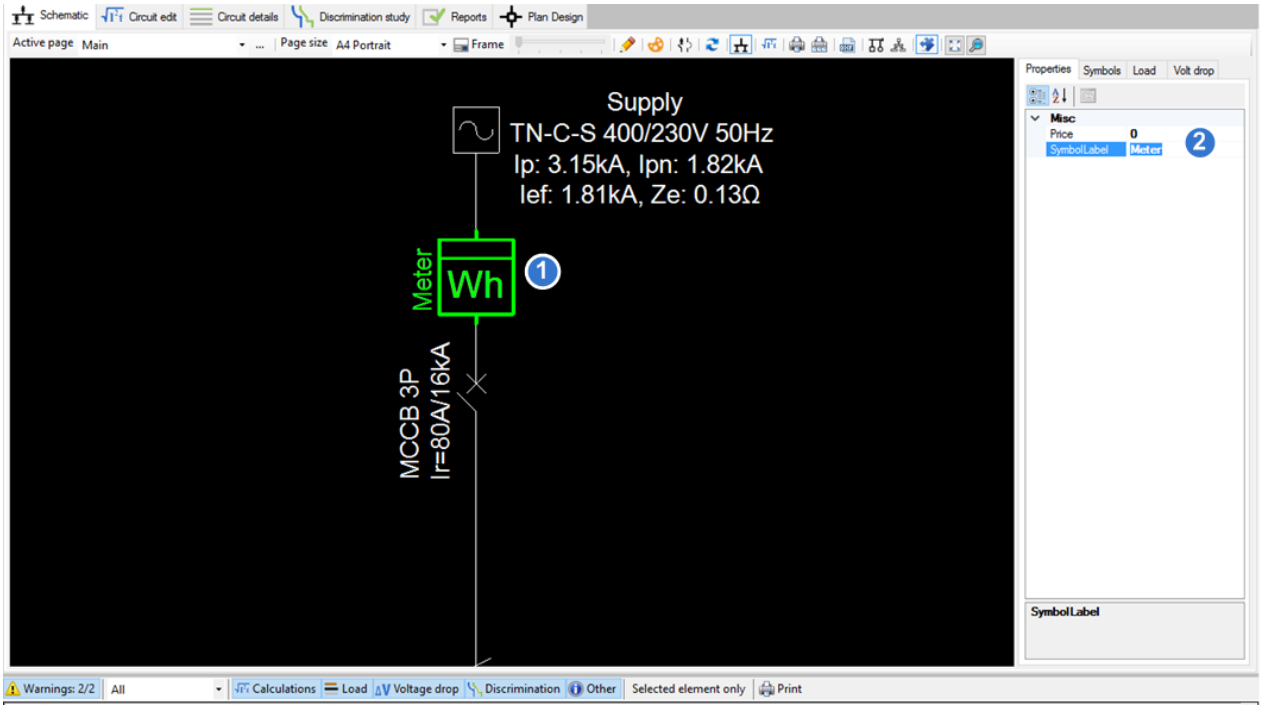
Schematic Drawing Mode

### Add Symbols to the Schematic

The designer can choose to add symbols in any part of the network by dragging and dropping the symbol from the symbols area (1) to the desired location, until the tick mark appears (2). In this example we have added a meter symbol before the main protective device.

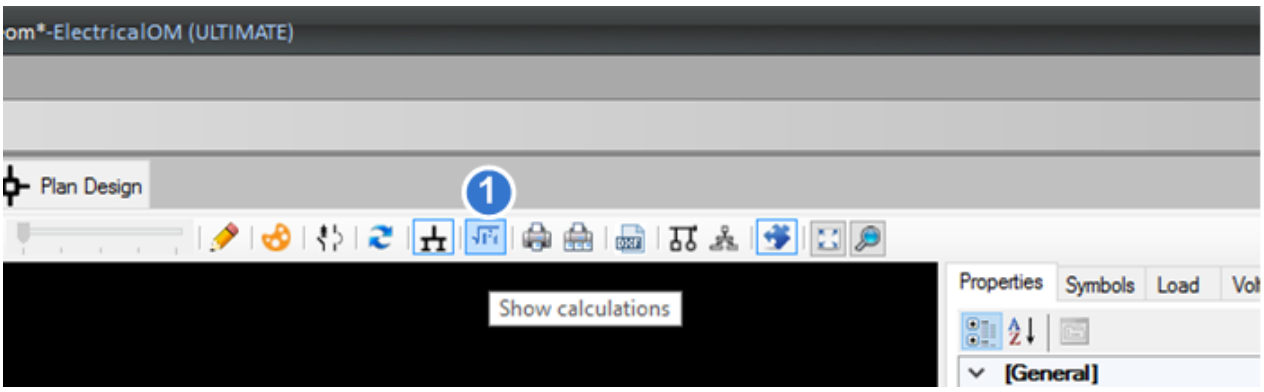



To modify the symbol's label, click the symbol so that it becomes green (1) and modify its properties from the properties area (2).

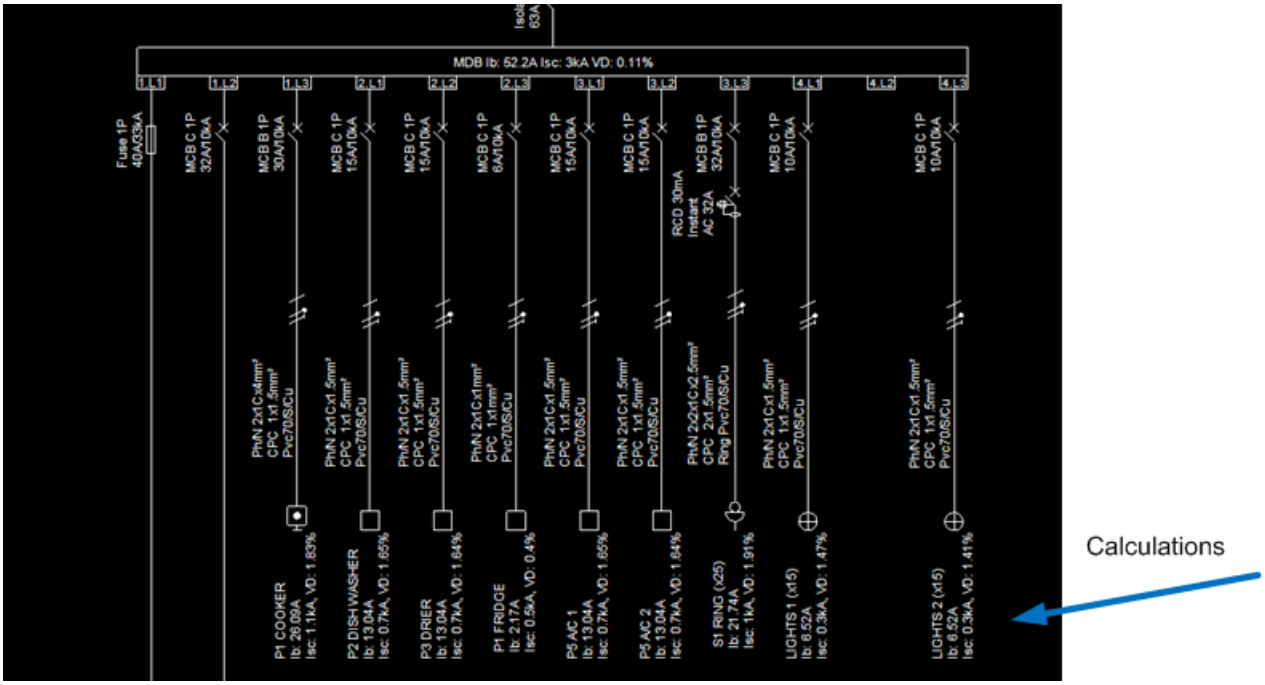



## Show Calculations in Schematic

To show calculations in the schematic click the show calculations button (1) from the schematic tool bar.

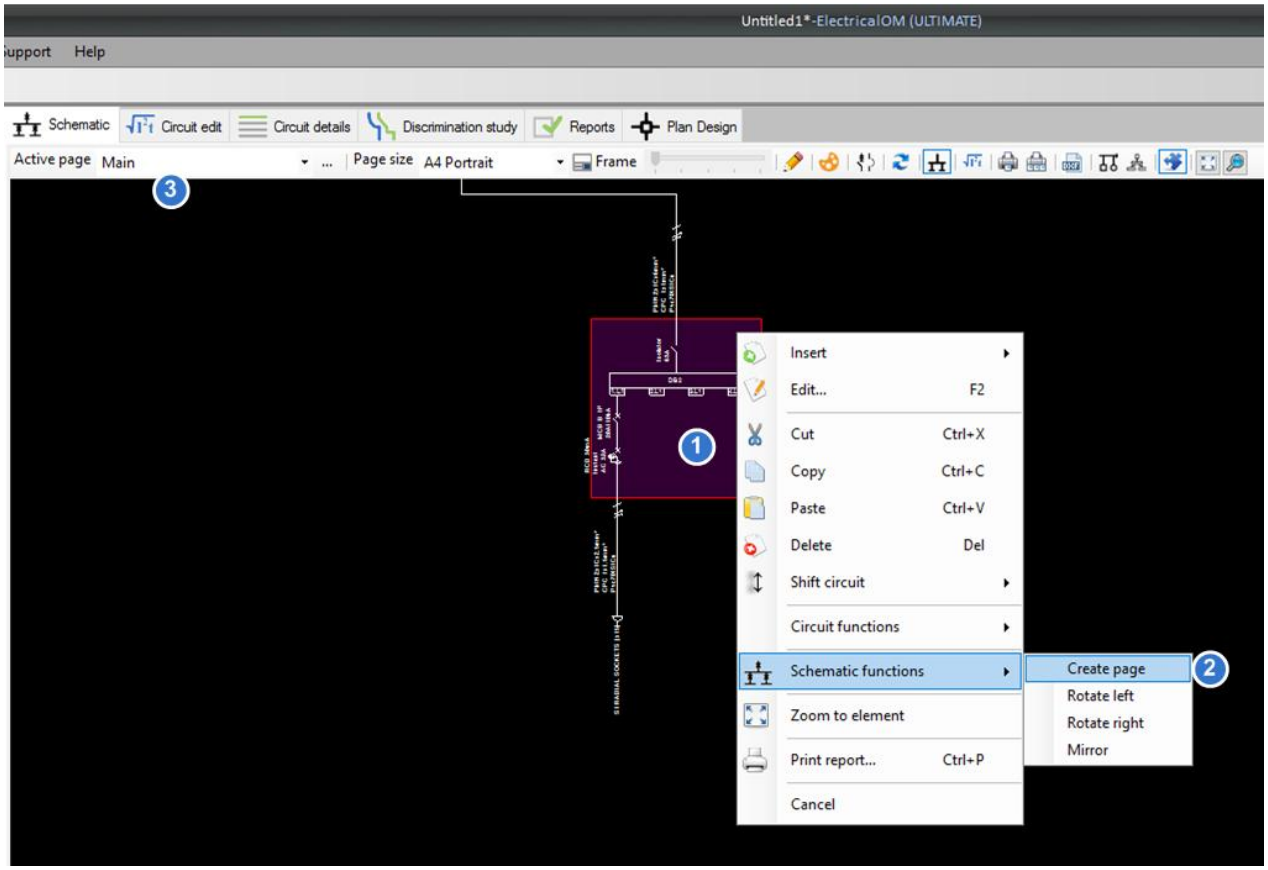



Calculations are shown beside the circuit's description.

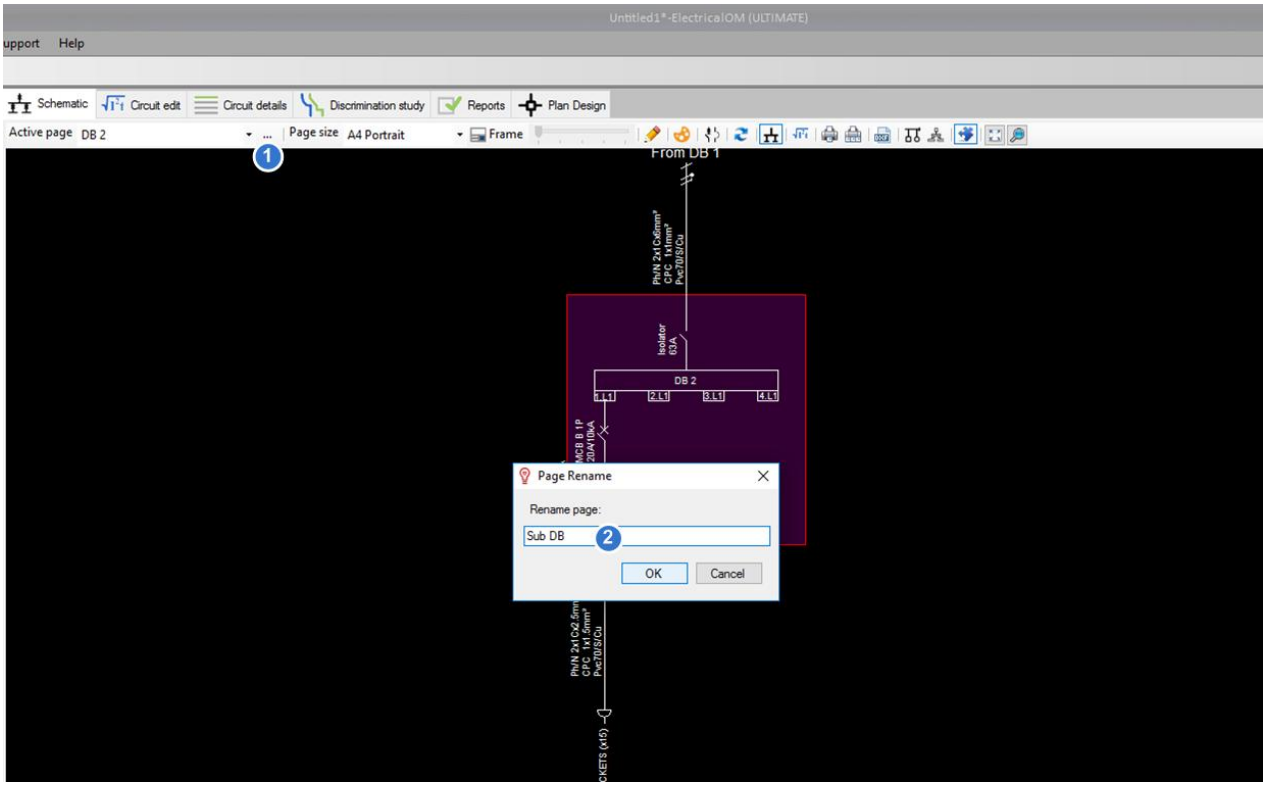



## Create New Schematic Page

For larger networks, the user may find it helpful to arrange the schematic over a number of pages. To do this, left-click a distribution circuit (1) that you want to move to a new page, and right click to show the design menu. From **Schematic functions** select **Create page** (2). You can navigate through the pages from the pages drop-down menu (3).



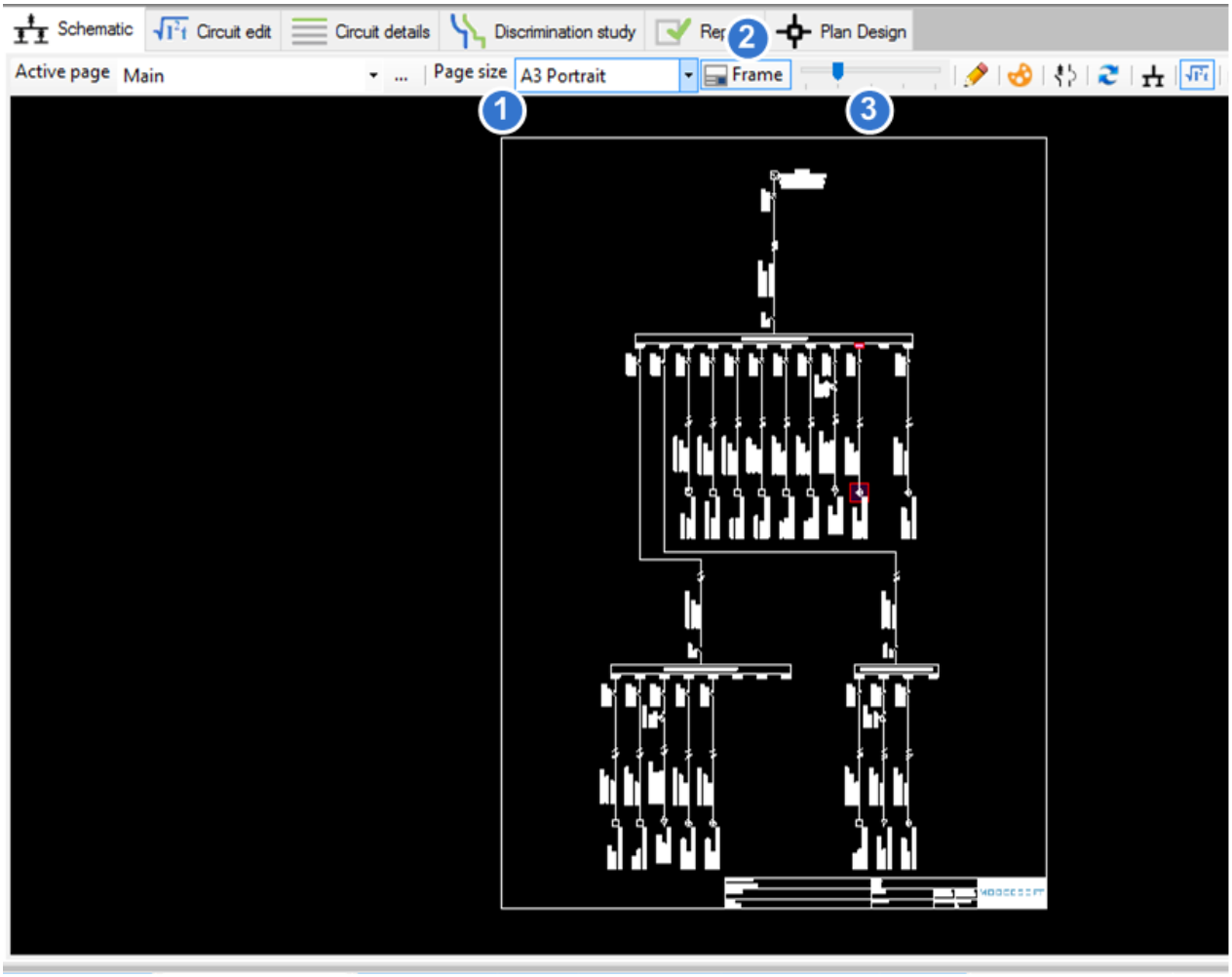

To rename the page press the button immediately to the right (4) of the pages drop-down menu. From the pop-up window (2) the user changes the description of the active page.




## Set Page Size and Add Frames

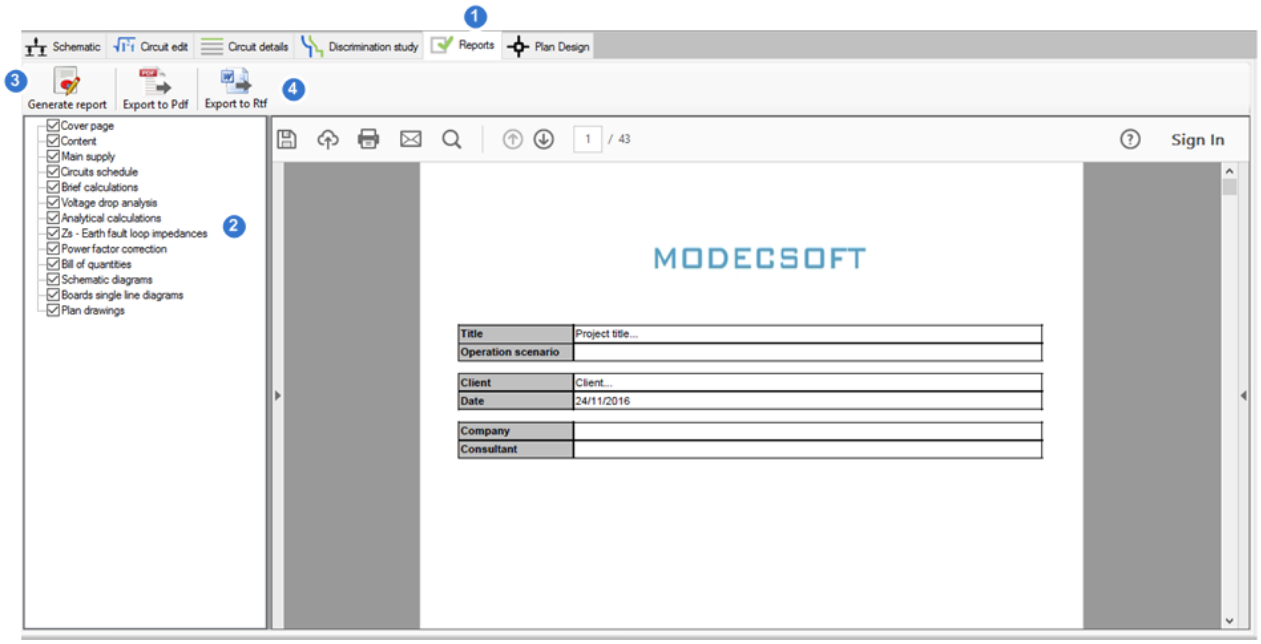
To define the active page size for printing the pages of the schematic, a choice must be made from the

corresponding drop-down menu (1). Also the designer may choose to show the page frame (2) that contains also all of the project information. To resize the frame use the track bar (3) so that the drawing fits into the frame.



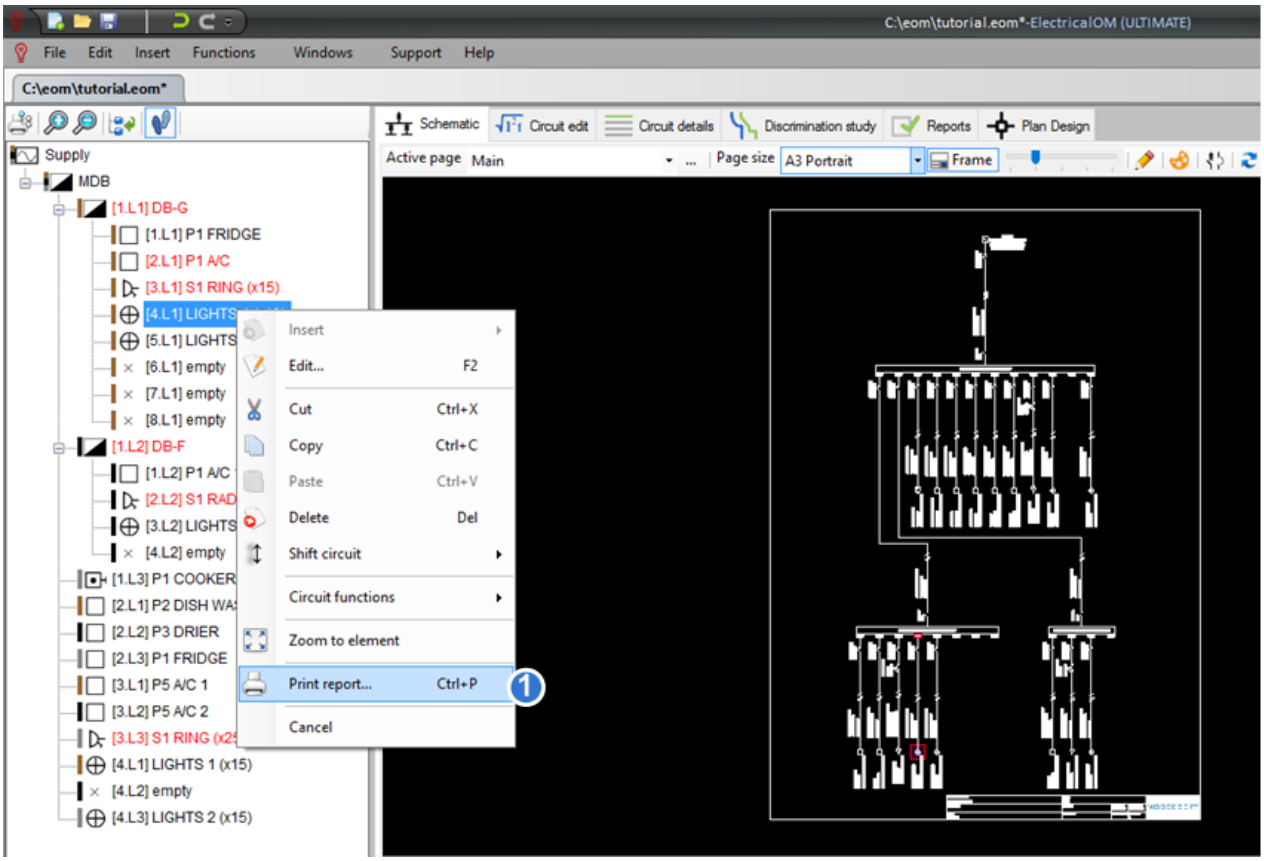

## Print and Export Results

From the reports tab (1) the designer can print calculations summaries and schematics together in one report. The list selection (2) let the user choose which type of output to include in the final report. After choosing the desired types, click the **Generate report** button (3) to create the report. The report can be exported to PDF or RTF format (4) for further editing.

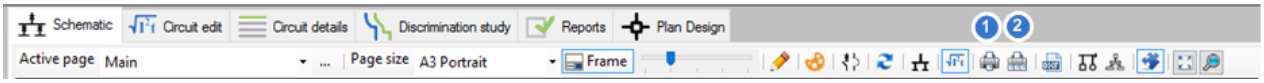



## Print Selected Circuit Report

To print the analytical calculations report of a circuit right click the circuit from the network tree or the schematic and choose **Print report** (1).

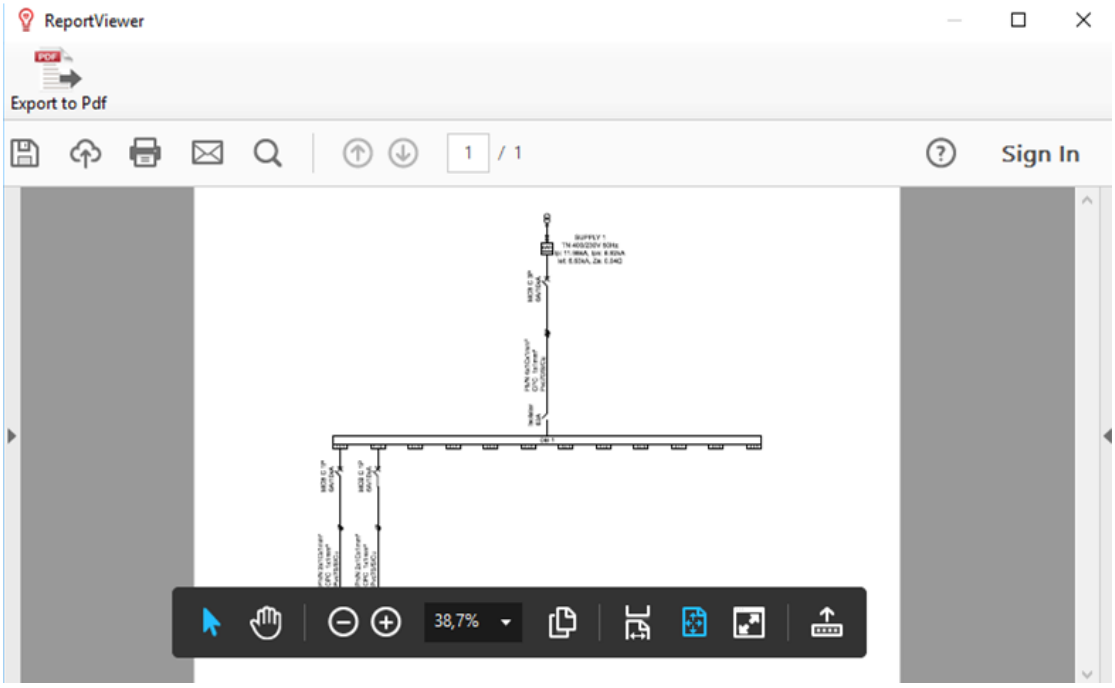



## Print Active Page of Schematic

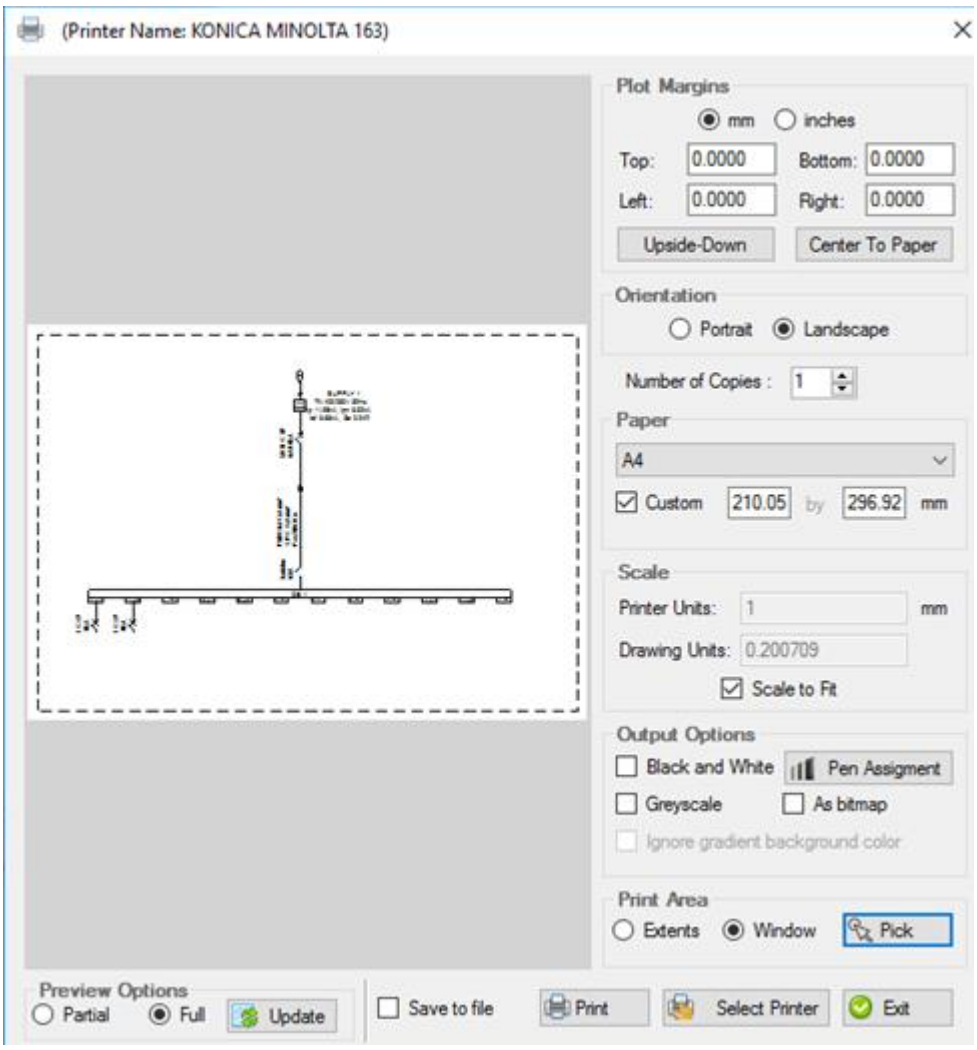



To print the active page press the print button (1). This will show a print preview as in the screen shot

below. Also the user can export the report to PDF file.

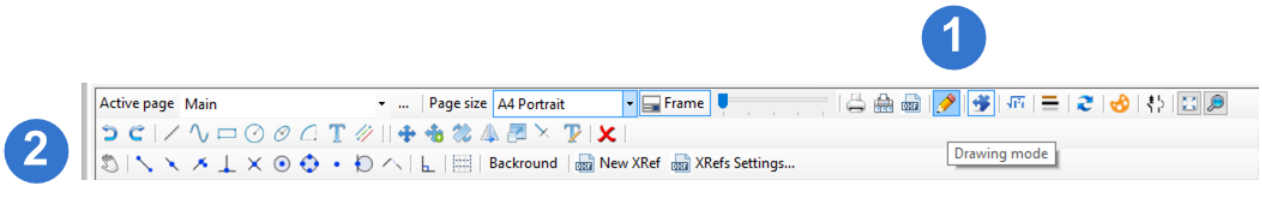



You can also print a part of the active page or change some of the print settings by clicking the print with settings button (2). This will show a form with settings that can be configured as shown below:




## Schematic Drawing Mode

The drawing mode enables the user to draw CAD entities including polylines, rectangles, circles and other figures in the pages of the schematic. Object Snaps, ortho mode and other CAD based functions are also supported during drawing.




To enable drawing mode, click the drawing mode button (1) from the schematic toolbar. Afterward, the drawing mode toolbar will appear (2) with the available tools for drawing. Users with experience in CAD software (like AutoCAD) will find this easy to follow because the drawing commands are very similar.

## Drawing Objects

Objects appearing in the drawing are specified by their geometry.

**1. Line**
A line is specified by two points, the start point and the end point. Lines can be one segment or a series of connected segments, but each segment is a separate line object.

2. **Polyline**
This object is composed of line and arc (bulges) segments.

**3.Rectangle**
A rectangle is defined by two points: the upper left and the lower right corner.

**4.Circle**
A full circle is defined by its center point and its radius.

**5.Ellipse**
An ellipse is determined by its center, and major and minor axes.

**6. Arc**
A circular arc is defined by the center point, the radius, the start angle and the end angle. An arc is always drawn anti-clockwise from the start angle to the end angle. The start point and end point properties of an arc are calculated through the start angle, end angle and radius properties.

**7. Text**
Text can be added to the drawing. The point must be specified where the text will begin. Then the angle of rotation must be specified. After that actual text content can be specified.

**8. Multiline**
Two or more lines in one object.

## Selecting Objects

When you run an edit command you have to select the objects that you want to edit.

There are a few ways to select objects:

- You can click one by one the objects you want to select.
- Crossing method. With this method you have to set a rectangle by setting the two opposite corners of the rectangle. Then all the objects that are included entirely in the rectangle or have an intersection point with the rectangle, will be selected.
- Window method. Similar to the crossing method, but only the objects that are included entirely in the rectangle will be selected.

## Edit Commands

In order to edit designed objects, most often you will run the specified command and then select the objects you want to edit. The same procedure applies when you want to create new objects from one or more drawing objects.

Alternatively, you can choose first the objects and then run the command. However not every command accepts preselected objects. Also not every command accepts multiple selected objects.

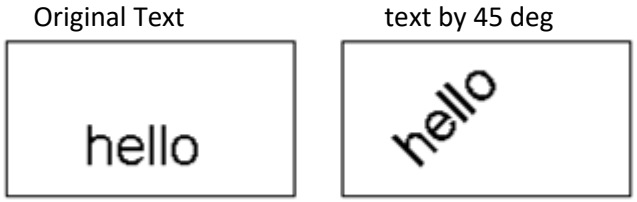

Commands can be used to edit objects in your drawing. For example, you can split a line into two smaller

lines, delete a circle etc. The commands are the following:

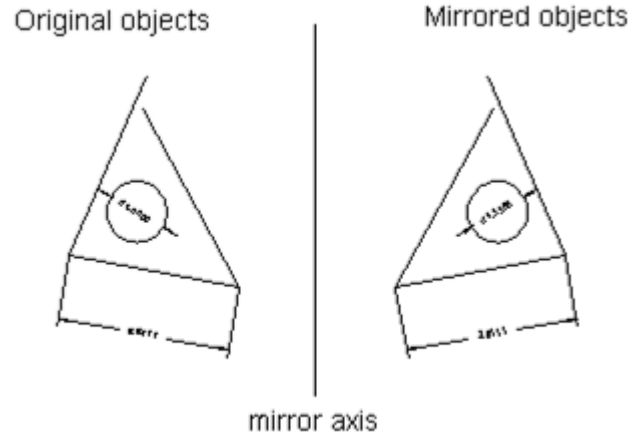
**1. Move**
With the move command you can move one or more drawing objects. After selecting the objects or object, define two points that define the distance and the direction of the movement. The first point defines the beginning of the "movement vector" and the second the end of the vector.

**2. Copy**
With the copy command you can copy one or more objects of the drawing. The user must select the objects to copy, and then the user is prompted to select two points. These two points define the "copy vector" and can either belong to the selected objects or not.The first point specifies the beginning of the "copy vector" and the second point the end of it.

**3. Rotate**
With rotate command you can rotate one or more objects around a base point.
First you have to select the object or objects and then specify the base point.Then you have to select an angle in radians to rotate the object.




**4. Mirror**
Objects can be reflected about an axis defined by the user. First you have to select the objects you want to mirror. Then you have to set the axis, by setting the first point of mirror line and then the second. At this point you have to choose if the source objects will be deleted or not.

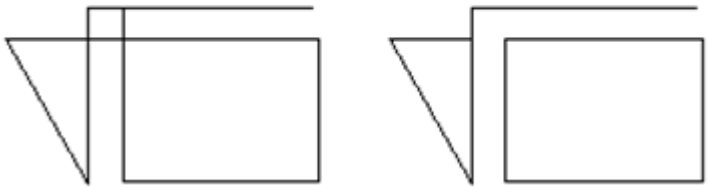



**5. Scale**
With scale command you can increase or decrease the size of one or more objects. First you have to select one or more objects. Then you have to pick one point, which is going to be the base point. Next step is to specify the scale factor.

**6. Trim**
First select the objects that define the cutting edges at which you want to trim an object and then the object. Objects that can be trimmed include arcs, circles, elliptical arcs, lines. Notice that the trim command does not function if the objects do not intersect. At the example below there are some lines that were trimmed.

before trim

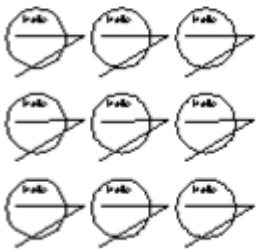
after trim



**7. Array**

Creates multiple copies of objects in an array pattern. The patterns are rectangular array and the polar array. With the rectangular array you can create an array defined by a number of rows and columns of copies of the selected object. First you have to select the objects.Then you have to define number of rows and number of columns of the rectangle, the distance between rows and the distance between columns.

Rectangular array



**8. Extend**

With extend command you can extend lines, arcs, polylines until they intersect with some other object which is used as limit of the extension. First you have to select the objects that constitute the limits of the extension. Then you have to choose a point at an object that you want to extend. If the object you want to extend does not intersect with above objects then nothing will happen.

Before extend

After extending the objects

**9. Text Edit**

With this command, you can edit the text content of a text object.

**10. Erase**

With the erase command you can delete one or more objects of the drawing. If you want to erase multiple objects you have to execute the select method. After the erase command, the objects no longer exist in the document or in the collection they belonged to, however the objects still exist as deleted objects in memory. So with undo command you can get them back to the drawing.

## Undo Redo

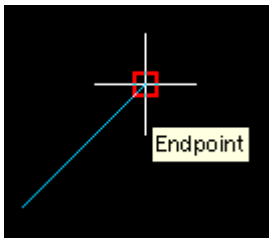

Drawing mode has its own local undo (1) redo (2) stack which is reset after leaving the drawing mode.

## Object Snaps

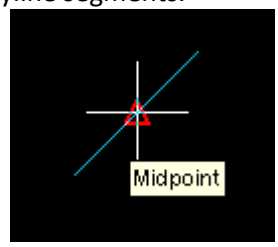
An Object Snap (Osnap) specifies a snap point on some part of an object. An Osnap mode will remain active until you turn it off.


Each Osnap has its own symbol when it is active. The screenshots below show an example of the related Osnap:

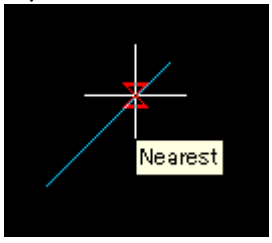
1. **Endpoint:** The Endpoint Osnap snaps to the end points of lines and arcs and to polyline vertices. This is one of the most useful and commonly used Osnaps.



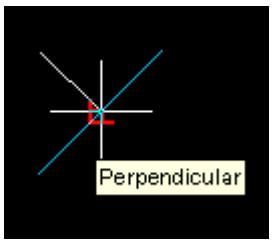

2. **Midpoint:** The Midpoint Osnap snaps to the mid points of lines and arcs and to the midpoint of polyline segments.



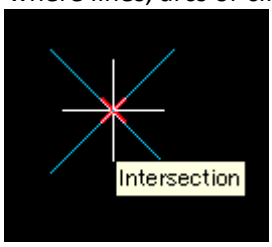

3. **Nearest:** The Nearest Osnap snaps to the nearest point on a drawing object. This Osnap is useful if you want to make sure that a picked point lies on a drawing object but you don't necessarily mind exactly where it is located.



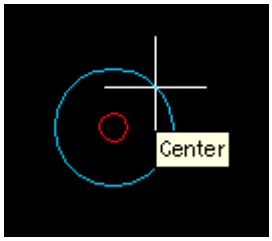

4. **Perpendicular:** The Perpendicular Osnap snaps to a point which forms a perpendicular with the selected object.



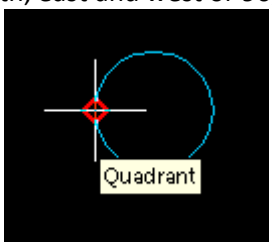

5. **Intersection:** The Intersection Osnap snaps to the physical intersection of any two drawing objects (i.e. where lines, arcs or circles etc. cross each other) and to polyline vertices.



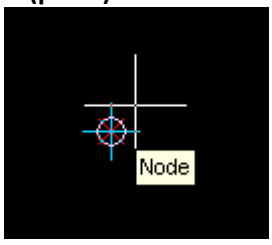

6. **Center:** The Center Osnap snaps to the centre of a circle, arc or polyline arc segment. The cursor must pass over the circumference of the circle or the arc so that the centre can be found.



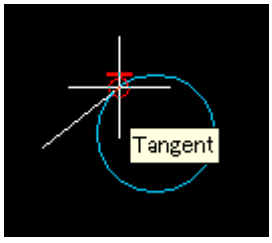

7. **Quadrant:** The Quadrant Osnap snaps to one of the four circle quadrant points located at north, south, east and west or 90, 270, 0 and 180 degrees respectively.



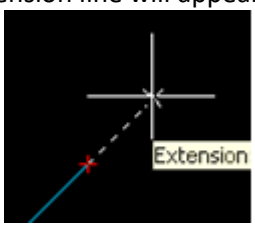

8. **Node (point):** The Node Osnap snaps to the center of a Point object.




9. **Tangent:** The Tangent Osnap snaps to a tangent point on a circle. This Osnap works in two ways. You can either draw a line from a point to the tangent point or you can draw a line from a tangent point, the latter is referred to as the "Deferred Tangent" snap mode.

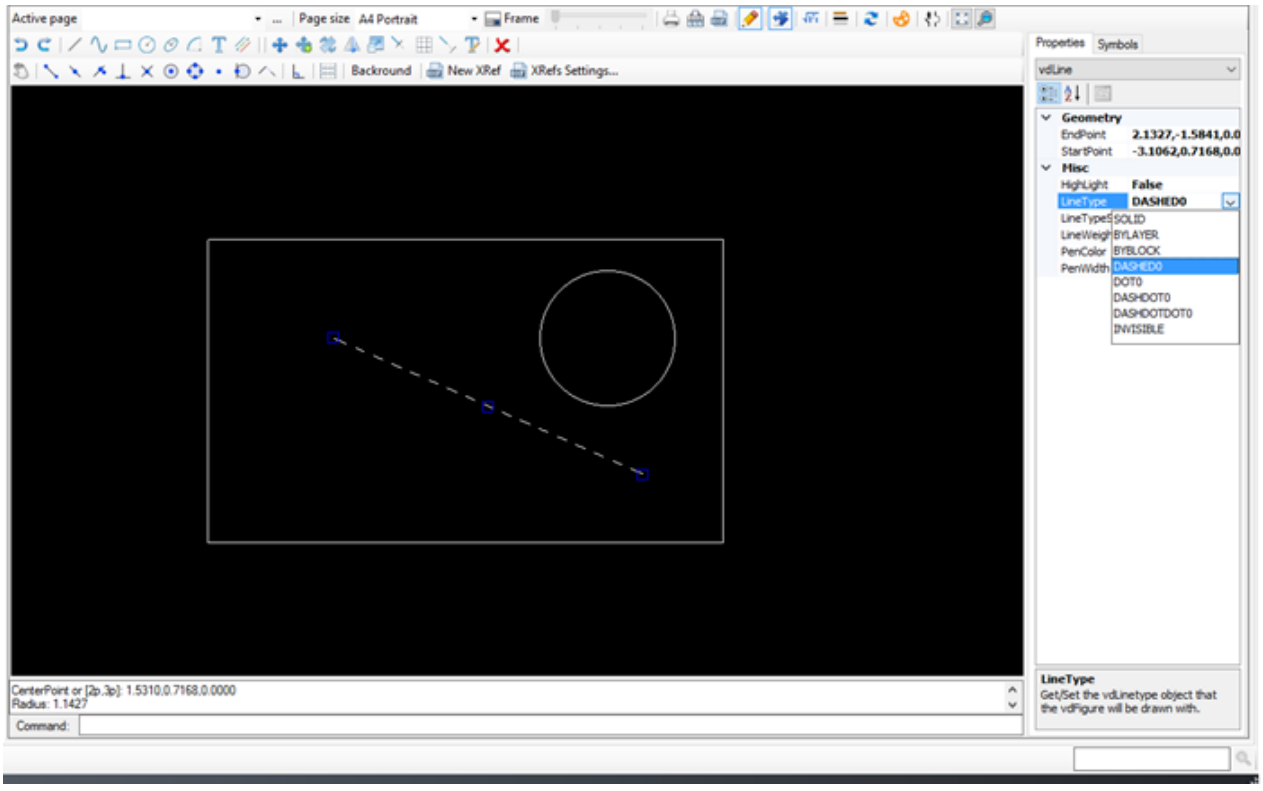


10. **Extension:** When the Extension Osnap is enabled and a user is passed over a line or arc temporary Osnaps are added that are used to get a point on the extension of those segments. If the extension of the two segments intersects, the user is getting the intersection of those segments. In particular, when the cursor passes over an entity then little crosses appear that indicate that the extension of this object is available. If the extension of a line or an arc is enabled (by passing the cursor over this object) then the user can move the cursor close to the extension of this object. At that time the extension line will appear providing also intersection extensions of multiple objects.

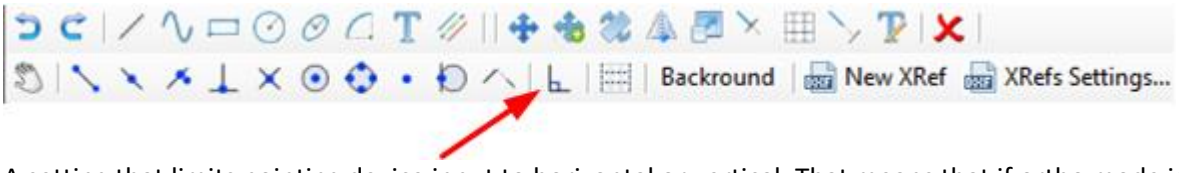



## Object Properties

When selecting an object its properties appear at the properties tab. From the properties tab the user can change several properties of an object such as the line type, the pen color, the pen width etc. The screen shot below shows an example how to change the line type property of the selected line object.




## Ortho Mode




A setting that limits pointing device input to horizontal or vertical. That means that if ortho mode is on and you want to draw for example one line , this line will be parallel to x or y axis.

Pan


With Pan command you can shift the location of your view. Also by pressing the mouse middle button activates the pan command. Like panning with a camera, pan does not change the location or magnification of objects on your drawing; it changes only the view. Pan command is a transparent command. Transparent commands are commands that can be invoked when another command is active.

## Calculations and Checks

This section describes the major calculations with the corresponding checks performed by ElectricalOM Software:



## Design Current and Current Carrying Capacity Calculations

**Design Current and Calculation of the Minimum Required Value of the Cable's Current Carrying Capacity**

$(I_b \text{ and } min\ I_z)$

**Checks**

$$I_b \leq I_n$$
$$min\ I_z \leq I_t$$

General

$$min\ I_z = \frac{I_n}{CorrectionFactors}$$

For ring socket circuit with In = 30A or 32A

$$min\ I_z = \frac{20}{CorrectionFactors}$$

Ring socket circuits otherwise

With:

| | |
|---|---|
| $I_b$ | the design current of the circu under consideration in Amper |
| $I_n$ | the nominal current or curren of the protective device prote the circuit against overcurrent Amperes |
| $min\ I_z$ | the minimum required value c cable's current carrying capaci |

$$min\ I_z = \frac{I_n \cdot 0.625}{CorrectionFactors}$$

Grouped circuits not liable to simultaneous overload

$$min\ I_z = max\left\{\frac{I_b}{C_g}, \sqrt{{I_n}^2 + 0.48 \cdot I_b \cdot \frac{1 - {C_g}^2}{{C_g}^2}}\right\}$$

General motor circuits

$$min\ I_z = \frac{OL}{CorrectionFactors}$$

Star-Delta Motor Circuits

$$min\ I_z = \frac{OL/\sqrt{3}}{CorrectionFactors}$$

With:

$$CorrectionFactors = C_a \cdot C_i \cdot C_g \cdot C_c \cdot C_d \cdot C_s \cdot C_h \cdot C_f$$

| | |
|---|---|
| $I_b$ | the design current of the circuit under consideration in Amperes |
| $I_n$ | the nominal current or current setting of the protective device protecting the circuit against overcurrent in Amperes |
| $min\ I_z$ | the minimum required value of the cable's current carrying capacity |
| $I_t$ | the value of current tabulated in cable tables |
| $C_a$ | Correction factor for ambient temperature |
| $C_i$ | Correction factor for thermal insulation |
| $C_g$ | Correction factor for grouping |
| $C_f$ | Correction factor for using BS3036 |
| $C_c$ | Correction factor for ground installations |
| $C_d$ | Correction factor for underground installation depth |
| $C_s$ | Correction factor for ground soil thermal resistivity |
| $C_s$ | Correction factor for triple harmonic currents |
| $OL$ | Motor starter overload. By default $OL = I_b$ |

**Busbar Trunking System notes:** With protection using a gG (gI) fuse an additional correction factor, equal to 1.1, is used. Note that using gI fuses for protection means reducing the busbar trunking's allowable current.

## Voltage Drop Calculation

### Voltage Drop Calculation $(V_d)$

**For single phase circuits:**

$$\frac{I_b \cdot (C_t \cdot \cos\varphi \cdot \langle mV/A/m \rangle_r + \sin\varphi \cdot \langle mV/A/m \rangle_x) \cdot L}{1000}$$

**For three phase circuits:**

### Voltage Drop Limits Check

The software checks that the total voltage drop (between the origin of the installation and the circuit) is in the voltage drop limit set.

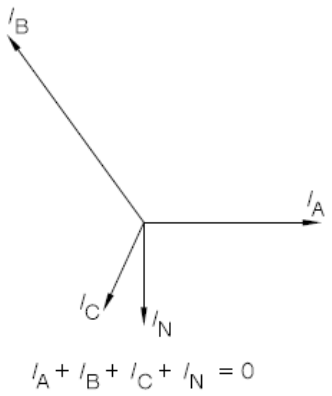
The voltage drop limits can be user defined or according to Table 4Ab in Appendix 4 of BS7671.

$$\frac{I_b \cdot \left(C_t \cdot \cos\varphi \cdot \frac{\langle mV/A/m\rangle_r}{\sqrt{3}} + \sin\varphi \cdot \frac{\langle mV/A/m\rangle_x}{\sqrt{3}}\right) \cdot L}{1000}$$

With:

| | |
|---|---|
| $I_b$ | the design current of the circuit under consideration in Amperes |
| $\langle mV/A/m\rangle_x$ | the tabulated resistance/reactance of the conductor taken from the tables 4D1B–4J4B of BS 7671 |
| $\cos\varphi$ | the power factor of the load of the circuit |
| $C_t$ | the temperature correction factor (according to BS 7671 Appendix 4) |
| $L$ | the circuit length in meters |

**Note:** For unbalanced 3 phase circuits, current will be flowing in the neutral conductor as illustrated in the phasor diagram below. The voltage drop in each phase is calculated by summing of the vectors of the phase and the neutral voltage drops.




## Maximum Phase Fault Current Calculation

**Maximum Phase Fault Current Calculation** $(max\ I_{sc})$

The total impedance is the sum of the impedances of the conductors from the origin of the installation to the circuit under consideration. For single phase circuits, the maximum fault current is between the phase and the neutral and in three phase circuits it is when all phases are shorted (symmetrical current). The total impedance is that with operating temperature 20oC (lower temperature means lower resistance).

In particular:

**For single phase circuits:**

**Protective Device Breaking Capacity Check**

The software acts according to regulation (434.5.1), to check the Breaking Capacity of the protective device:

$$I_{cu} > max\ I_{sc}$$

$$I_{sc} = \frac{C_{max} \cdot U_{ph}}{Z_e + Z_1^{20°C} + Z_N^{20°C}}$$

**For three phase circuits:**

$$I_{sc} = \frac{C_{max} \cdot U_{ph}}{Z_e + Z_1^{20°C}}$$

With:

| | |
|---|---|
| $U_{ph}$ | the phase to neutral voltage |
| $Z_x^{20°C}$ | the impedance corrected at 20 oC |
| $Z_1$ | the impedance of the phase conductor |
| $Z_N$ | the impedance of the neutral conductor |
| $Z_e$ | the external impedance (from the starting point of the circuit up to the origin of the installation) |
| $C_{max}$ | The voltage factor Cmax is to take into account the worst case voltage variations conditions in a low voltage installation, specified in BS EN 60909 as 1.1 (optional factor) |

## Minimum Phase Fault Current Calculation

### Minimum Phase Fault Current Calculation $(min\, I_{sc})$

The type of the circuit will determine how the minimum phase fault current will be calculated. It is done according to IET Electrical Guidance Note 1, using the factors in Table E2 to calculate the maximum impedance of the conductor.

**Single phase circuits:**

$$I_{sc} = \frac{C_{min} \cdot U_{ph}}{Z_e + Z_1 + Z_N}$$

**Three phase and Neutral circuits:**

$$I_{sc} = \frac{C_{min} \cdot U_{ph}}{Z_e + Z_1 + Z_N}$$

**Three phase (without neutral) circuits:**

### Adiabatic Check of the Phase Conductor During Phase Fault

The Software acts according to regulation (434.5.2), in order make the adiabatic check i.e whether or not the heat energy $(I^2t)$ flowing during the time taken for the protective device to trip, exceeds the conductor withstand $(k^2S^2)$.

$$t = \frac{k^2 \cdot S^2}{I^2}$$

With:

| | |
|---|---|
| *t* | the maximum permissible disconnection time in seconds |
| *k* | the cable factor |
| *S* | the cross sectional area of the conductor mm2 |
| *I* | the minimum phase fault curre |

$$I_{sc} = \frac{C_{min} \cdot U_{ph-ph}}{2 \cdot (Z_e + Z_1)}$$

With:

| | |
|---|---|
| $U_{ph}$ | the phase to neural voltage |
| $U_{ph-ph}$ | the phase to phase voltage |
| $Z_1$ | the impedance of the phase conductor |
| $Z_N$ | the impedance of the neutral conductor |
| $Z_e$ | the external impedance |
| $C_{min}$ | The voltage factor Cmin is to take into account the worst case voltage variations conditions in a low voltage installation, specified in BS EN 60909 as 0.95 (optional factor) |

The software compares the maximum permissible disconnection time with the time taken from the time-current curve of the protective device at the phase fault to find if the adiabatic check stands.

**Note:** For disconnection times less than 0.1 sec, the software checks for available Let-Through energy characteristics of the protective device at the calculated fault current and uses them during the adiabatic check.

## Earth Fault Current Calculation

**-Earth Fault Current Calculation $(I_{ef})$**

**TT Earthing System:**

$$I_{ef} = \frac{C_{min} \cdot U_{ph}}{Z_d + Z_a + Z_1 + Z_2}$$

With:

| | |
|---|---|
| $U_{ph}$ | the phase to neutral voltage |
| $Z_d$ | the impedance of the supply |
| $Z_a$ | the impedance of the earthing electrode |
| $Z_1$ | the impedance of the phase conductor |
| $Z_2$ | the impedance of the CPC |
| $C_{min}$ | The voltage factor Cmin is to take into account the worst case voltage variations conditions in a low voltage installation, specified in IEC 60909 as 0.95 |

**TN Earthing Systems:**

**Adiabatic Check of the Protective Conductor During Earth Fault**

The software, in accordance with regulation (543.1.3), makes use of the earth fault current, together with the operating time that has been found from the time-current curve of the protective device, in order to obtain a lower bound on the cross-sectional area of the protective conductor (CPC):

$$S_{min} = \frac{\sqrt{I^2 \cdot t}}{k}$$

With:

| | |
|---|---|
| $S_{min}$ | the minimum cross-sec the protective conduct |
| $k$ | the cable factor |

If the operating time is less than 0.1 sec, then

| | |
|---|---|
| $I^2t$ | Is the let-through ene characteristic of the p device |

$$I_{ef} = \frac{C_{min} \cdot U_{ph}}{Z_e + Z_1 + Z_2}$$

With:

| | |
|---|---|
| $U_{ph}$ | the phase to neutral voltage |
| $Z_e$ | the exterior impedance |
| $Z_1$ | the impedance of the phase conductor |
| $Z_2$ | the impedance of the protective CPC |
| $C_{min}$ | The voltage factor Cmin is to take into account the worst case voltage variations conditions in a low voltage installation, specified in IEC 60909 as 0.95 |

Otherwise,

| | |
|---|---|
| *I* | is the earth fault curr |
| *t* | is the operating time the time-current curv protective device |

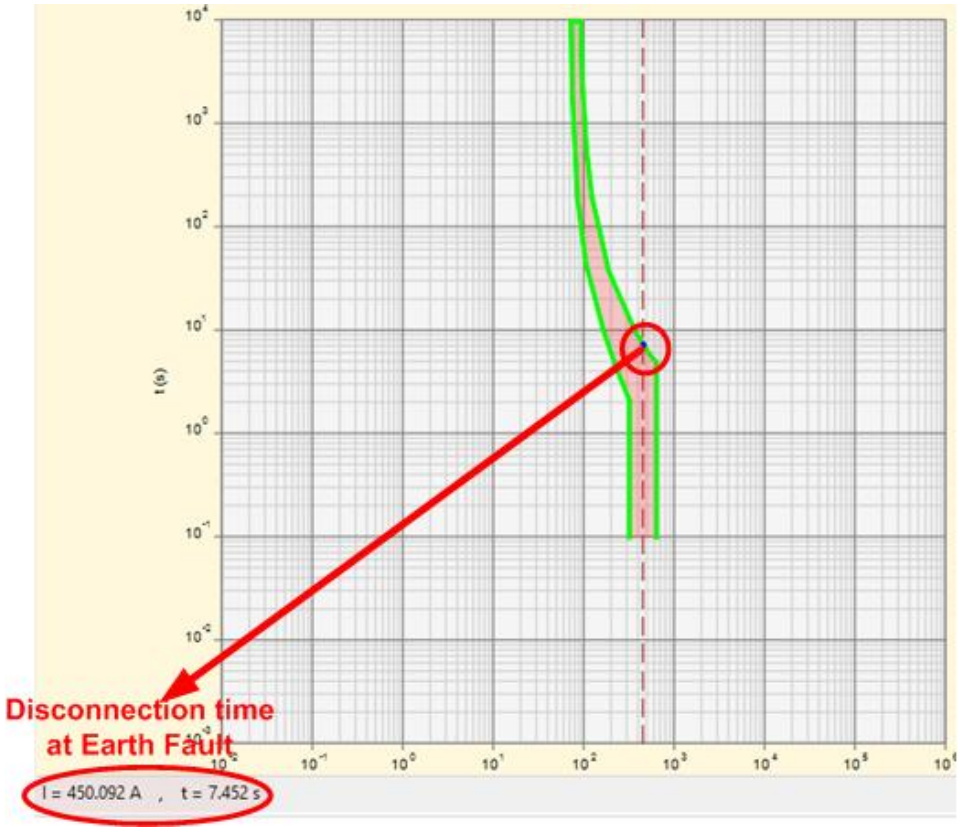
Note: If the protective device is an RCD or RCCB, then the software makes the check using for t the operating time of the RCD or RCCB.

**Note:** Impedances under fault conditions are calculated in accordance with Guidance Note 1: Table E2.

## Protective Device Disconnection Time at Earth Fault

**Protective Device Disconnection Time in the Event of Earth Fault**

The maximum permitted disconnection time in the event of earth fault is determined by the time-current curve of the protective device. This can be examined in detail in the Discrimination Study Module, shown below:




**Maximum Permitted Disconnection Time in the Event of Earth Fault**

The maximum permitted disconnection time during earth fault is compared to the disconnection time calculated during earth fault.

## Calculation of Touch Voltage

### Calculation of the Touch Voltage Limit $(U_t)$

**TT Earthing System, with RCD:**

$$U_T = I_{\Delta N} \cdot Z_A$$

**TT Earthing System, without RCD:**

$$U_T = I_a \cdot Z_s$$

**TN Earthing Systems:**

$$U_T = I_{\Delta N} \cdot Z_s$$

With:

$Z_A = Z_a + Z_2$

$Z_s = Z_e + Z_1 + Z_2$

And with:

| | |
|---|---|
| $I_{\Delta N}$ | the nominal sensitivity of the RCD |
| $I_a$ | the current causing the operation of the protective device at the maximum time threshold |
| $Z_e$ | the external impedance |
| $Z_a$ | the impedance of the earthing electrode |
| $Z_1$ | the impedance of the phase conductor |
| $Z_2$ | the impedance of the protective conductor |

### Verification of the Touch Voltage Limit

The software, in accordance with regulation 411.5.3, verifies that the touch voltage does not surpass the allowable limit:

$$U_t \leq max\, U_t$$

Where:

| | |
|---|---|
| $max\, U_t$ | is the maximum touch voltage been defined by the user |

Note:

| | |
|---|---|
| $max\, Z_A$ | For TT earthing system, the s calculates this value in order check for touch voltage. |

Note:

$Z_A$ *is usually identified with* $R_A$

$Z_A = Z_a + Z_2$

The value of $Z_A$ is verified that is less than 200 Ω, as recommended in the ON SITE GUIDE, Section 10.3.5.

## Maximum Earth Fault Loop Impedance Calculation

### Maximum Earth Fault Loop Impedance Calculation $(max\, Z_s)$

The calculation of max Zs is made in order to verify that the protective device functions within time limits during earth fault.

The maximum impedance during earth fault, max Zs, is calculated from the time-current curve of the protective device.

After the user has defined the protective device's operating time limits during earth fault, the software finds from the time-current curve of the protective device the corresponding current ImaxZs, and calculates max Zs, as below:

### Maximum Earth Fault Loop Impedance Check

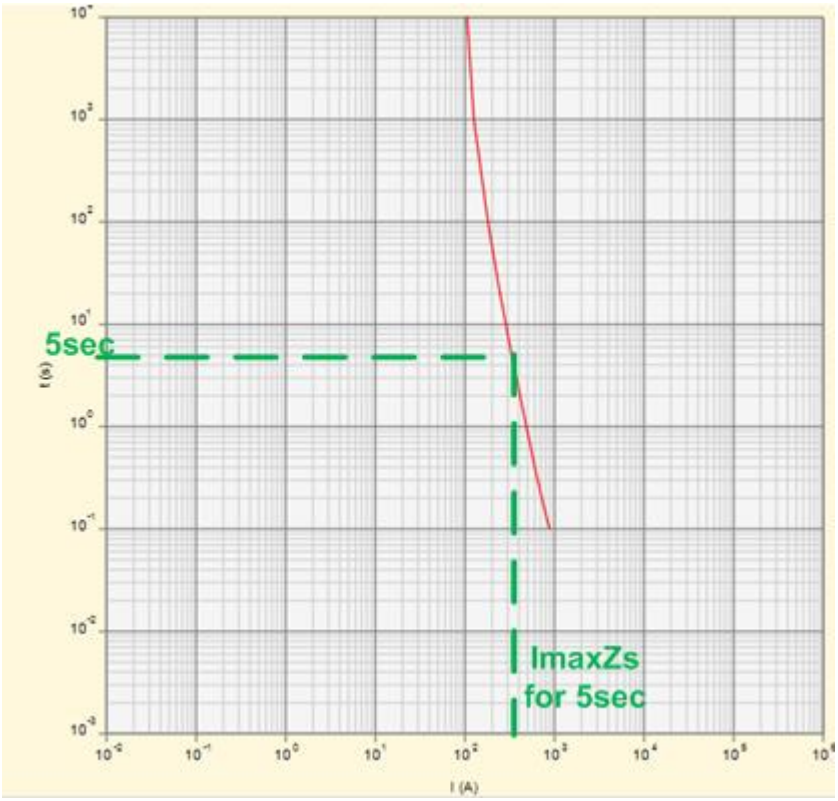
$Z_s \leq max\, Z_s$

with:

$Z_s = Z_e + Z_1 + Z_2$

where

| | |
|---|---|
| $Z_e$ | the external impedan |
| $Z_1$ | the impedance of the conductor, |
| $Z_2$ | the impedance of the conductor. |




**Note:** For TT Systems Zs includes also the impedance of the earthing electrode.

$$maxZs = \frac{Uo\ x\ Cmin}{I_{maxZs}}$$

where:

| | |
|---|---|
| *Uo* | The nominal ac rms line voltage to Earth in volts (V) , |
| *Cmin* | The minimum voltage factor to take account of voltage variations. Cmin = 0.95 |
| $I_{max\,Z_S}$ | The current causing the operation of the protective device at the maximum time threshold, calculated from the time-current curve of the device. |

## Short-Circuit Maximum Peak Value for Busbar Trunking Systems

**Short-circuit Maximum Peak Value for Busbar Trunking Systems**

The permissible peak current, peak I, of the Busbar Trunking System must be greater than the peak value of the assumed asymmetrical short-circuit current, asymm. Isc.

The value of the asymmetrical short-circuit current is obtained from the value of the symmetrical short-circuit current, Isc, multiplied by a standardized asymmetry factor (k).

The first value of the 1st short-circuit asymmetry peak in the transient state is the one that is taken into account.

**Standardized table for calculating the asymmetrical short-circuit**

| Isc: assumed symmetrical short-circuit kA (rms value) | Assymetric factor k |
|---|---|
| 4.5 ≤ I ≤ 6 | 1.5 |
| 6 < I ≤ 10 | 1.7 |
| 10 < I ≤ 20 | 2.0 |
| 20 < I ≤ 50 | 2.1 |
| 50 < I | 2.2 |

Reference: Coordination and protection of busbar distribution - Schneider Electric

## Transformer short circuit fault current calculation

The transformer fault level calculator assumes that the transformer is supplied from an infinite bus. In other words, the fault level on the primary side of the transformer is considered to be infinite. Note that this assumption will give the worse case fault level on the secondary side of the transformer, which is sufficient for sizing of equipment according to fault rating.

**Parameters:**

- **Transformer rating (S):** Rating in kVA.
- **Voltage rating (V):** Voltage rating of the secondary windings.
- **Impedance (*Z*%):** Per-unit impedance of the transformer in %. Typically 4% to 10%.

The transformer short circuit current is calculated as follows:
Ip (kA) = (*S*×100)/ (√3×*V*×*Z*%)

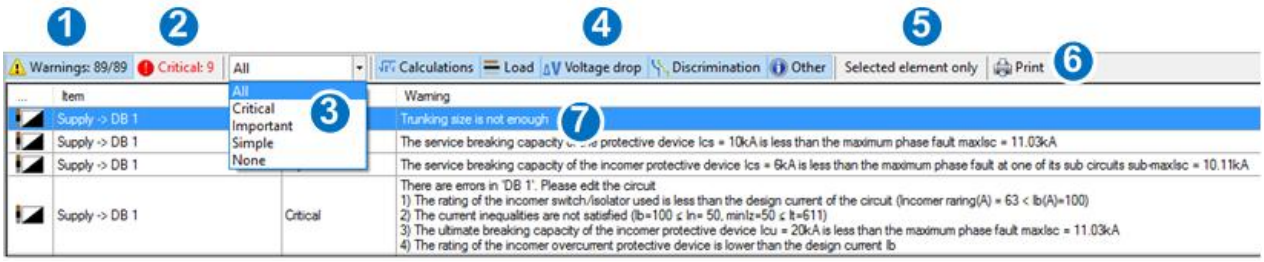
## References

**References**


1. BS 7671
2. IET on Site Guide BS 7671
3. IET Electrical Guidance Notes 1-8
4. IET ELECTRICAL INSTALLATION DESIGN GUIDE 3nd Edition
5. CENELEC - TR 50480


# Warnings Environment

Problems with the current implementation of the model are indicated in the Warnings Environment.



The  warnings environment can be filtered easily, so that the engineer can focus on warnings of a particular type, or so that only the warnings associated with the selected circuit appear. The environment gives the user the option of filtering warnings by severity (critical, important, simple) (3)  and/or the type (load, voltage drop, discrimination, other) (4). The user can choose to display only the warnings associated with the node that is selected in the tree view, by clicking on the **Selected element only** (5) option.

The total number of warnings is given by (1). The total number of critical warnings is given by (2).

Each of the warnings appearing in the list (7) indicates the originating circuit, the severity of the problem, and is accompanied by a brief description. With a double-click on a particular warning the user is brought to the configuration of the originating circuit to make changes and resolve the problem. Also the engineer is able to print the warnings list by clicking the **Print** button (6). Note that an element that has a warning associated with it is marked in red in the tree network view.

Warnings are grouped into three severity categories: Critical, Important and Simple.



## Critical

Critical warnings are those that have to be resolved. The user will not be able to move forward to the completion of the study if critical warnings are outstanding. These warnings have primarily to do with errors found by checks to the model, and for project configurations out of compliance with regulation.

[UPS Power Rating Check]

[Transfer Switch Load Rating Check]

[Source Load Capacity Check]

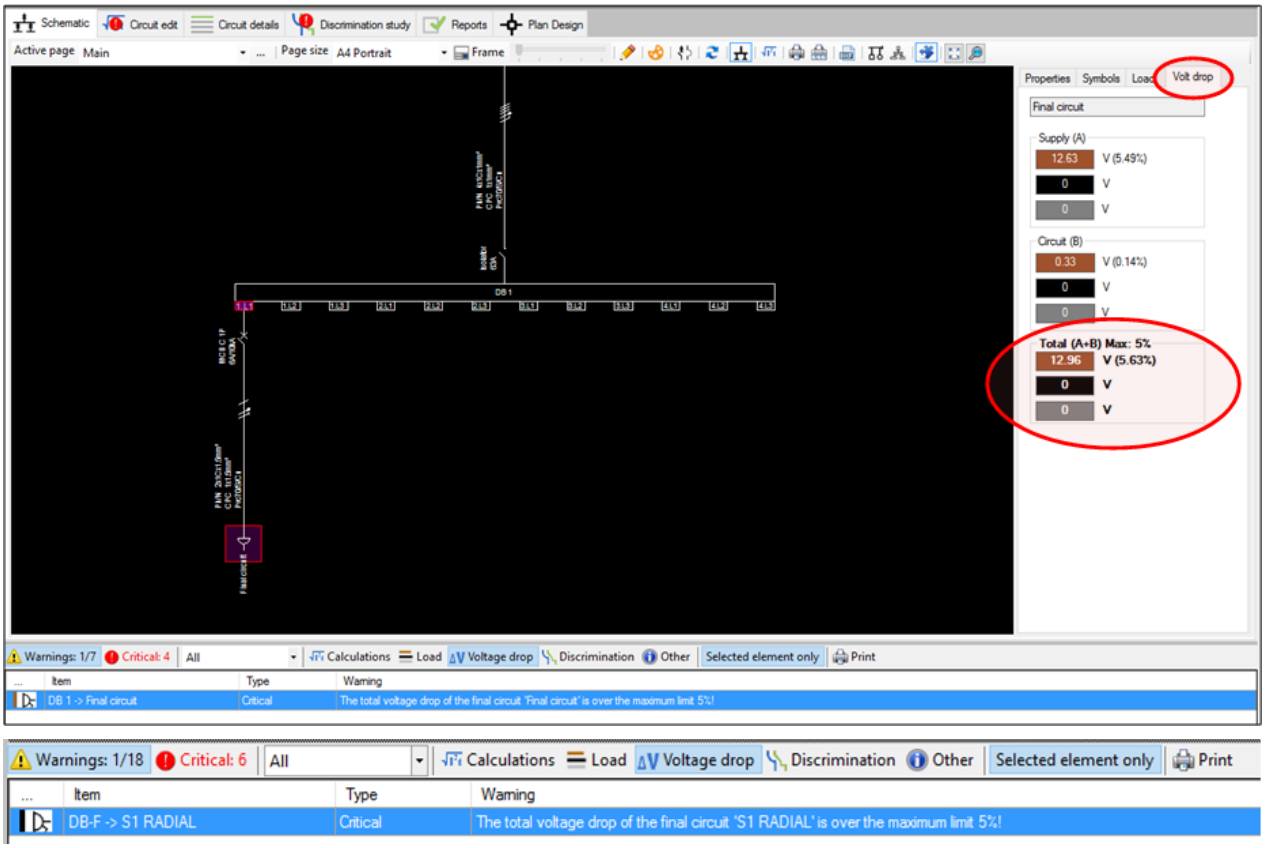
[Source Earthing Conductor Adiabatic Check]

## Voltage Drop Check

Voltage drop warnings will appear when the voltage drop between the Main Supply and a downstream circuit exceeds the voltage drop limit. To correct the problem, reconsider the cable sizes of the offending circuit, or the cable sizes of circuits upstream from it. Values that affect the voltage drop calculation are the design current ($I_b$), the circuit length and the cable size. The power factor and other correction factors such as circuit grouping and ambient temperature also take part in the voltage drop calculation. Note that you can change the voltage drop limit for each circuit under the **Volt drop** tab in the circuit editor.

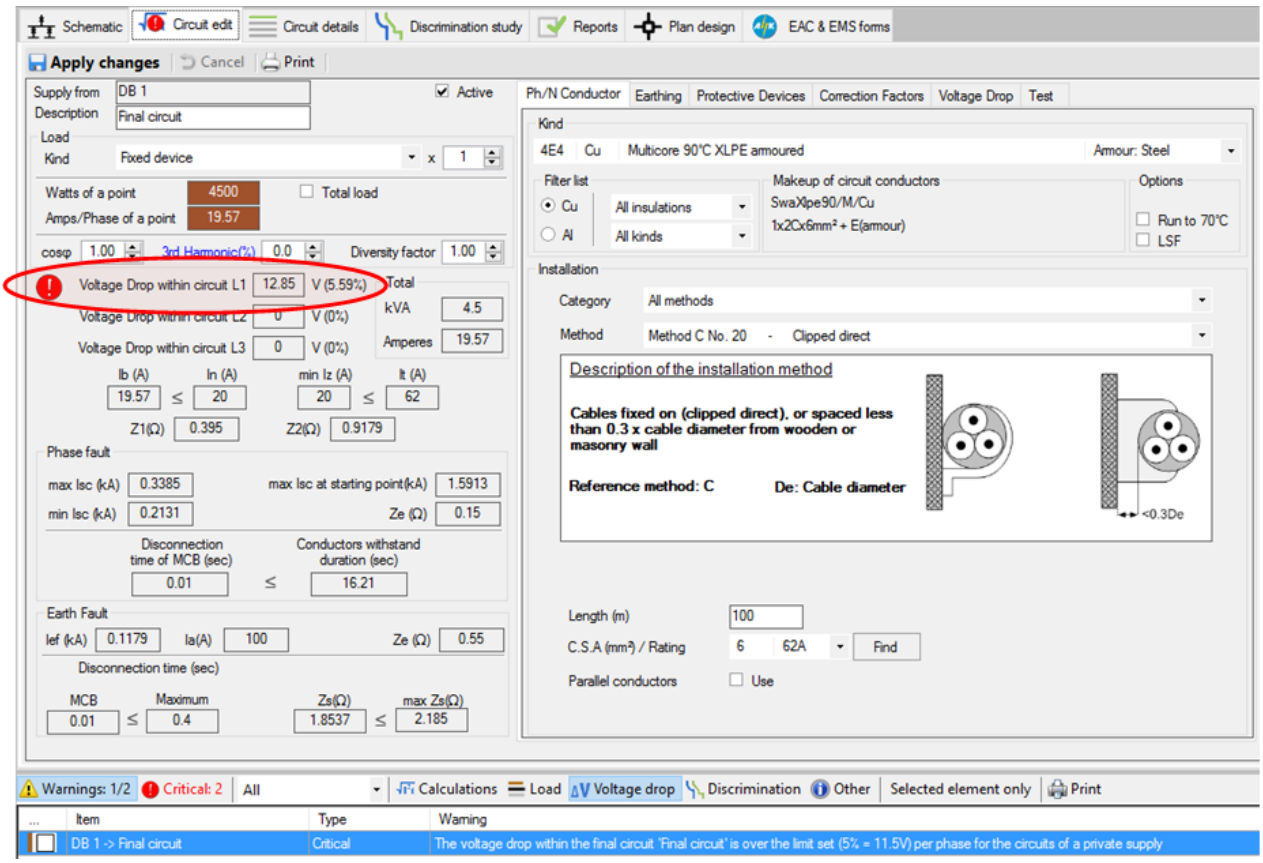
[See the Voltage drop calculations]

To examine the voltage drop calculations go to the Volt drop tab at the properties area as shown below:




## Voltage Drop Within Final Circuit for a Private Supply

When the voltage drop limits selected during the main source editing are for a private low voltage supply, the software checks the voltage drop within a final circuit according to Table 4Ab in Appendix 4 of BS7671:2008 + A3:2015.



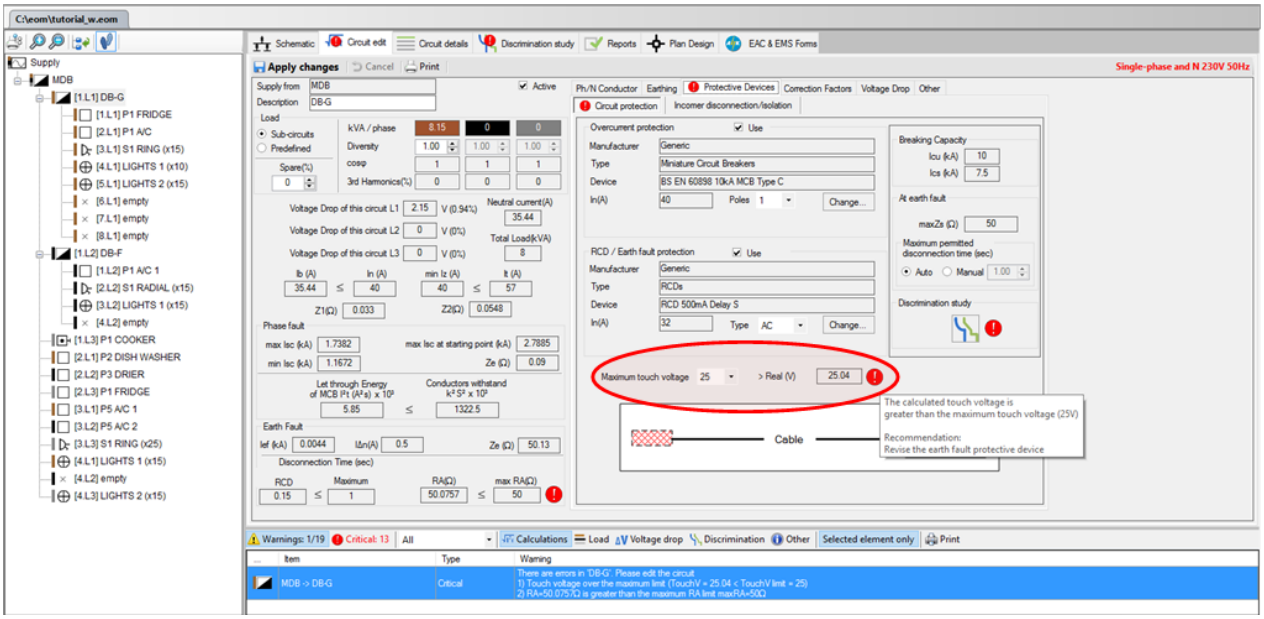

## Touch Voltage Limit Check

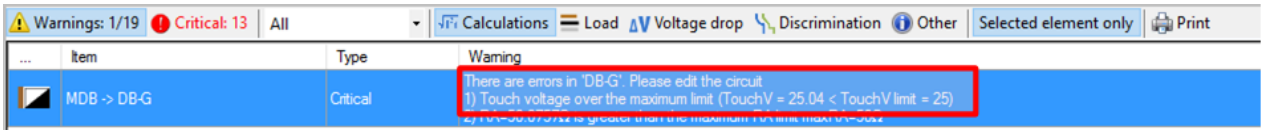
The touch voltage is used to determine the magnitude of the voltage to which the person at risk would be subjected in the event of an earth fault occurring in an installation. By assuming values of body resistance, the touch voltage concept can be extended to give an indication of the severity of the electric shock that could be experienced by that person.

The connection of all exposed- and extraneous-conductive-parts, either directly or indirectly, to a common terminal, i.e. the main earthing terminal of the installation, leads to the creation of touch voltages in the event of an earth fault and hence to the shock risk. In a correctly designed and erected electrical installation such a shock risk is not eliminated. Where the protective measure is automatic disconnection of supply then in the event of an earth fault, the speed of disconnection should be such that should the person at risk experience an electric shock it will not be a harmful one.

In order to resolve touch voltage warnings, it recommended that the engineer revise the CPC or the protective device. It is also recommended that the user make sure that the upstream circuits have been set correctly.

[See the touch voltage calculations]





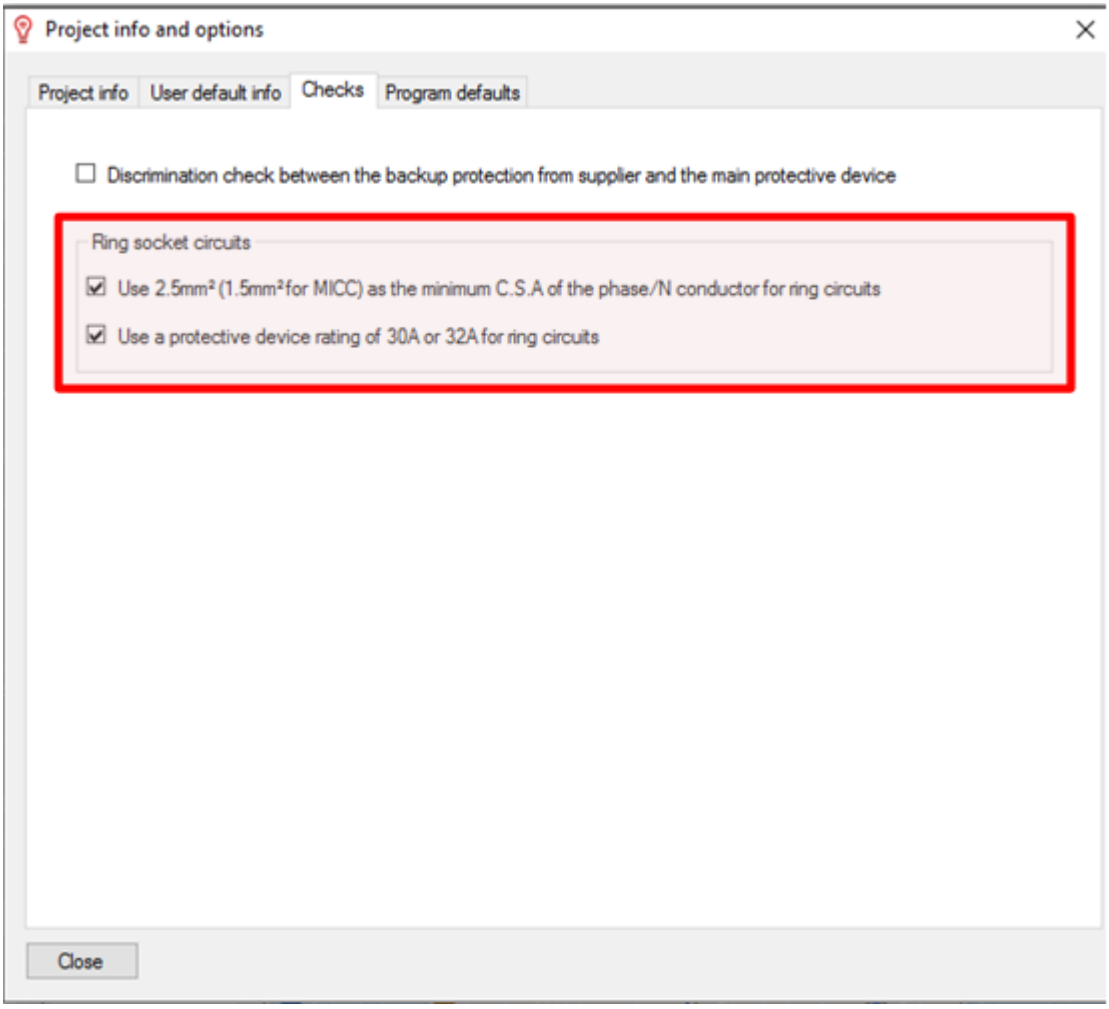

## Ring Sockets

For ring sockets, special check settings that consider the cross sectional area of the phase and neutral conductor and the protective device rating are applied by default. The designer can omit these checks through the project info and options, under the **Checks** tab, as shown below.

**Checks related to ring socket circuits:**

Protective device rating check

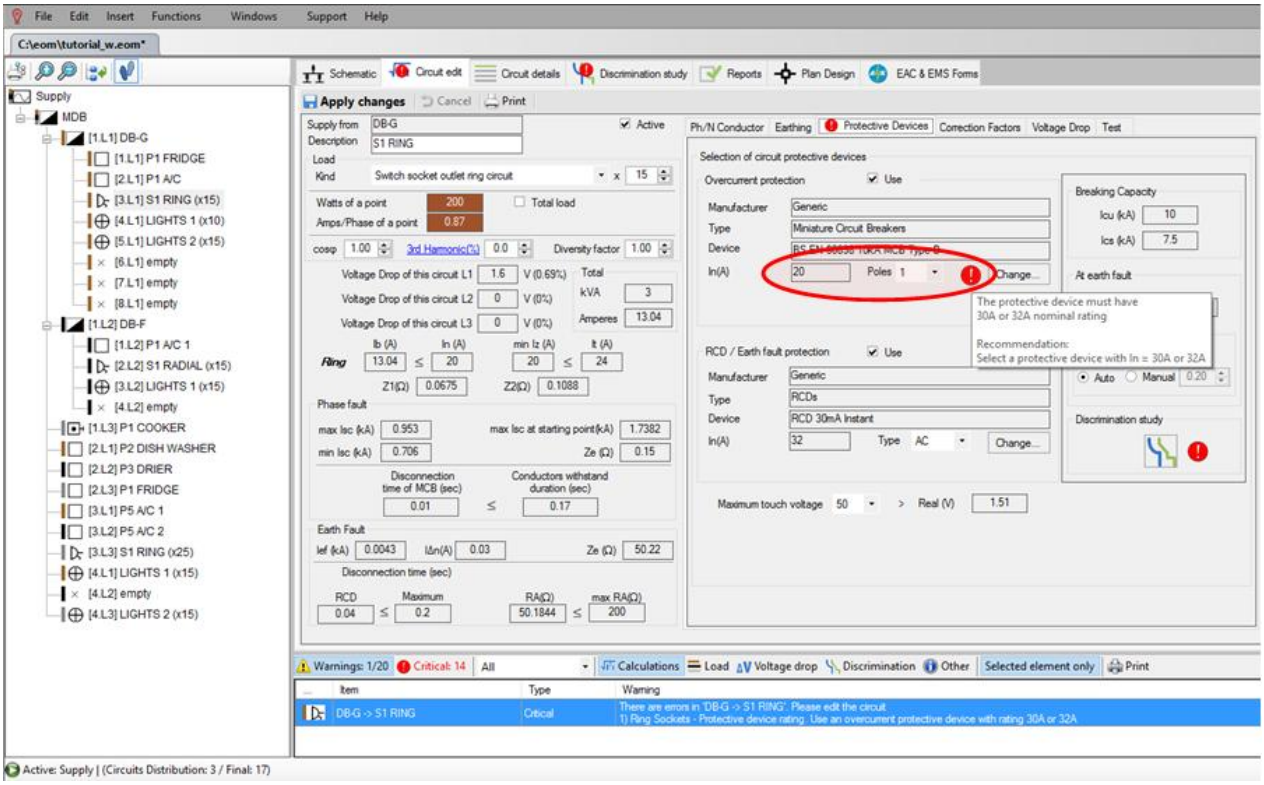
Ph/N conductor C.S.A check




## Protective Device Rating Check

Ring sockets require 30A or 32A protective device. To bypass the check and accept any rating see the ring sockets check options.

**Recommendation to resolve the error:**
Use a  30A or 32A protective device.

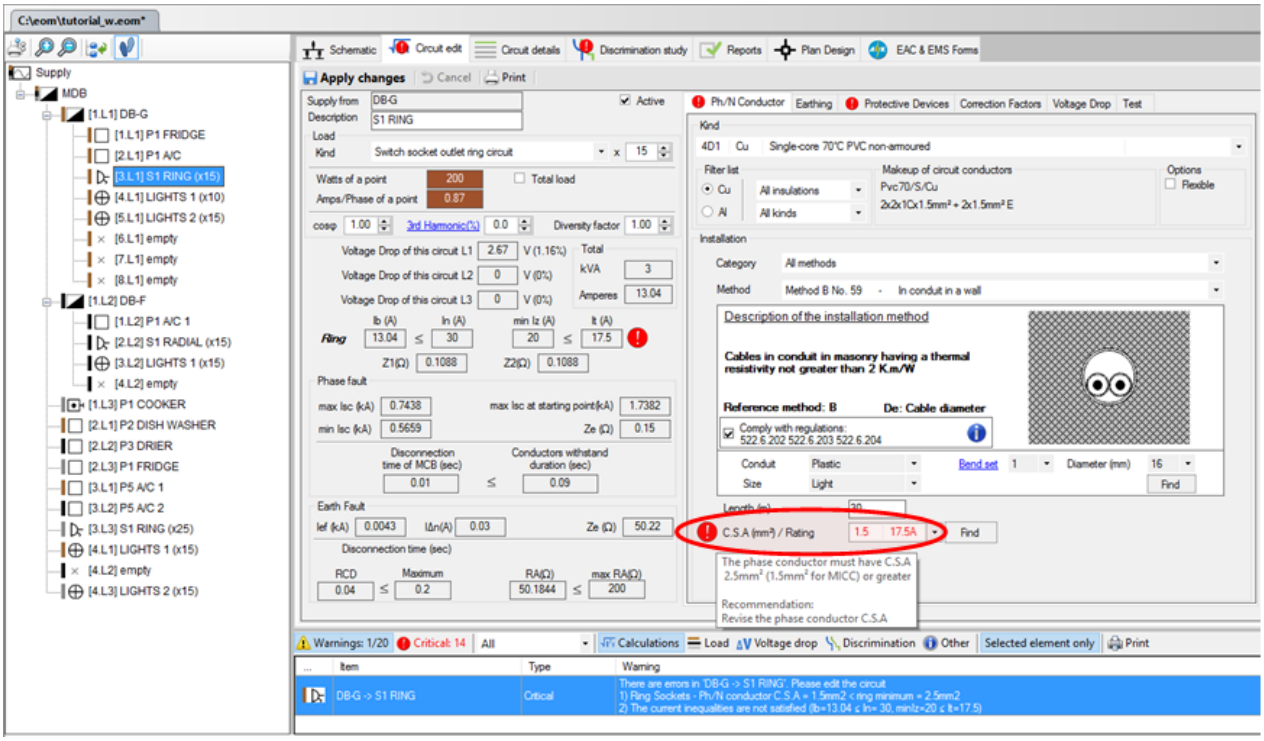




## Ph/N Conductor C.S.A Check

Ring sockets require 2.5mm$^2$ phase conductor (or 1.5mm$^2$ for MICC). To bypass the check and accept any rating see the ring sockets check options.

**Recommendation to resolve the error:**
Use a 2.5mm$^2$ phase conductor (or 1.5mm$^2$ for MICC).




## RCD Device Required for Circuit Check

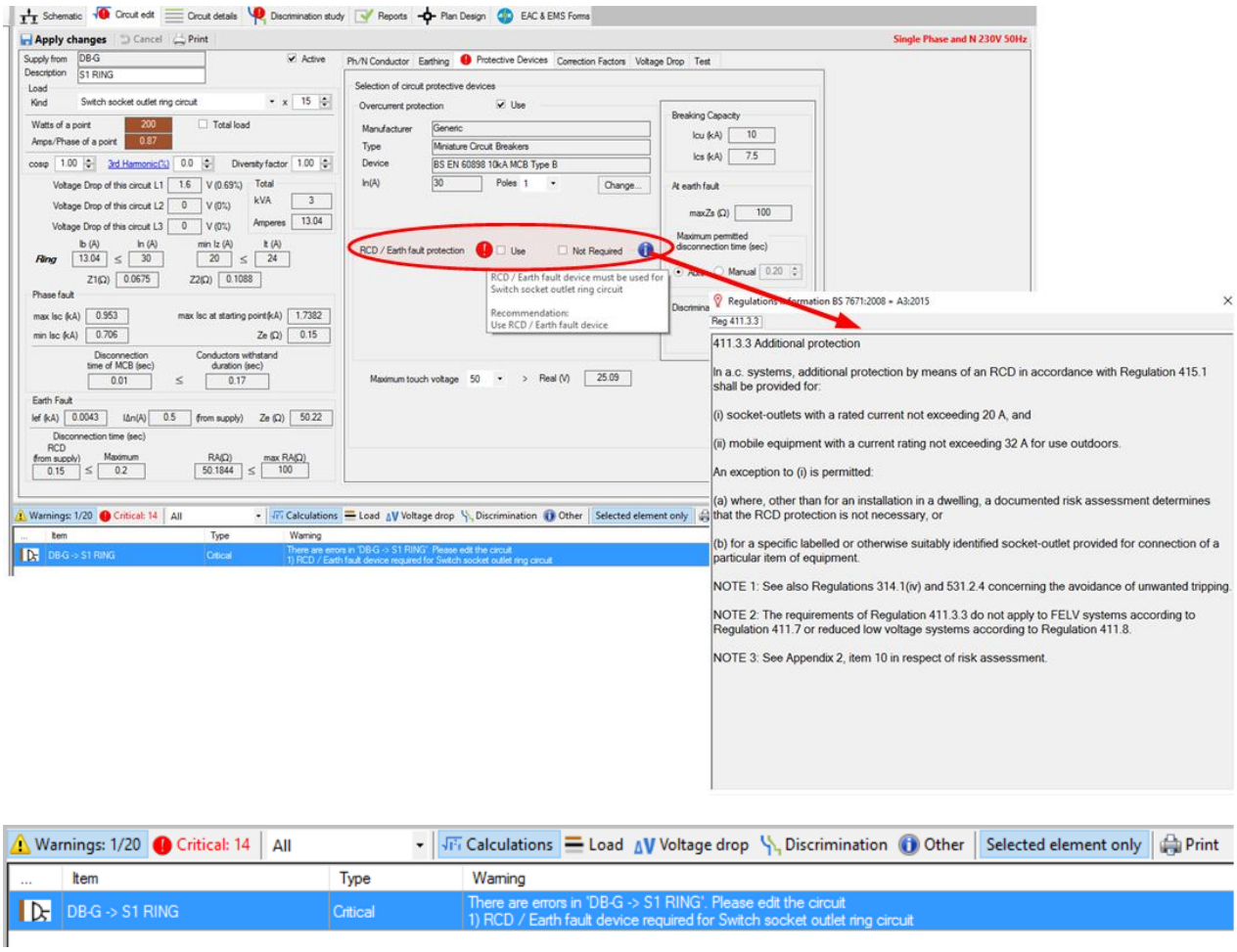
For RCD use, BS7671 states the following regulation:

411.3.3 Additional protection.

In alternating current systems, additional protection by means of an RCD in accordance with Regulation 415.1 shall be provided for:
(i) socket-outlets with a rated current not exceeding 20 A, and
(ii) mobile equipment with a current rating not exceeding 32 A for use outdoors.

An exception to (i) is permitted:
(a) where, other than for an installation in a dwelling, a documented risk assessment determines that the RCD protection is not necessary, or
(b) for a specific labelled or otherwise suitably identified socket-outlet provided for connection of a particular item of equipment.

**NOTE 1:** See also Regulations 314.1(iv) and 531.2.4 concerning the avoidance of unwanted tripping.
**NOTE 2:** The requirements of Regulation 411.3.3 do not apply to FELV systems according to Regulation 411.7 or reduced low voltage systems according to Regulation 411.8.
**NOTE 3:** See Appendix 2, Item 10 with respect to risk assessment.





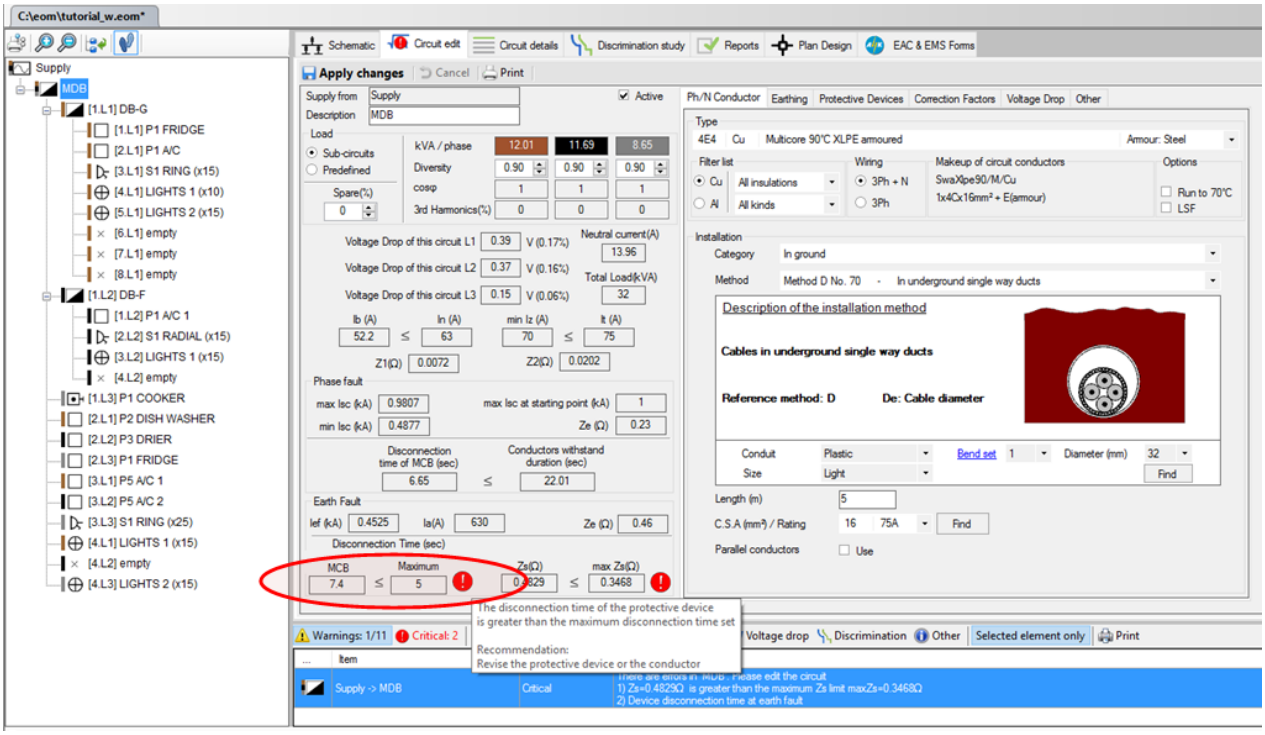


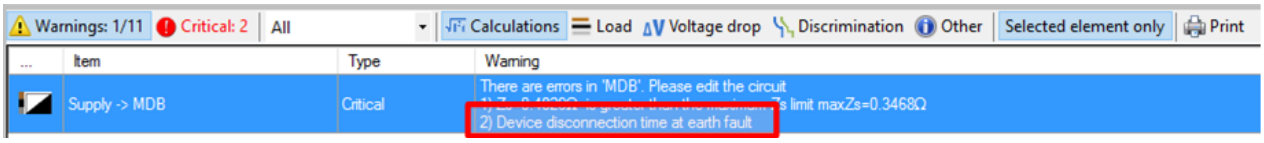
## Maximum Permitted Disconnection Time at Earth Fault Check

The software checks that the protective device operates within the maximum permitted disconnection time in the event of an earth fault.

**Recommendation to resolve the error:**
Revise the CPC or the protective device. Also make sure the upstream circuits have been set correctly.

See Protective device disconnection time at Earth Fault



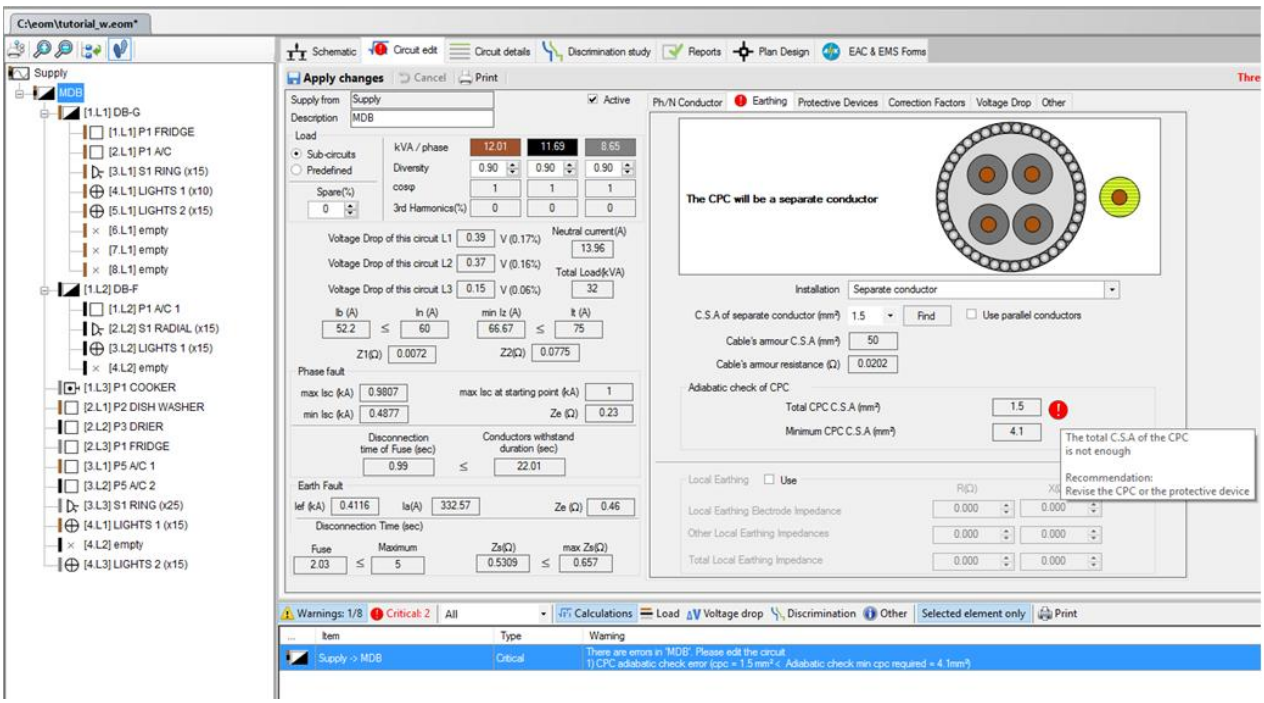



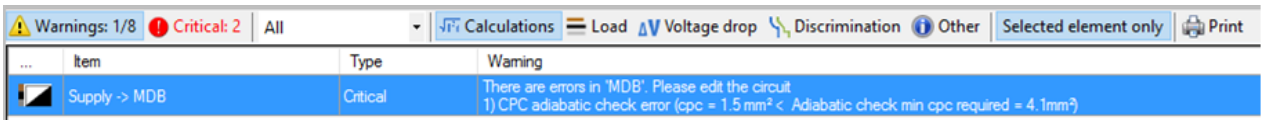

## CPC Adiabatic Check

The software checks that the cross sectional area of the protective conductor is large enough that the protective device functions within time limits in the event of an earth fault.

See Earth Fault Current Calculation

**Recommendation to resolve the error:**
Revise the CPC or the protective device. Also make sure the upstream circuits have been set correctly.



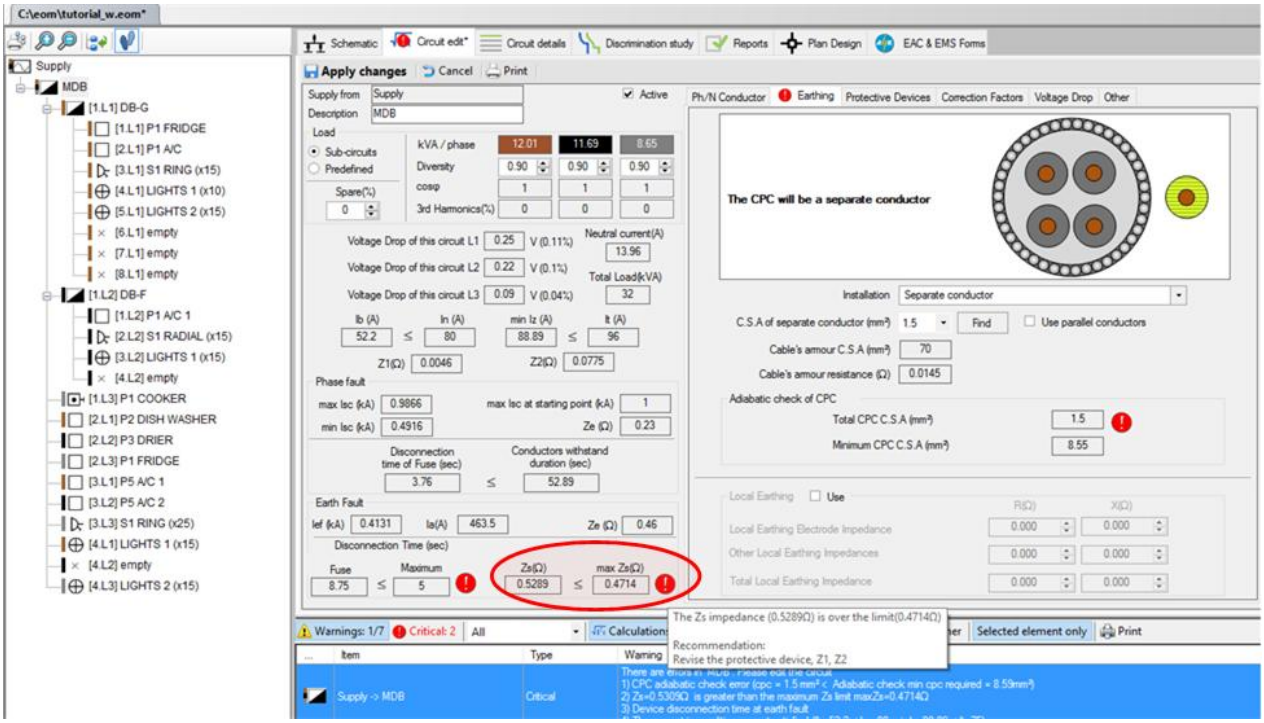



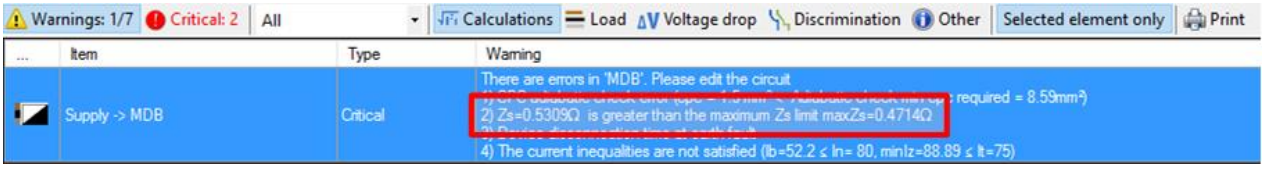

## Maximum Earth Fault Loop Impedance Check

The software calculates the maximum loop impedance to check that the protective device functions within time limits in the event of an earth fault.

See Maximum Earth Fault Loop Impedance (max $Z_s$) Calculation

**Recommendation to resolve the error:**
Revise the protective device, Z1 (impedance of the phase conductor), Z2 (impedance of the CPC). Also make sure the upstream circuits have been set correctly.



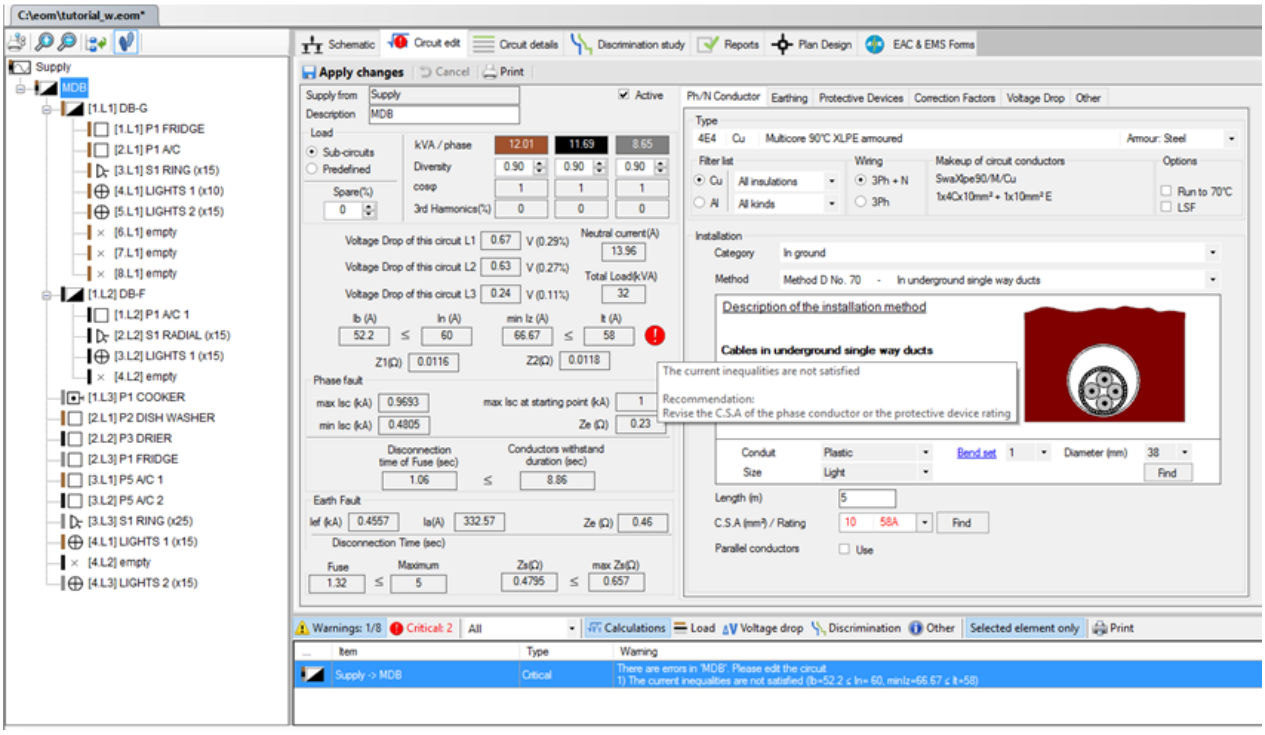



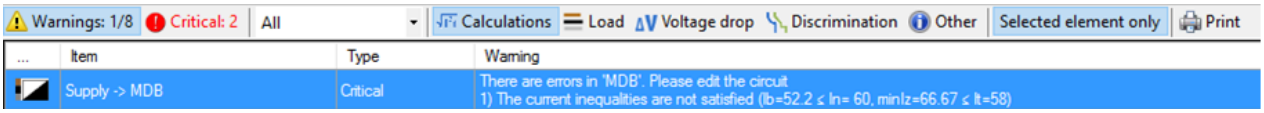

## Design Current and Current Carrying Capacity Checks

The software checks that the phase conductor has a current carrying capacity not less than the design current.

See the Design Current and Current Carrying Capacity Calculations

**Recommendation to resolve the error:**
Revise the C.S.A of the phase conductor or the protective device rating. Also make sure that correction factors are applied correctly.



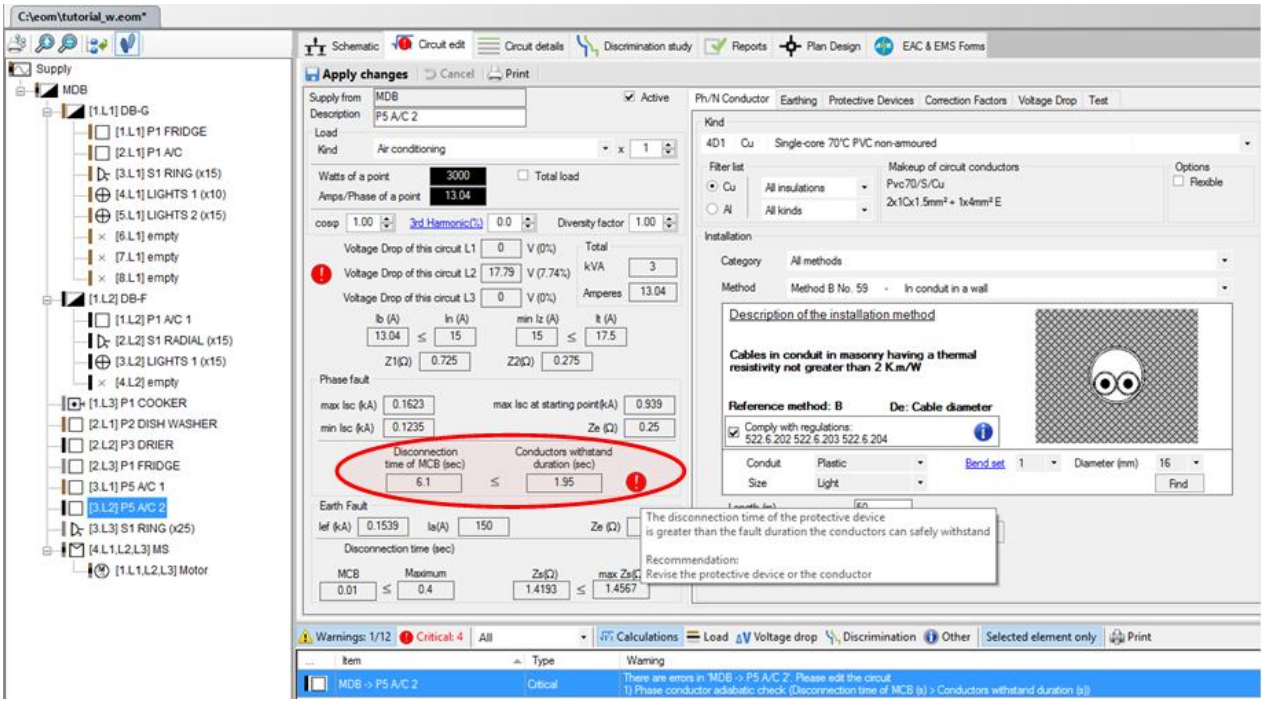



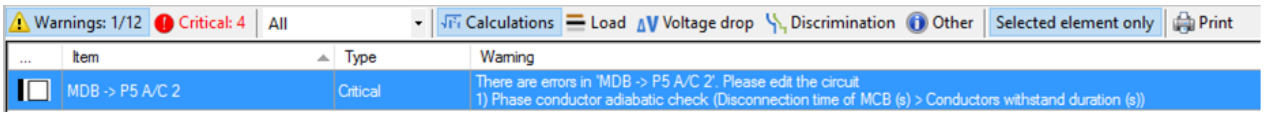

## Phase Conductor Adiabatic Check

The software checks that the circuit protective device has a disconnection time satisfying the phase conductor adiabatic check.

See Minimum Phase Fault Current Calculation

**Recommendation to resolve the error:**
Revise the phase conductor or the protective device. Also make sure the upstream circuits have been set correctly.



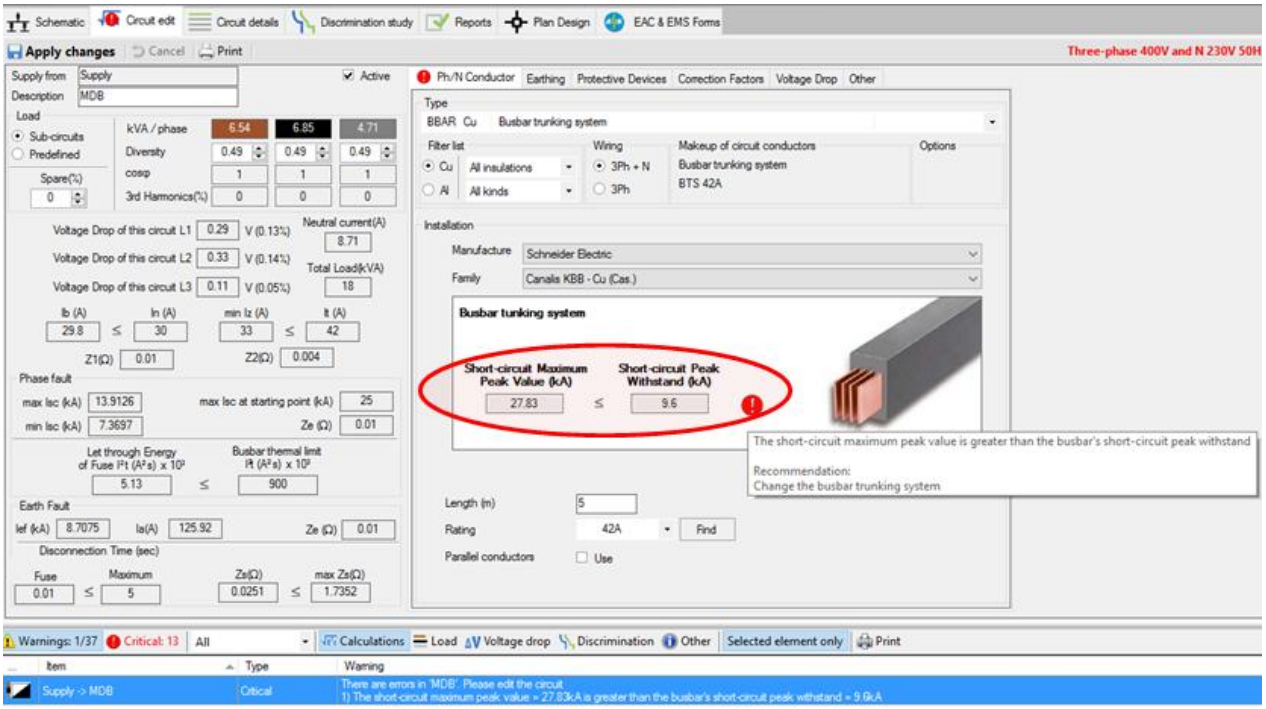


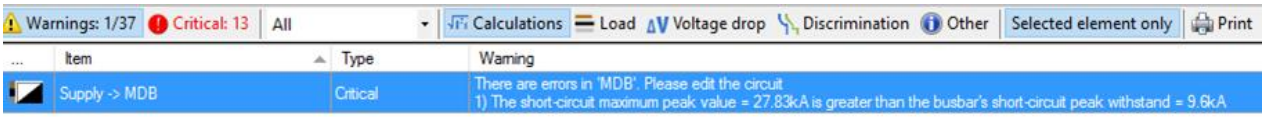

## Busbar Trunking System Short-Circuit Peak Withstand Check

Where a manufacturer specific busbar trunking system is used, the software checks that the short-circuit maximum peak value is not greater than the withstand value given by the manufacturer.

See Short-Circuit Maximum Peak Value for Busbar Trunking Systems

**Recommendation to resolve the error:**
Revise the selection of the busbar trunking system. Also make sure the upstream circuits have been set correctly.



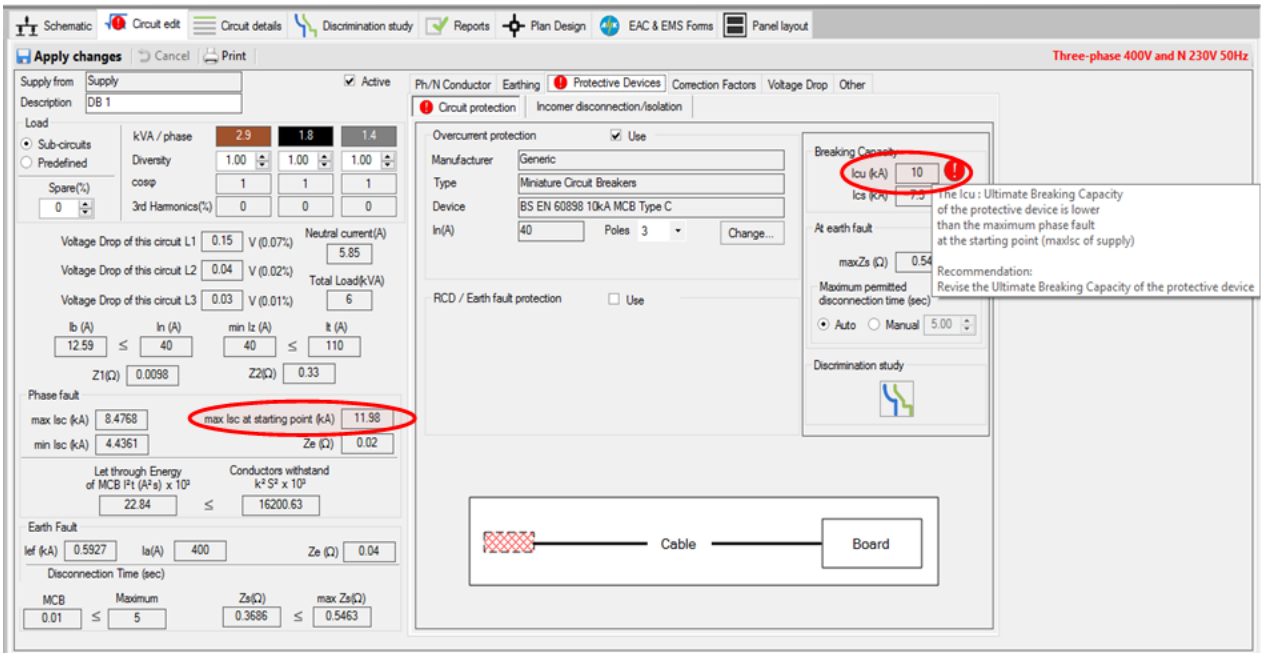


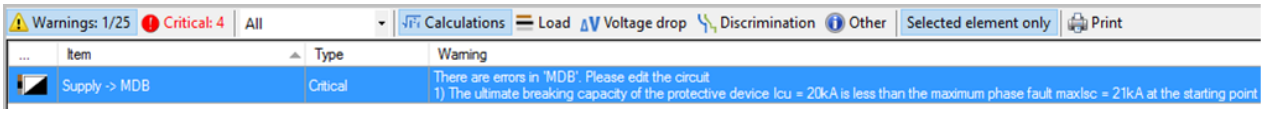

## Ultimate Breaking Capacity of the Circuit's Protective Device Check

The software checks that the ultimate breaking capacity of the circuit's protective device ($I_{cu}$) is not less than the maximum phase fault current at the starting point.

**Recommendation to resolve the error:**
Revise the circuit's protective device breaking capacity. Also make sure the upstream circuits have been set correctly.

See the calculation details

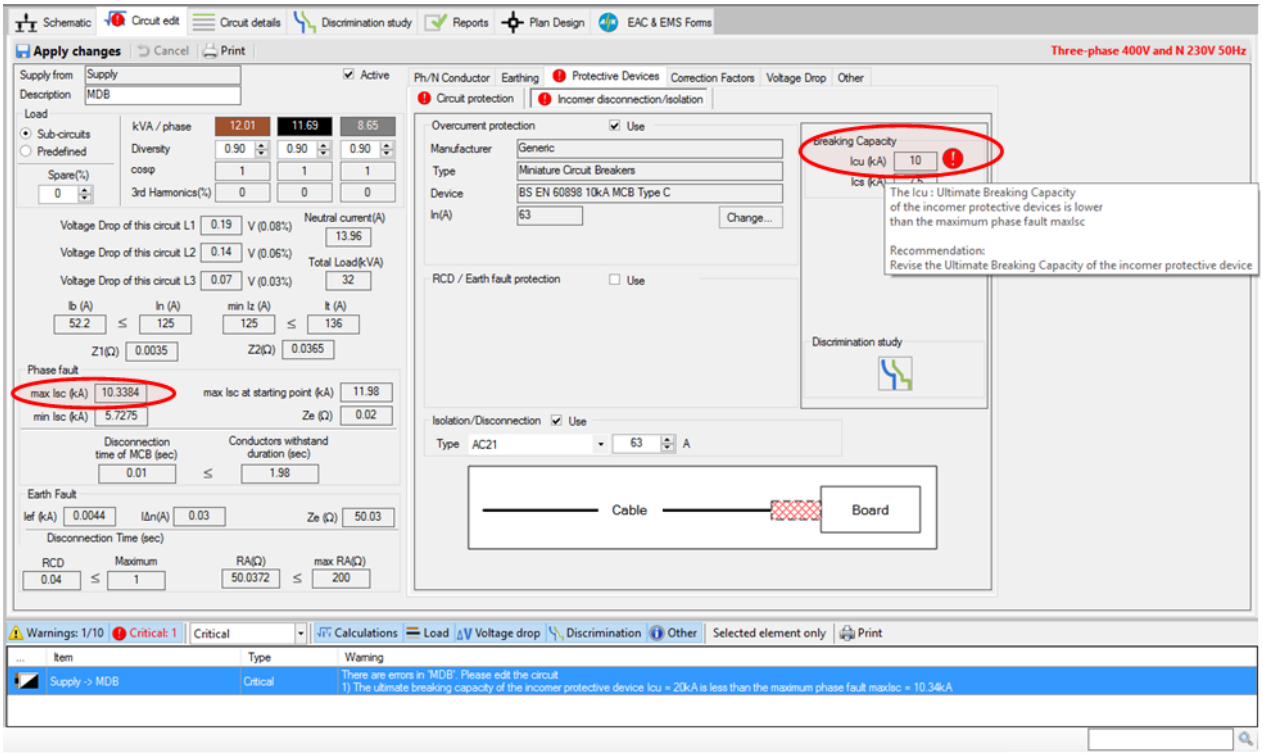


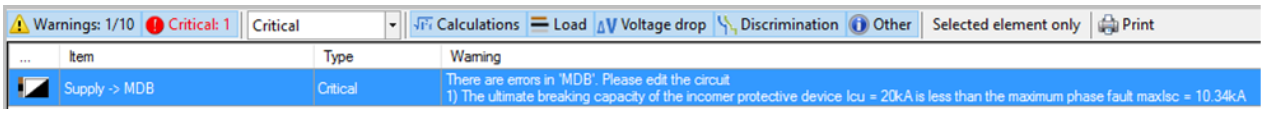




## Ultimate Breaking Capacity of the Incomer Protective Device Check

The software checks that the ultimate breaking capacity of the incomer protective device ($I_{cu}$) is not less than the maximum phase fault current.

**Recommendation to resolve the error:**
Revise the incomer protective device breaking capacity. Also make sure the upstream circuits have been set correctly.

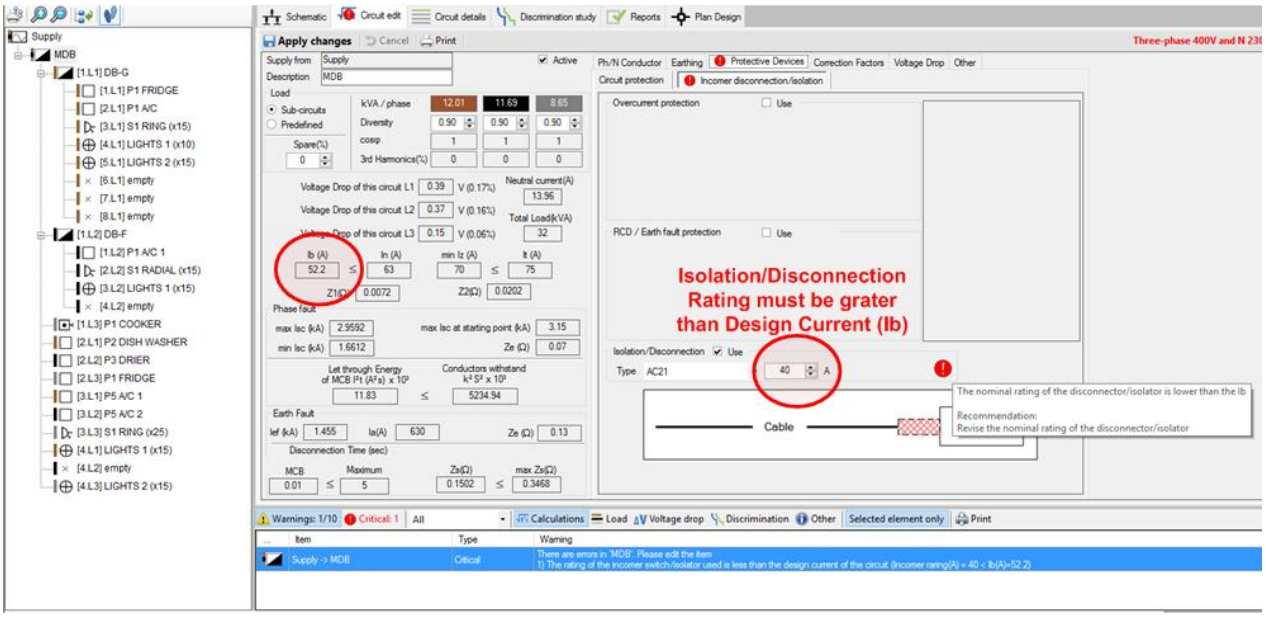


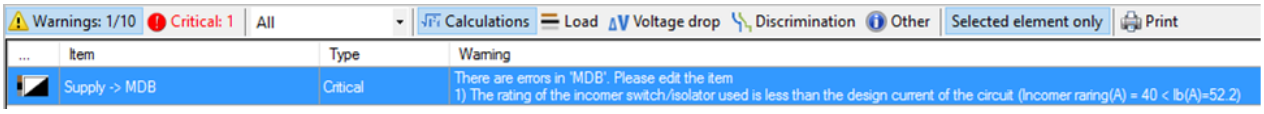




## Rating of the Incomer Switch/Isolator Check

The software checks that the incomer isolation/disconnection device rating is greater than or equal to the design current ($I_b$).

**Recommendation to resolve the error:**
Select an incomer with rating greater than or equal to the design current value ($I_b$).

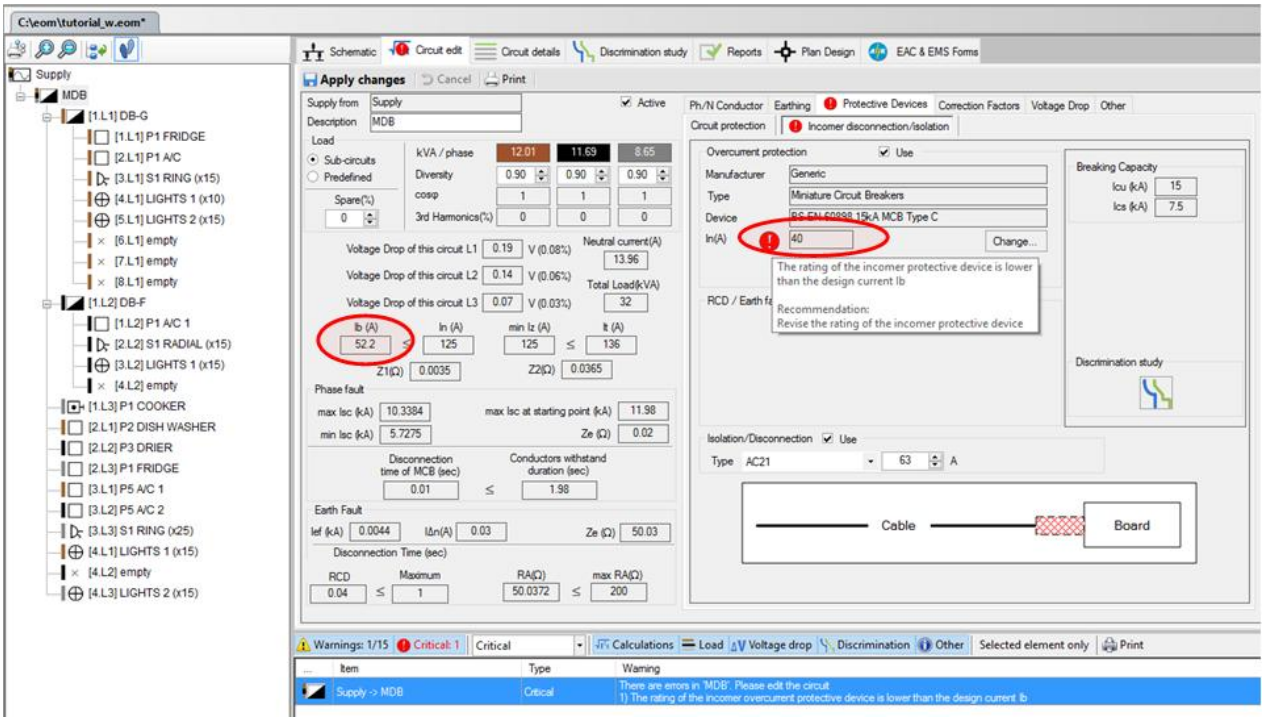


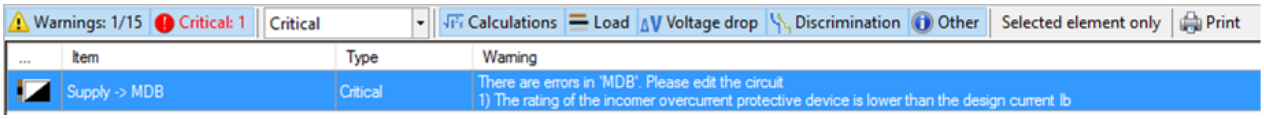



## Rating of the Incomer Overcurrent Protective Device Check

The software checks that the rating of the incomer overcurrent protective device is not lower than the design current ($I_b$).

**Recommendation to resolve the error:**
Revise the rating of the incomer overcurrent protective device.

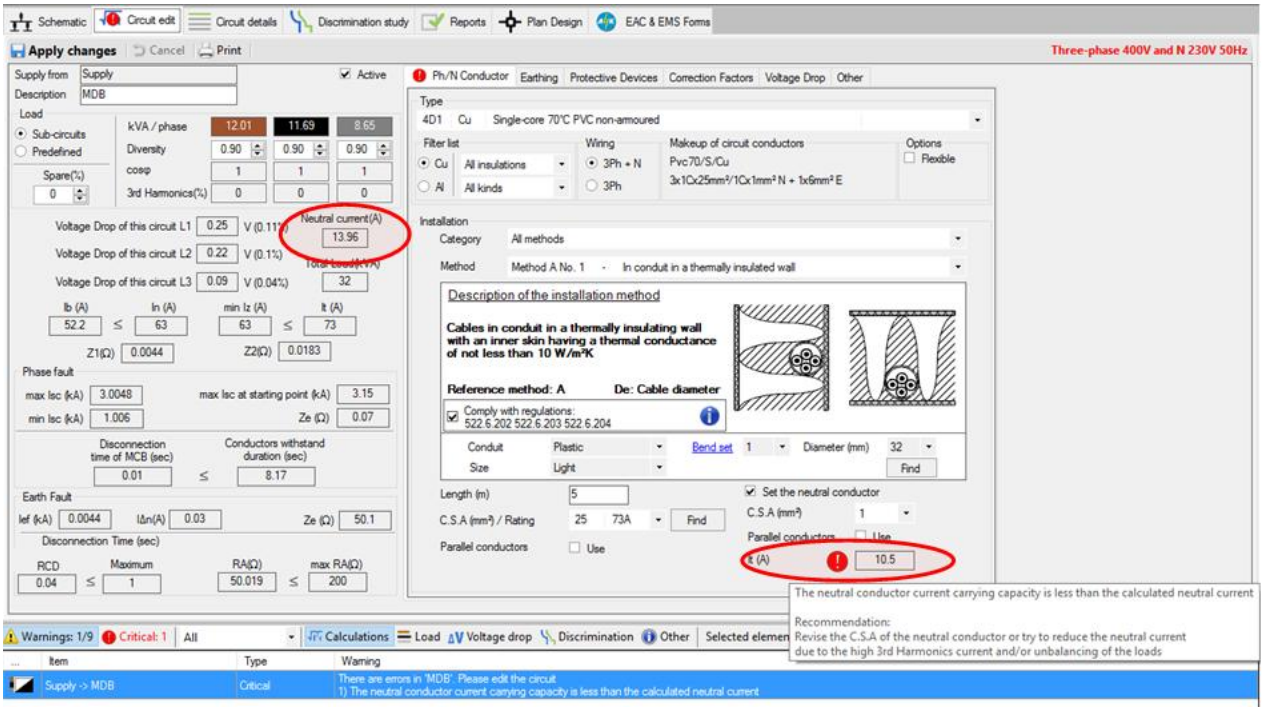


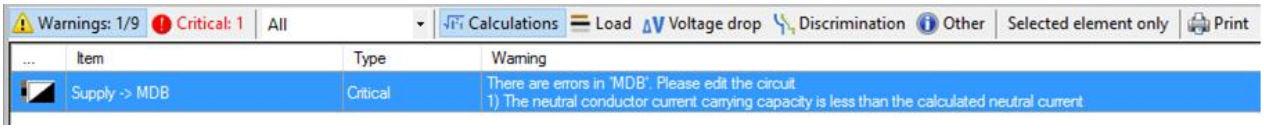




## Neutral Conductor Current Carrying Capacity Check

When the engineer chooses to size the neutral conductor separately, in a three-phase + neutral single-core cable, the software checks if the neutral conductor's current carrying capacity is equal to or greater than the calculated neutral current.

**Recommendation to resolve the error:**
Revise the C.S.A of the neutral conductor or try to reduce the high neutral current due to the high third harmonics current and/or unbalancing of the loads.

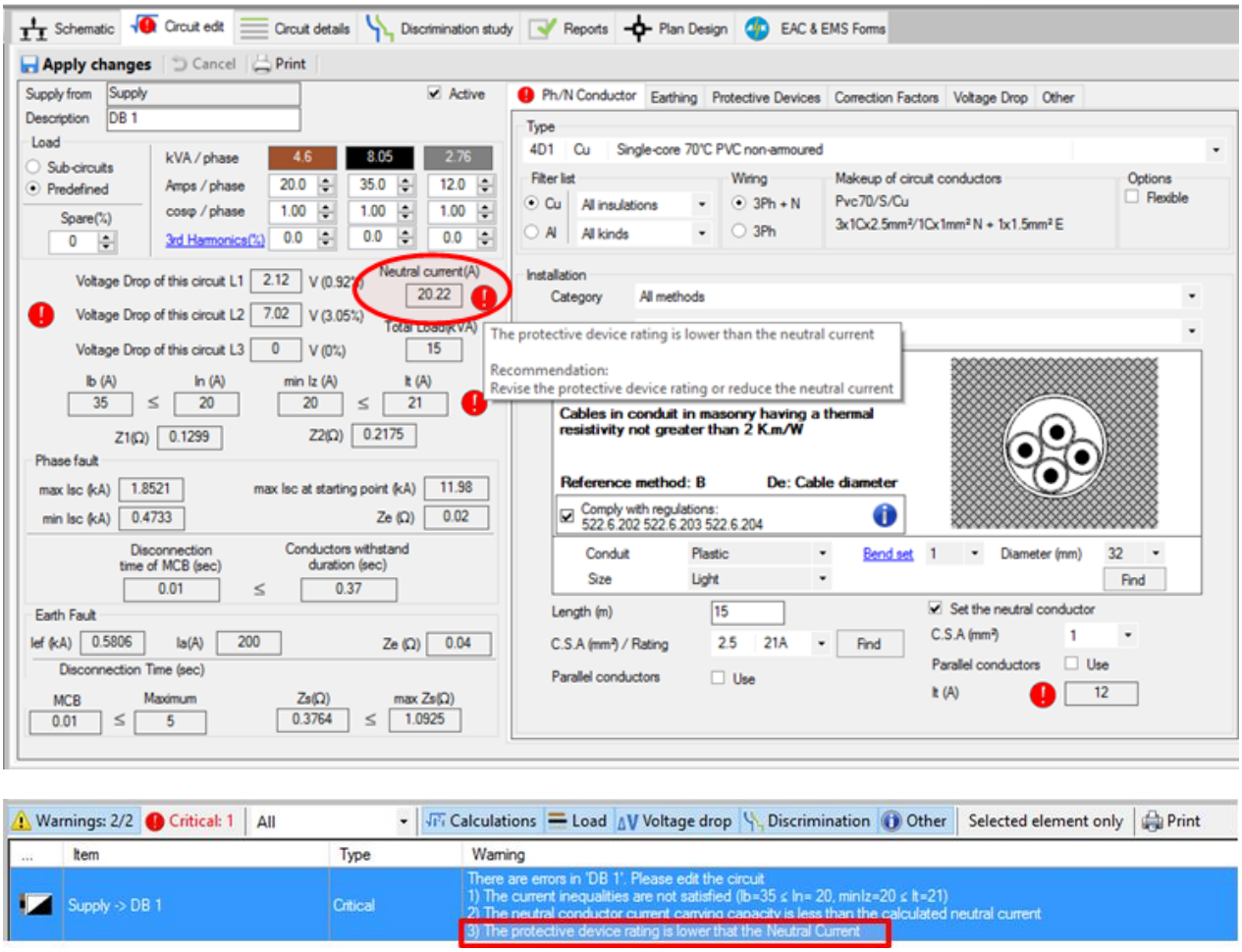



## Neutral Current Protective Device Rating Check

The software checks whether the neutral current is over the circuit's protective device rating due to high third harmonics current and/or unbalancing of the loads.

**Recommendation to resolve the error:**
Revise the protective device rating or try to reduce the high neutral current due to the high third harmonics current and/or unbalancing of the loads.



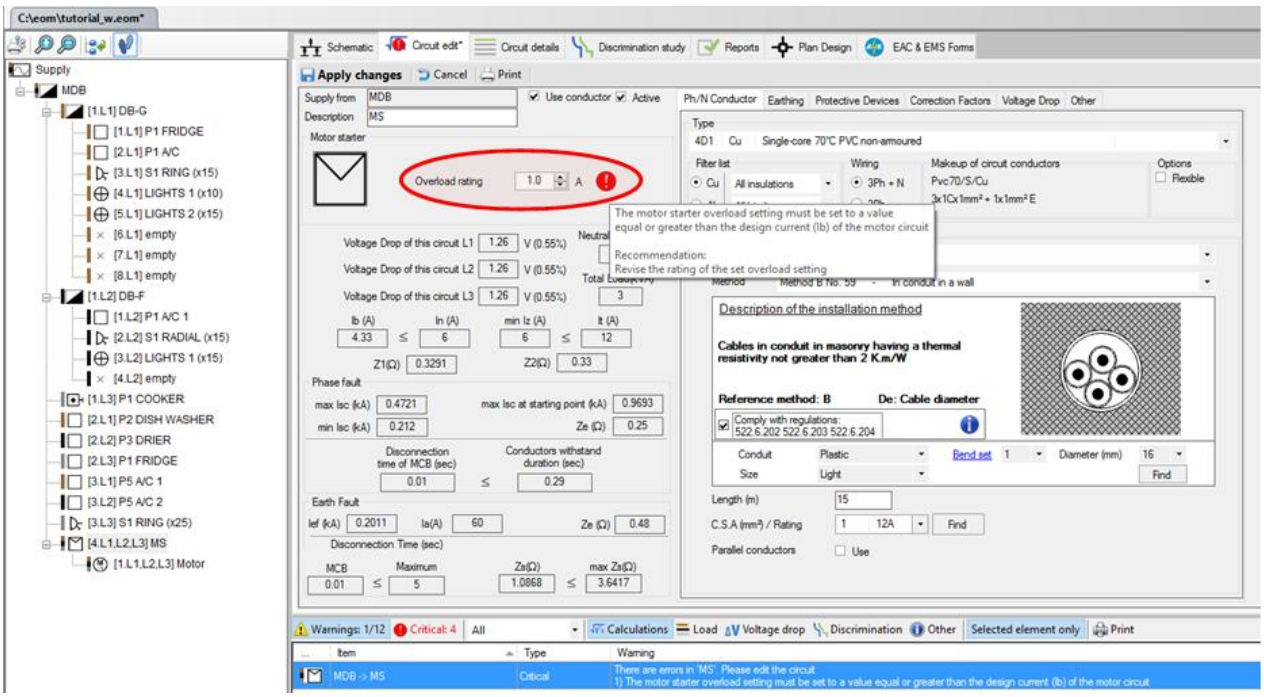


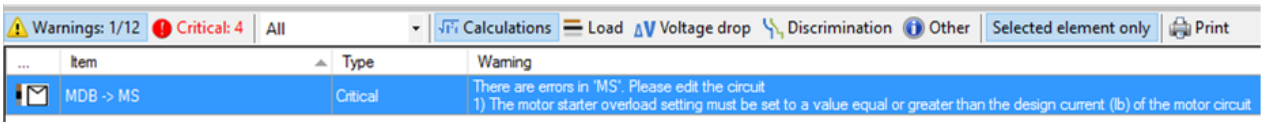


## Motor Starter Overload Setting Check

The software checks that the motor starter overload rating is greater than or equal to the design current ($I_b$) of the motor circuit.

**Recommendation to resolve the error:**
Revise the motor starter overload rating to a value greater than or equal to the design current ($I_b$) of the motor circuit.

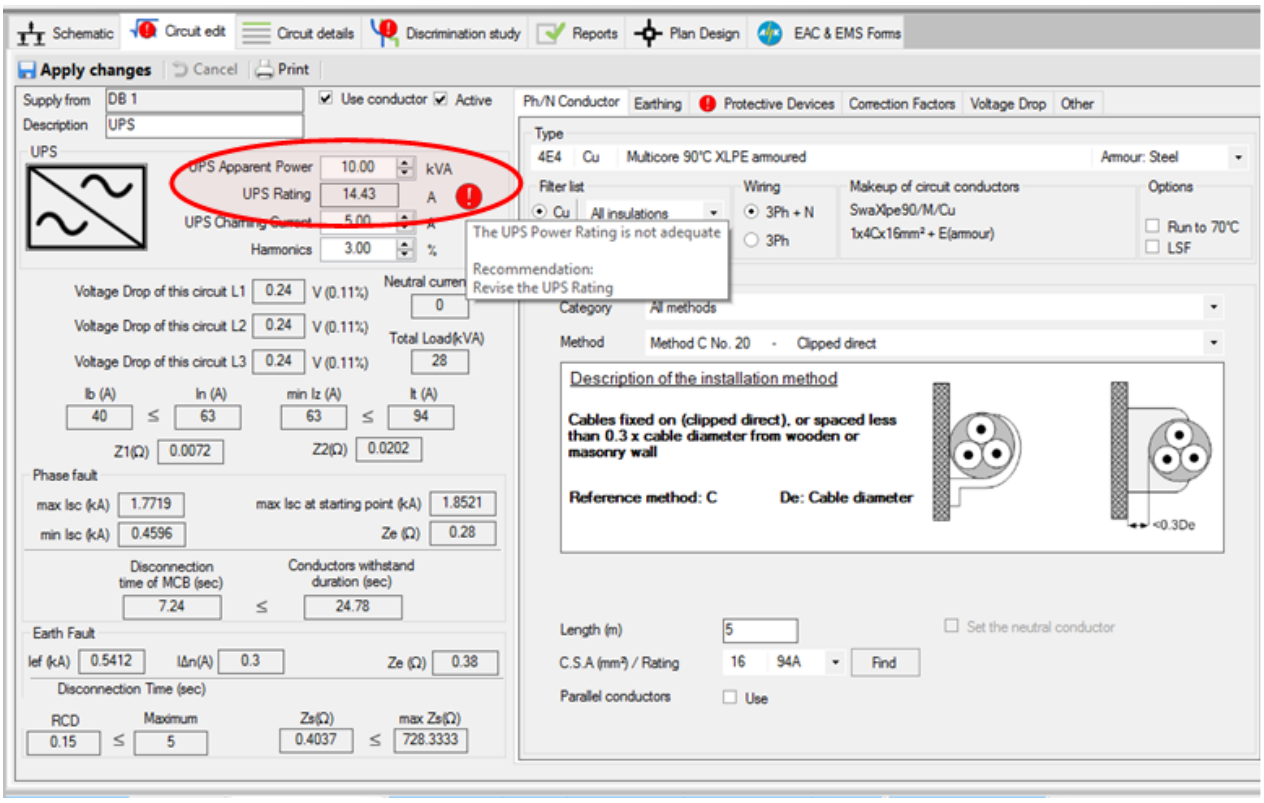


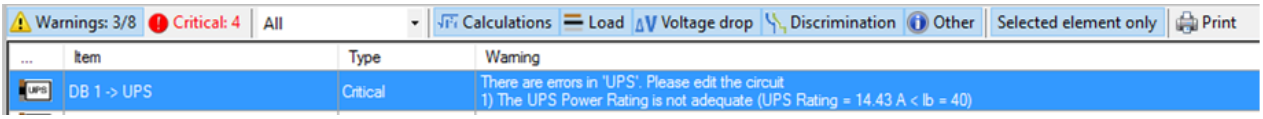




## UPS Power Rating Check

The software checks the UPS rating and provides a warning when this is lower than the design current of the circuit.

**Recommendation to resolve the error:**
Revise the UPS apparent power value.

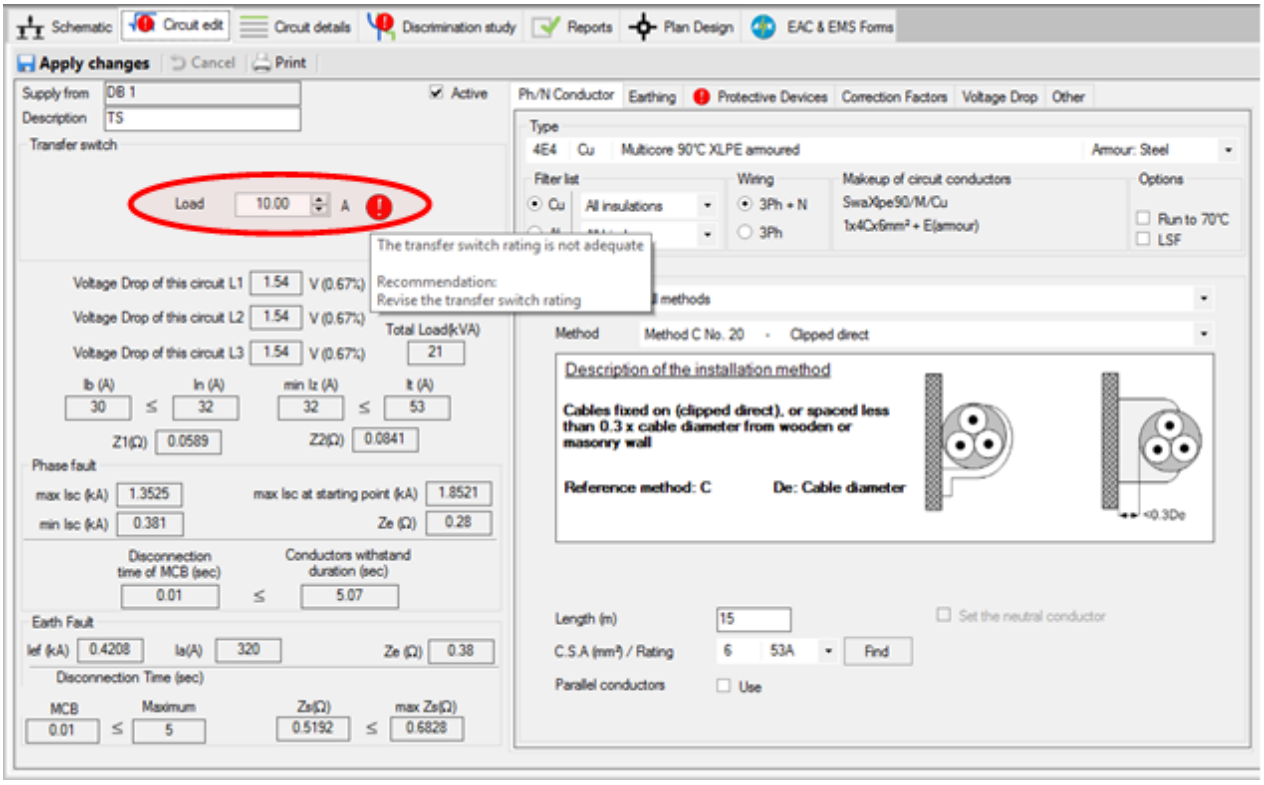


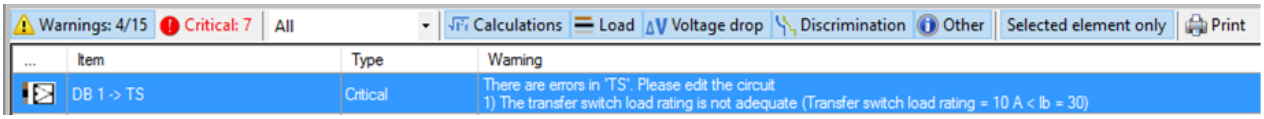



## Transfer Switch Load Rating Check

The software checks the transfer switch load rating and provides a warning when this is lower than the design current of the circuit.

**Recommendation to resolve the error:**
Revise the transfer switch load rating.

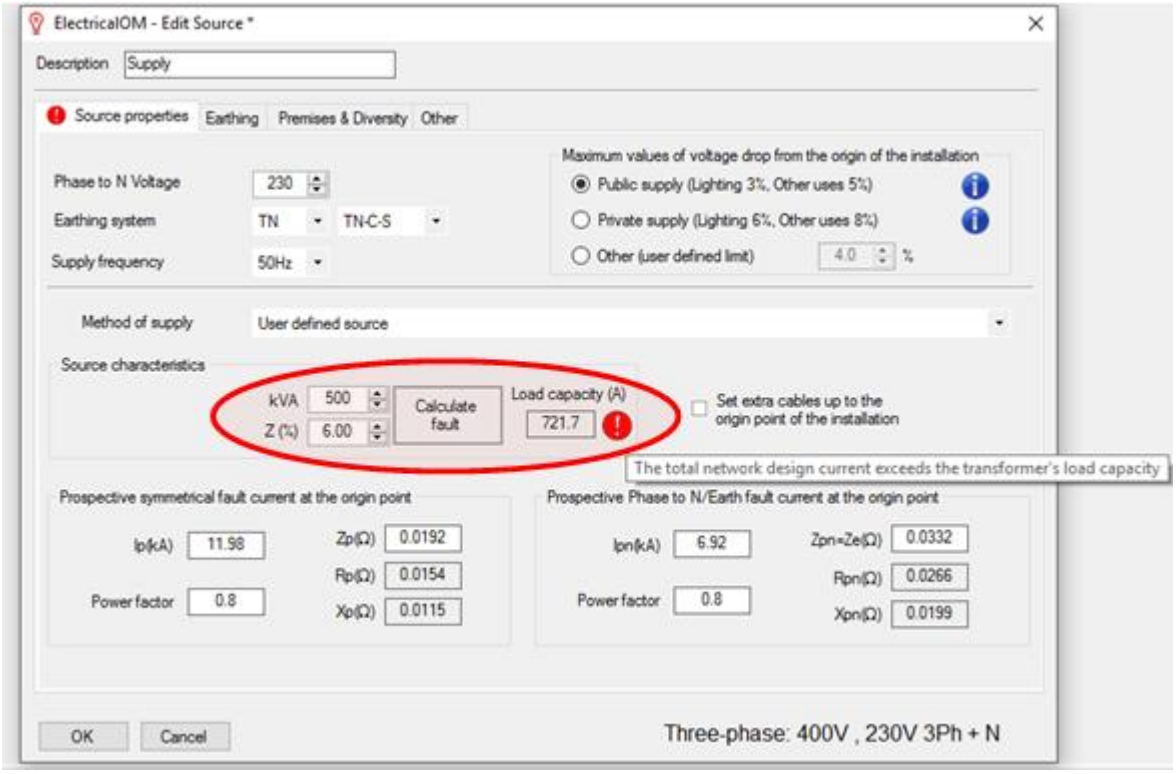


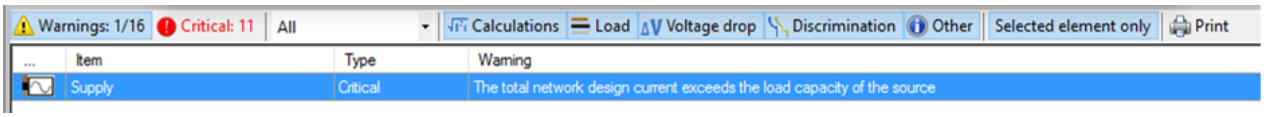




## Source Load Capacity Check

The software checks the active source load capacity and provides a warning when this is lower than the active network's total design current.

**Recommendation to resolve the error:**
Increase the source load capacity or apply more diversity to the total design current.

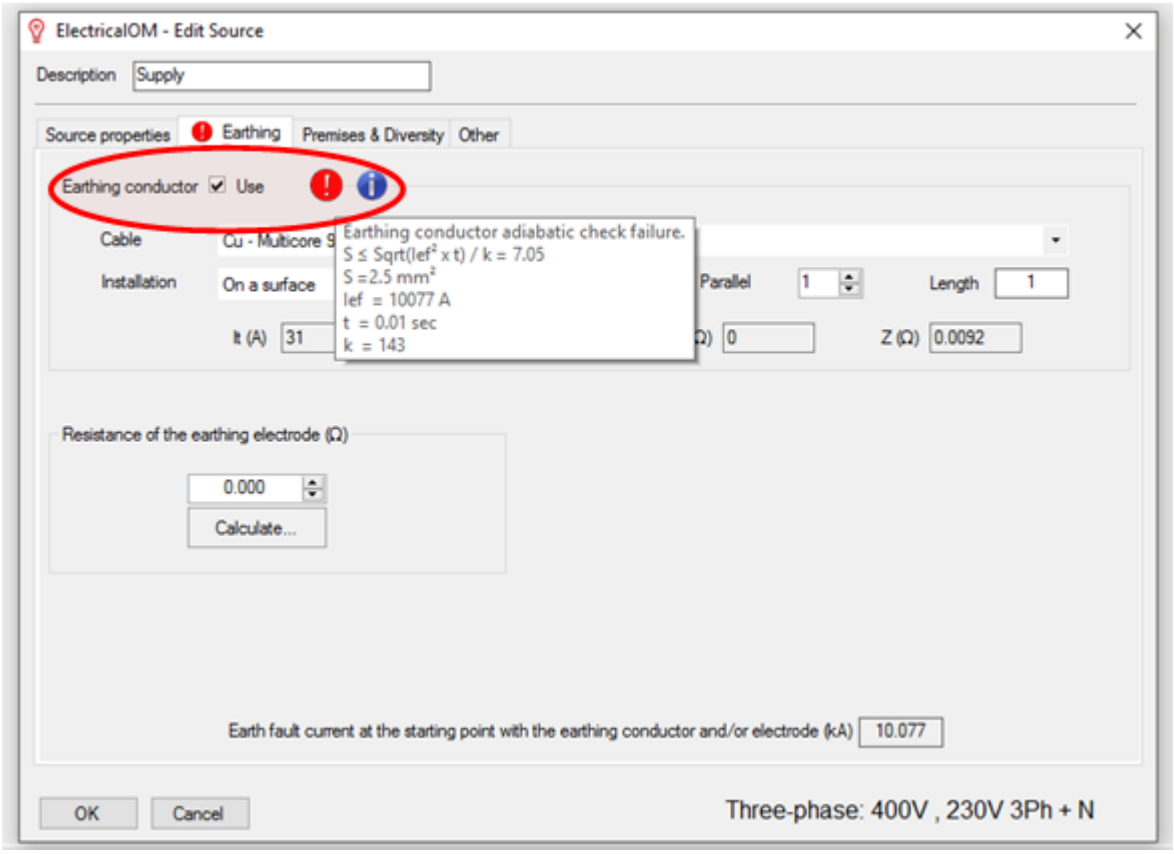


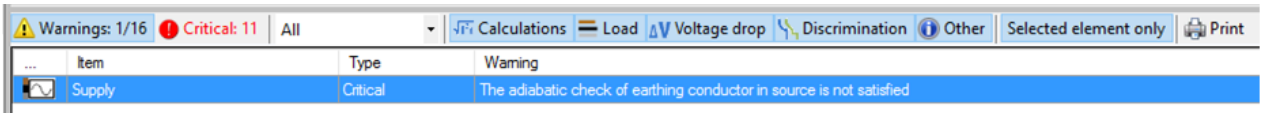




## Source Earthing Conductor Adiabatic Check

If the engineer has chosen to set the earthing conductor at the source level (the starting point of the installation), the software checks that the earthing conductor has a cross-sectional area satisfying the adiabatic check.

**Recommendation to resolve the error:**
Revise the earthing conductor.




## Important

Important warnings should be resolved in good practice but can be left unresolved for the completion of the study. They are warnings about potential hazards to the installation.

Voltage Drop over the Split Limit Set Check

Energy Based Discrimination Check

Discrimination During Overcurrent Check

Discrimination During Earth Fault Check

Motor Starting Check

Service Breaking Capacity of the Circuit Protective Device Check

Service Breaking Capacity of the Incomers Protective Device Check

Installation in Conduit Check

Installation in Trunking Check

Installation Compliance with Regulations Check

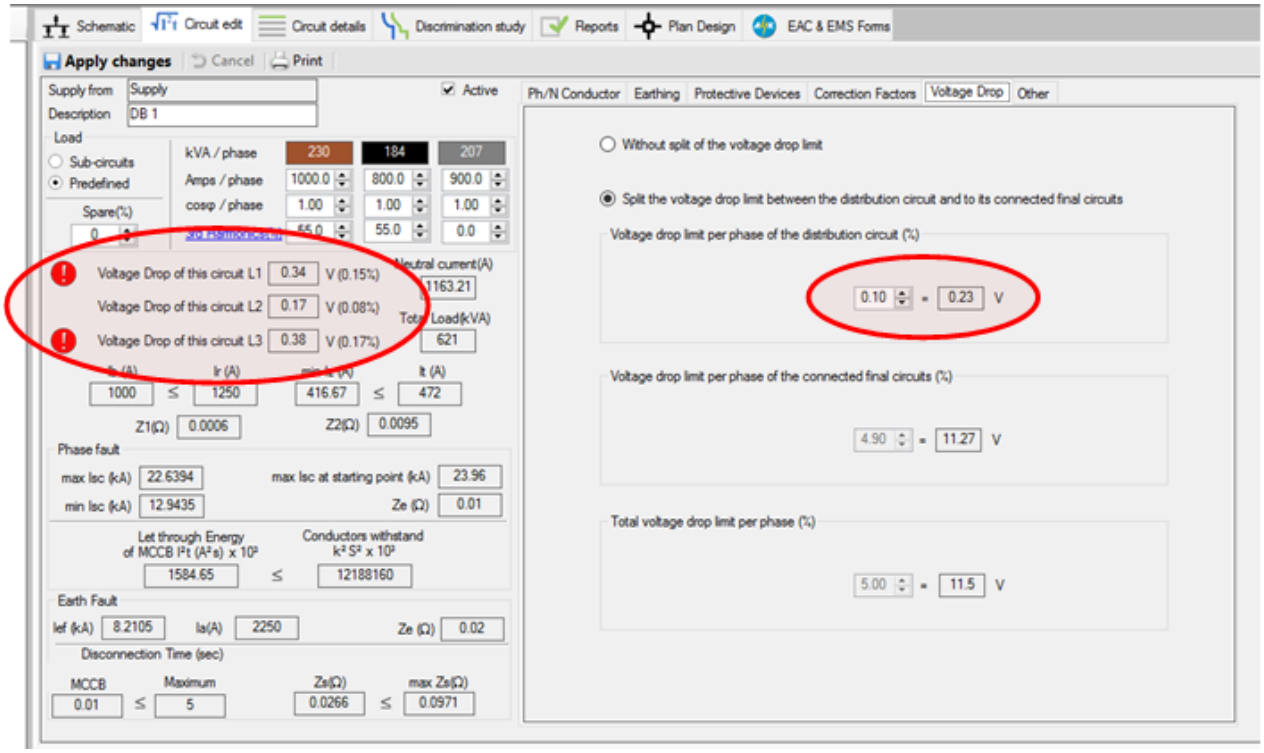
Harmonic Content in Circuit Check

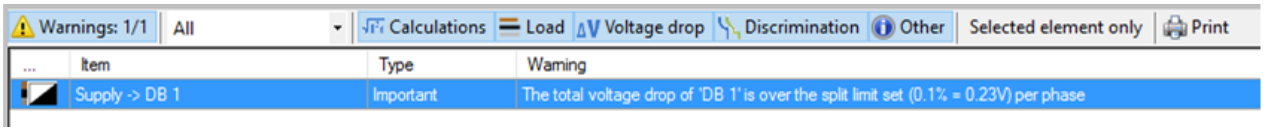
Current Carrying Capacity of the Tails Conductor Check

## Voltage Drop over the Split Limit Set Check

For distribution circuits there is an option to split the voltage drop limit between the distribution circuit and its final circuits. This split limit is not a regulation requirement but is set by the designer to warn him or her about circuits exceeding the specified voltage drop percentage value, allowing for finer control of the voltage drop across circuits. The software provides a warning when the voltage drop of the circuit is over the split limit set.

**Recommendation to resolve the error:**
Revise the conductor or set a higher voltage drop split limit for the particular circuit.

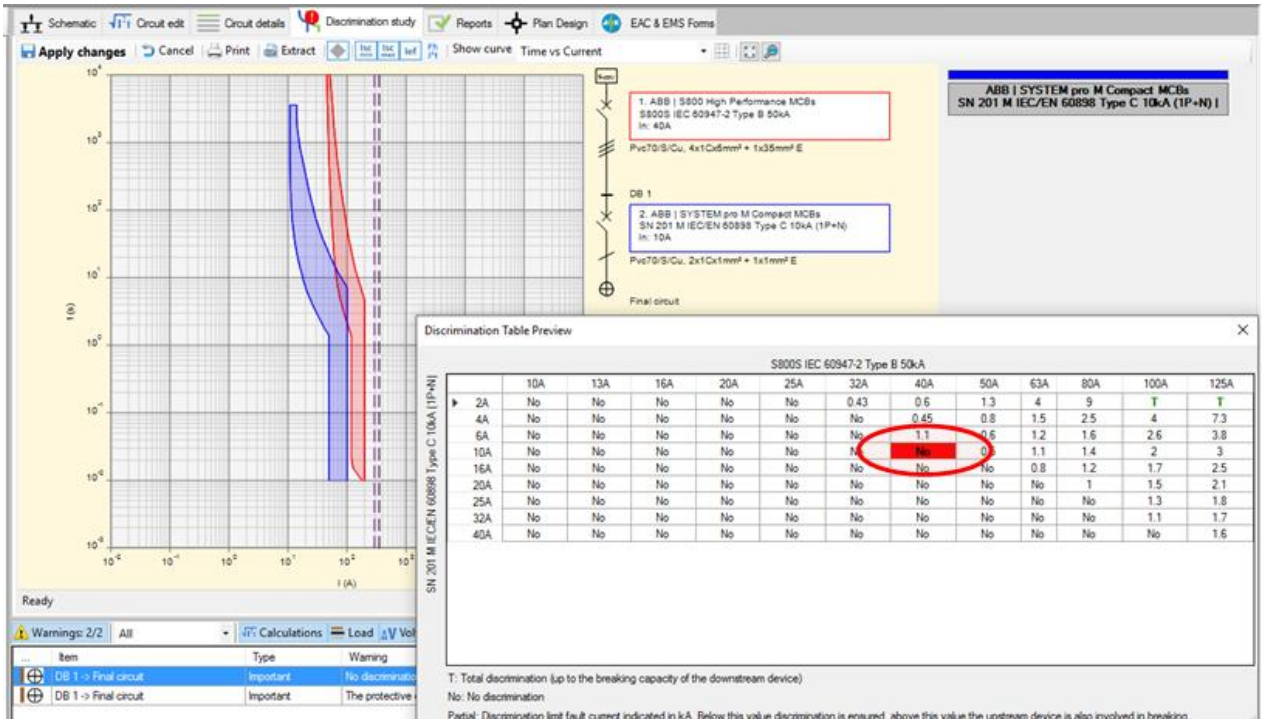


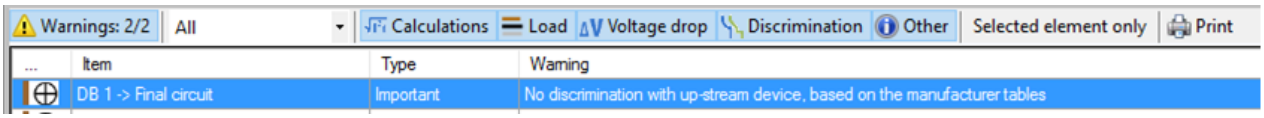




## Energy Based Discrimination Check

When the manufacturer's energy-based discrimination data are available and the fault condition is causing operation of the protective device below 0.1 sec, the checks are performed based on the manufacturer's discrimination tables. The software provides a warning when the discrimination check fails against an up-stream device.

**Recommendation to resolve the error:**
Revise the protective device.

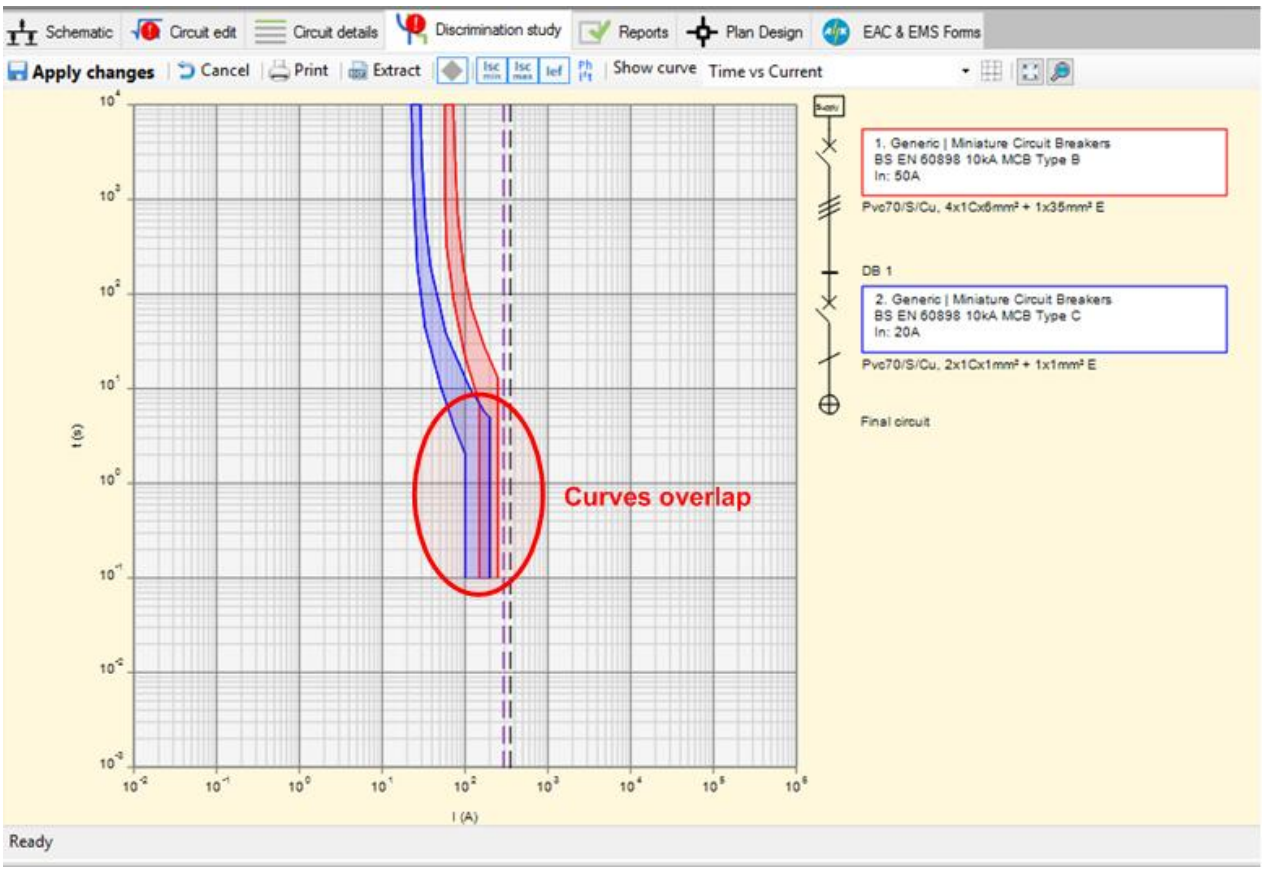


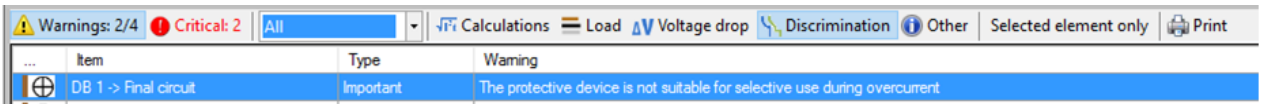




## Discrimination During Overcurrent Check

When the manufacturer's energy-based discrimination data are not available or the fault condition is causing operation of the protective device over 0.1 sec, ElectricalOM performs discrimination checks between the time-amperes curves of the protective devices, where overlapping curves indicate a discrimination problem. The check is made up to the value of the maximum prospective short-circuit current at the downstream protective device.

**Recommendation to resolve the error:**
Revise the protective device so the curves are not overlapping.



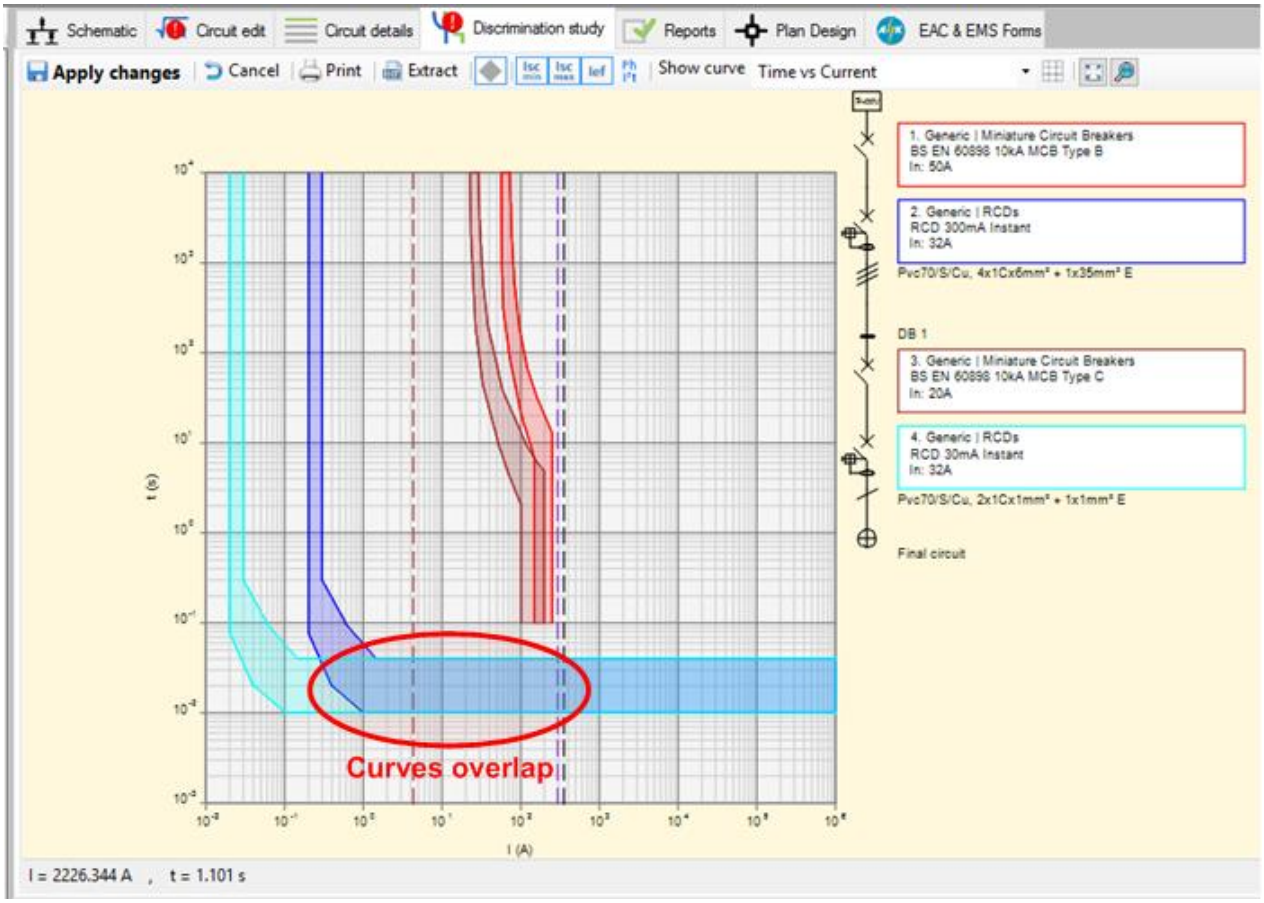

## Incomer Protective Device Discrimination During Overcurrent Check

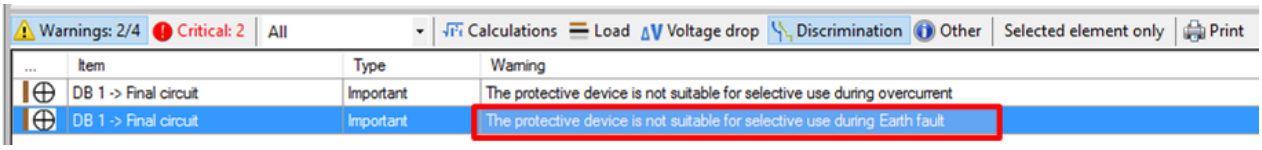
Discrimination checks are also made for incomer overcurrent protective devices. See Discrimination During Overcurrent.

## Discrimination During Earth Fault Check

Where an RCD device has not been installed, the check is performed in the same way as for the overcurrent protective device, but considering the earth fault levels. Otherwise the check is made comparing the RCD curves.

**Recommendation to resolve the error:**
Revise the protective device so the curves are not overlapping.



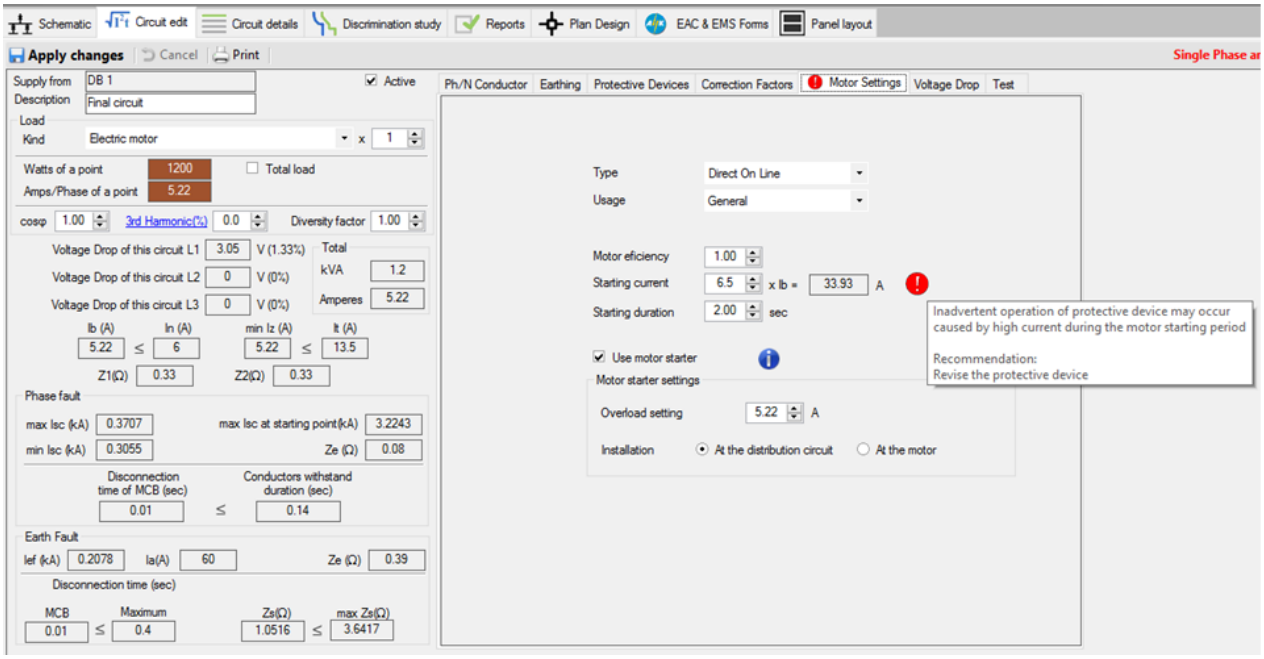

## Incomer Protective Device Discrimination During Earth Fault Check

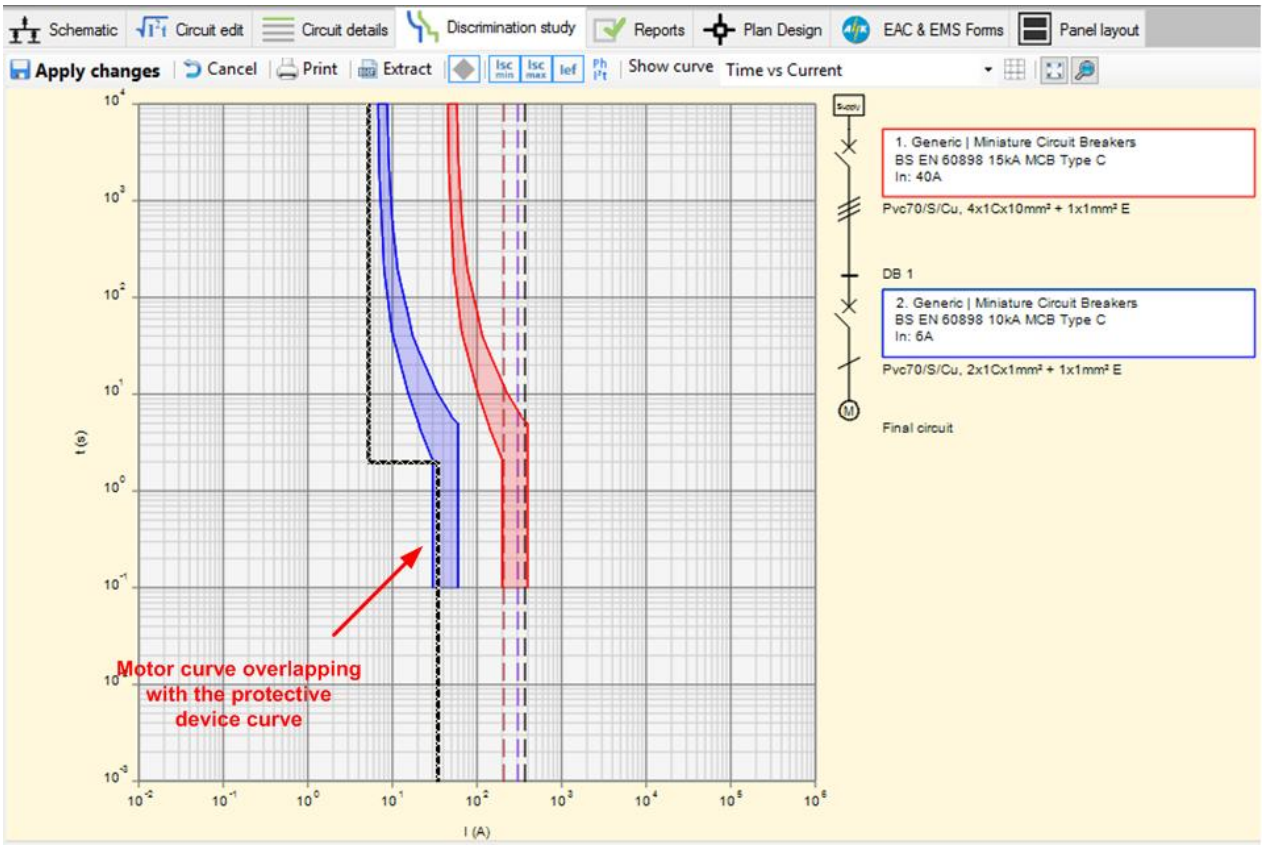
Discrimination checks are also made for incomer RCD devices. See Discrimination During Earth Fault.

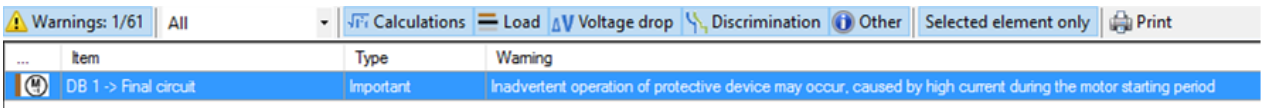
## Motor Starting Check

Motor circuits require that their protective devices have specific characteristics to avoid inadvertent operation during the motor starting period. The check made is based on the selected protective device and the motor's starting current and starting duration settings. Based on these parameters the motor starting curve is calculated and compared to the protective device curve. Overlapping between the curves indicates inadvertent operation.

**Recommendation to resolve the error:**
Revise the protective device so the motor and protective device curves are not overlapping.



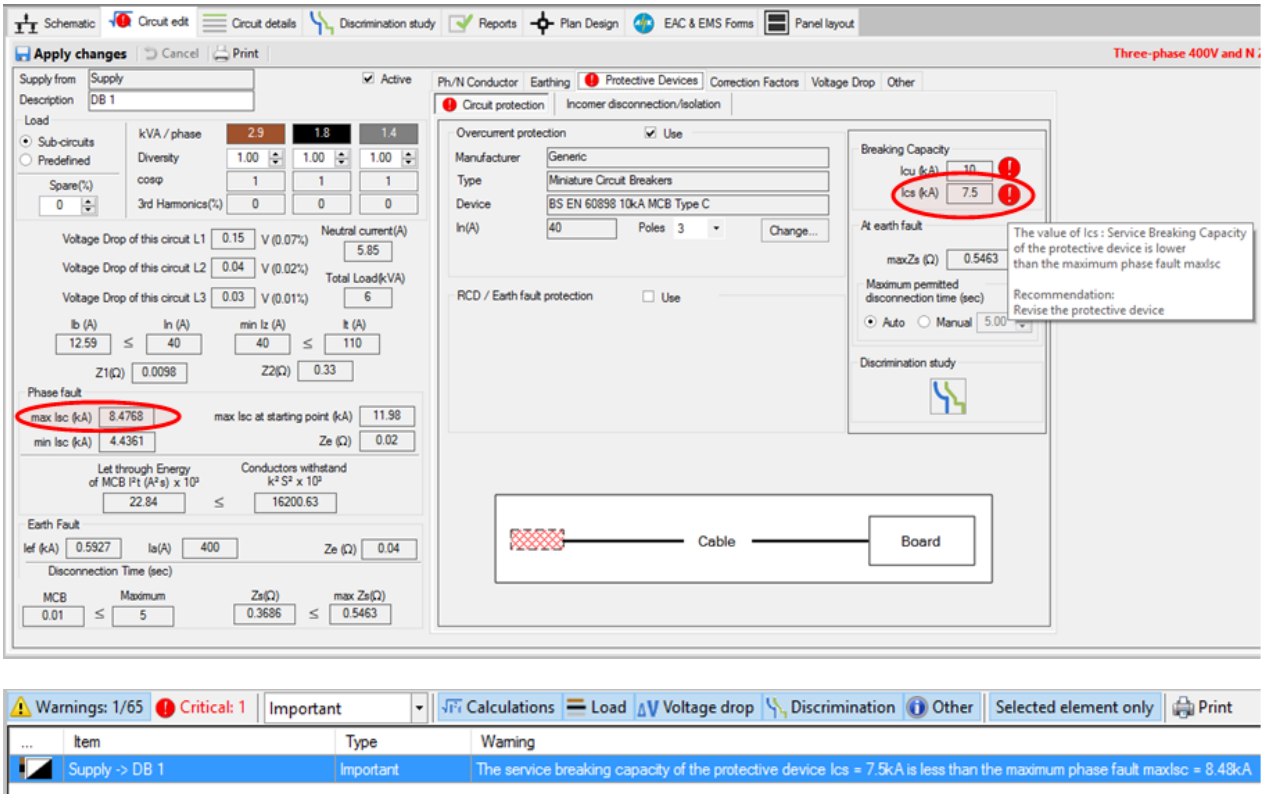




## Service Breaking Capacity of the Circuit Protective Device Check

The software checks that the service breaking capacity of the protective device ($I_{cs}$) is not less than the circuit's maximum phase fault current.

**Recommendation to resolve the error:**
Revise the circuit's protective device $I_{cs}$. Also make sure the upstream circuits have been set correctly.



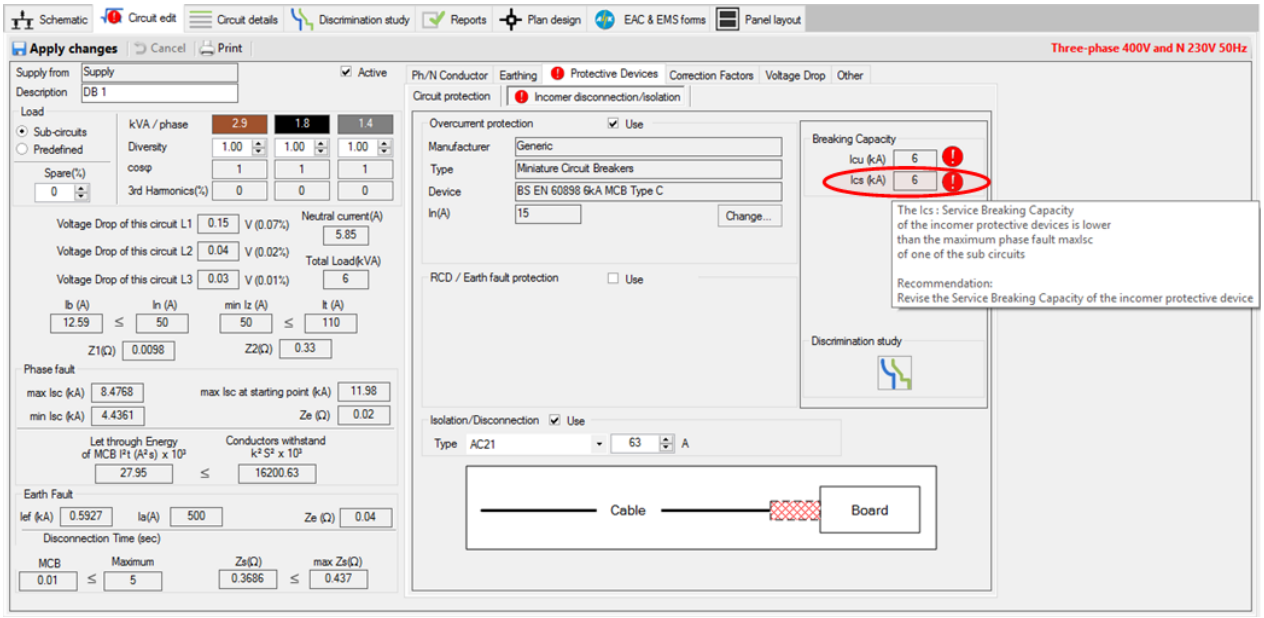


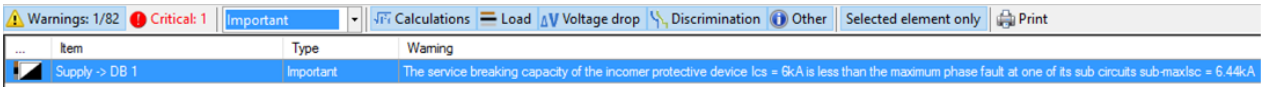


## Service Breaking Capacity of the Incomers Protective Device Check

The software checks that the service breaking capacity of the incomer protective device ($I_{cs}$) is not less than the maximum phase fault current of one of the sub circuits.

**Recommendation to resolve the error:**
Revise the incomer protective device $I_{cs}$.

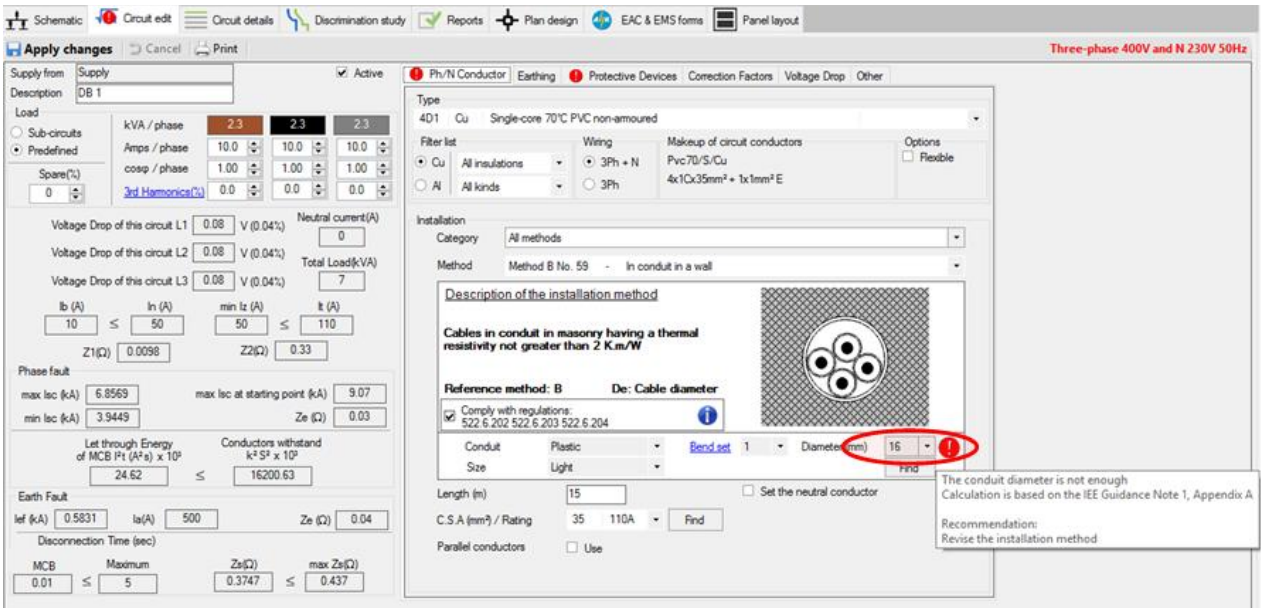


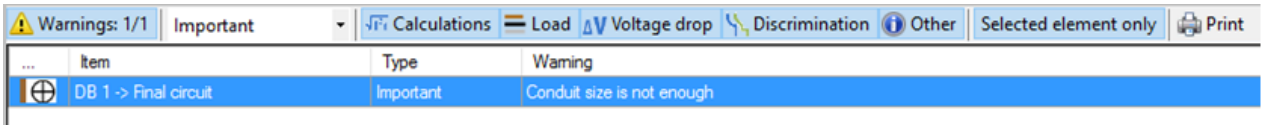



## Installation in Conduit Check

Where the installation incorporates conduit, a check is made that the conduit is sized to accommodate the makeup of the conductors. *Calculation is based on the IET Guidance Note 1, Appendix A.*

**Recommendation to resolve the error:**
Revise the conduit size.

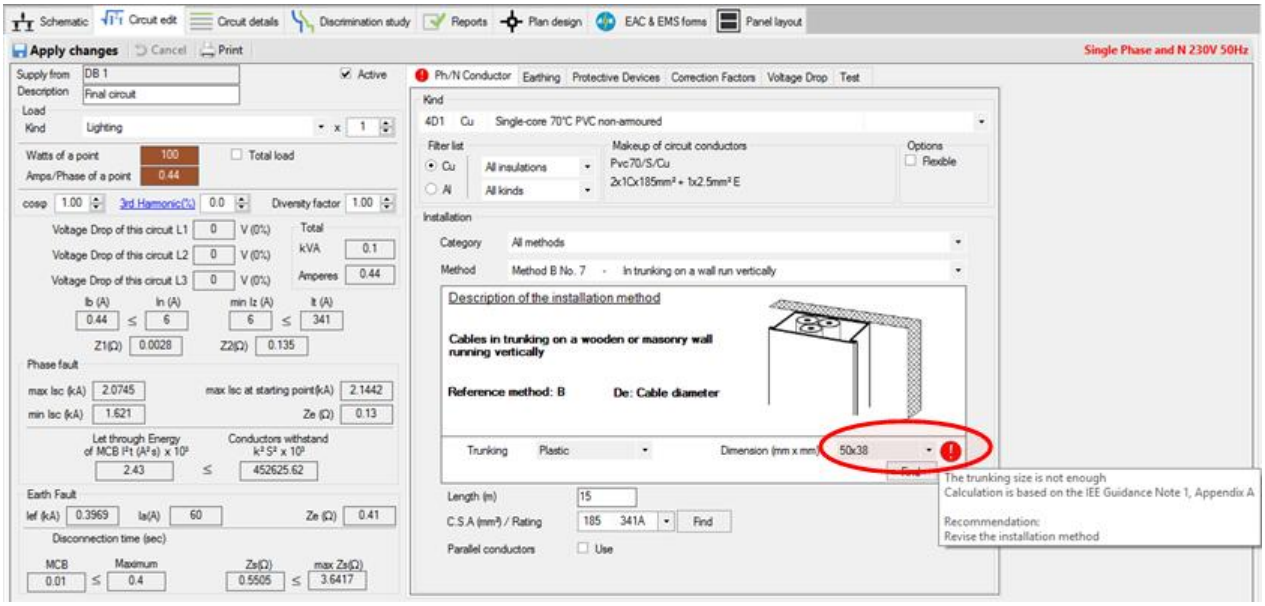


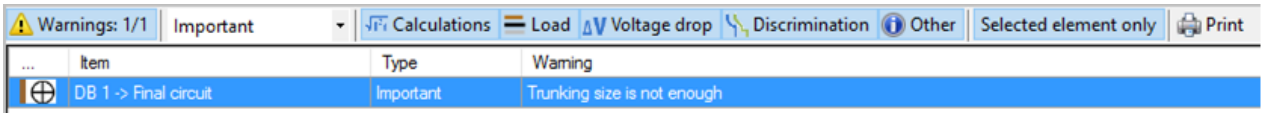




## Installation in Trunking Check

Where the installation incorporates trunking, a check is made that the trunking is sized to accommodate the makeup of the conductors. *Calculation is based on the IET Guidance Note 1, Appendix A.*

**Recommendation to resolve the error:**
Revise the trunking size.

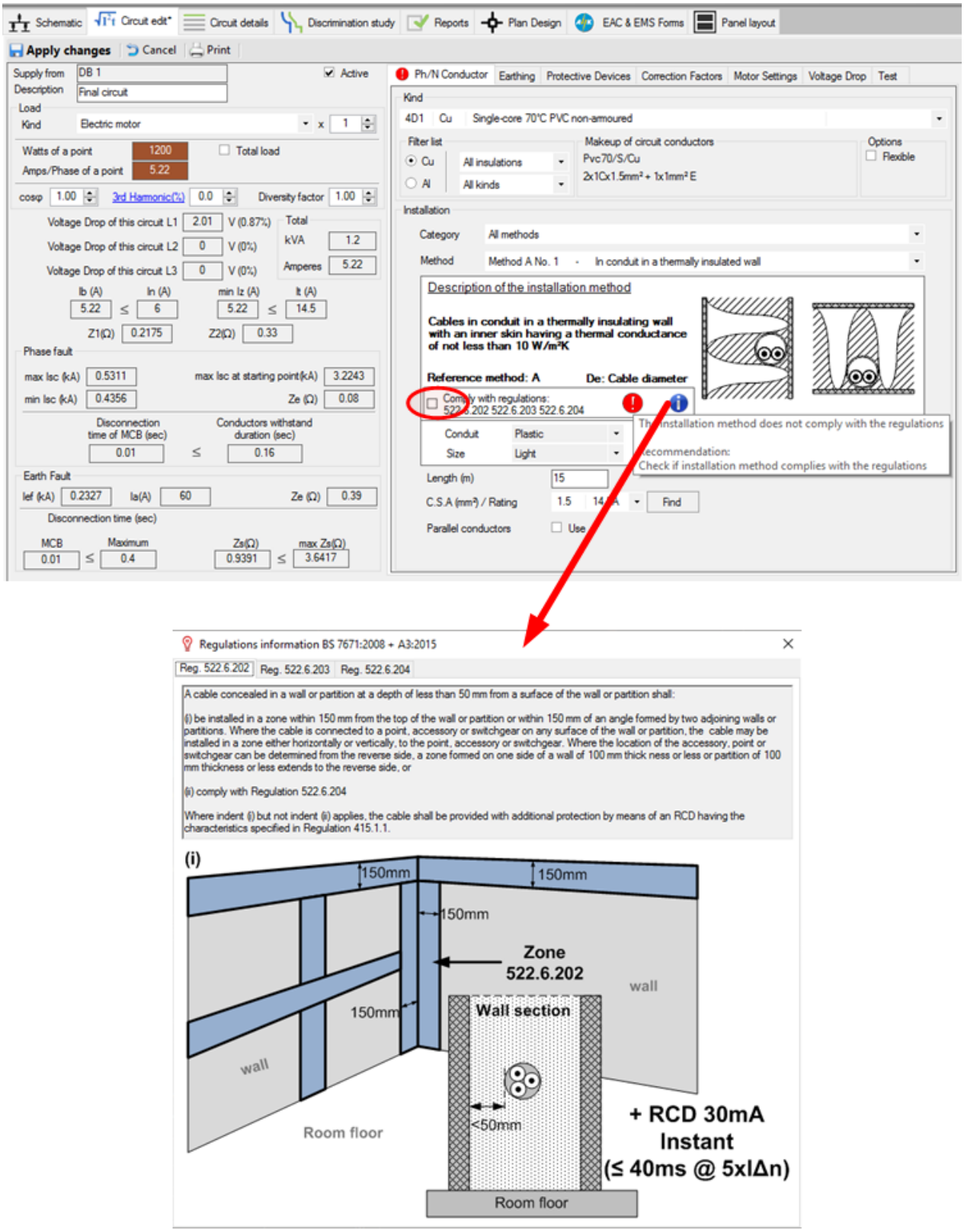





## Installation Compliance with Regulations Check

Installations in wall, floor, or ceiling must comply with the regulations 522.6.202,522.6.203,522.6.204 in BS 7671:2008 (2015).

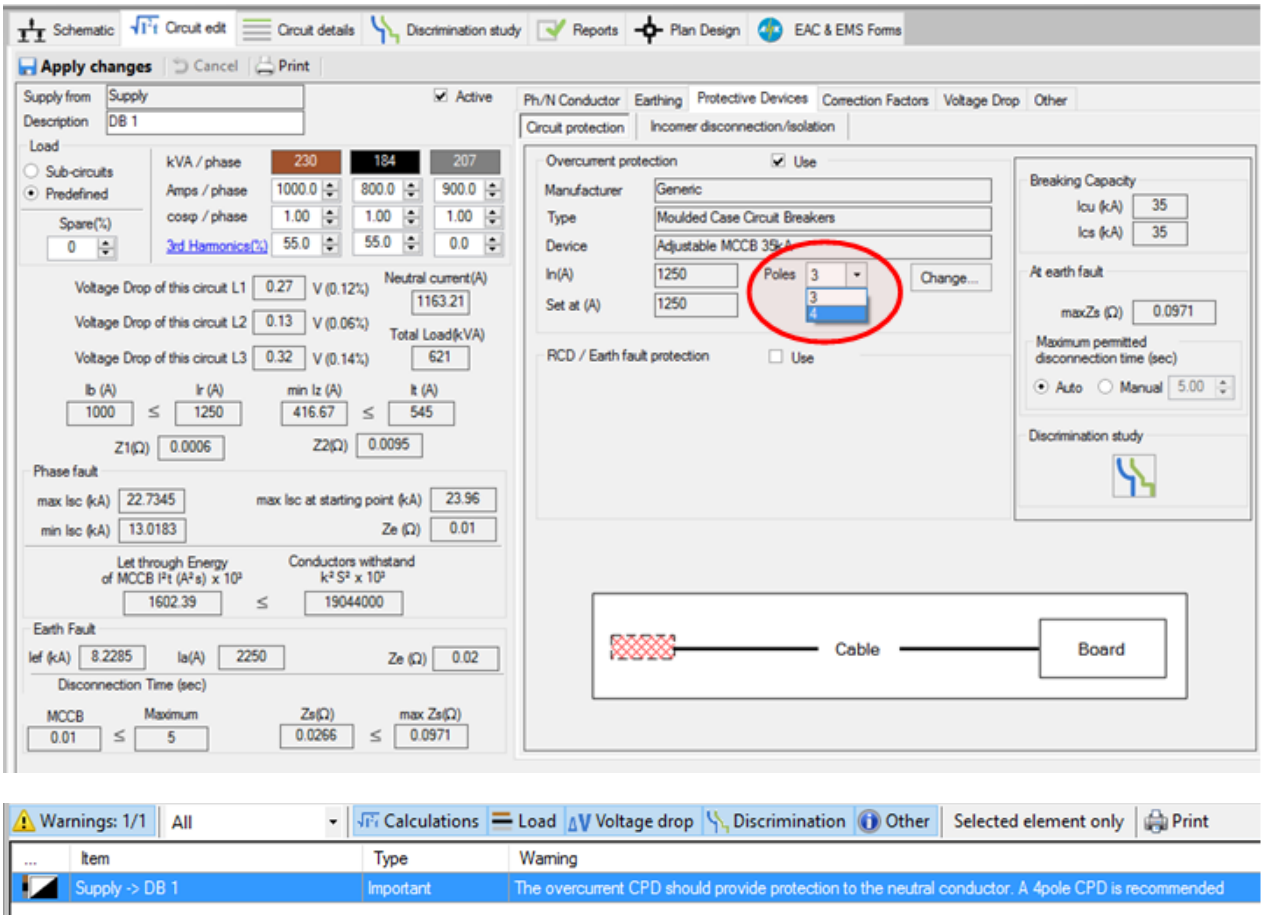
**Recommendation to resolve the error:**
Check the **Comply with regulations** box, to declare awareness about the specific regulations.




## Harmonic Content in Circuit Check

When high harmonic content is present in the circuit, the software checks that overcurrent protection is provided for the neutral conductor (BS 7671 Reg. 431.2.3).

**Recommendation to resolve the error:**
Use a 4 pole CPD.



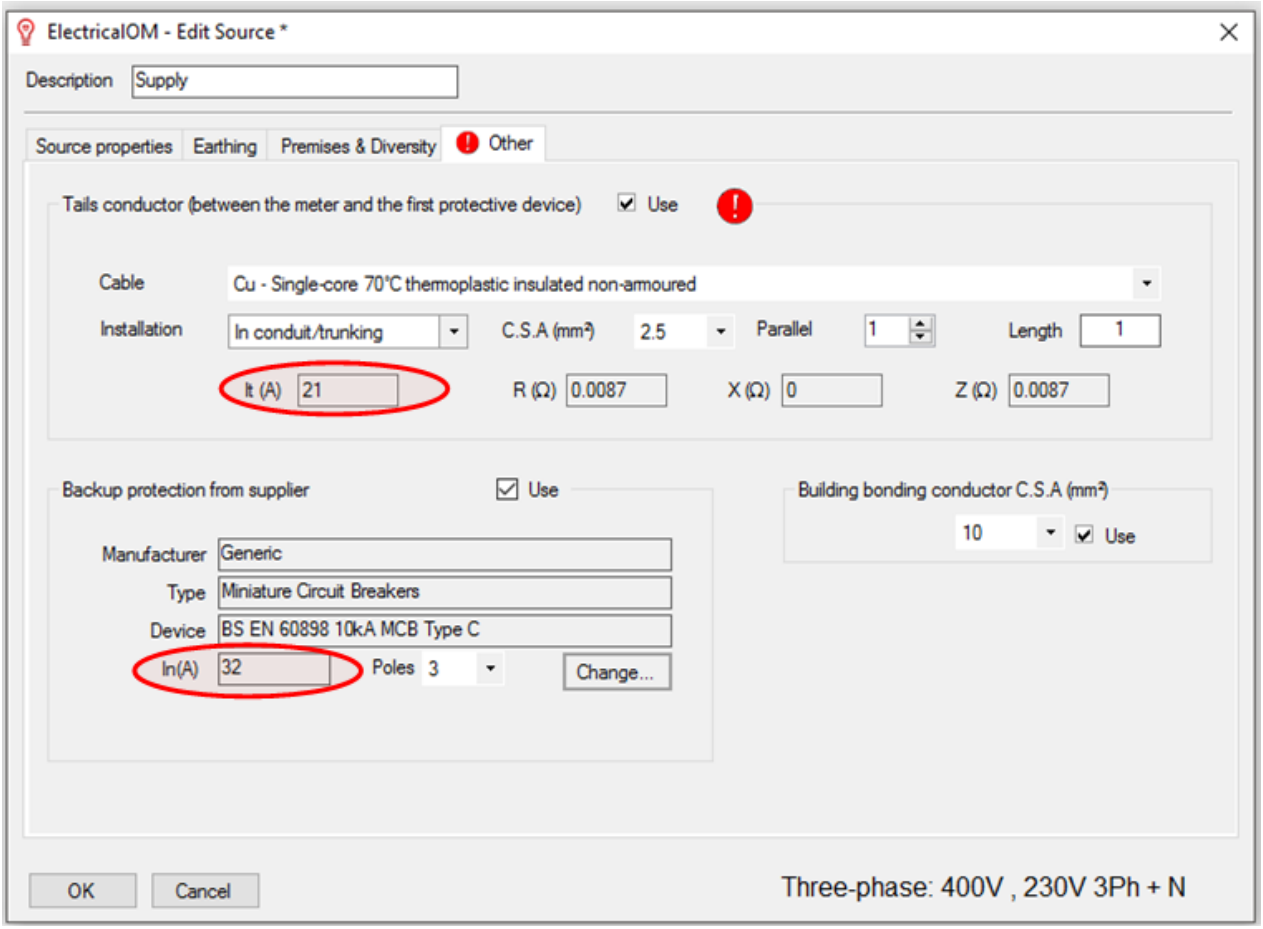


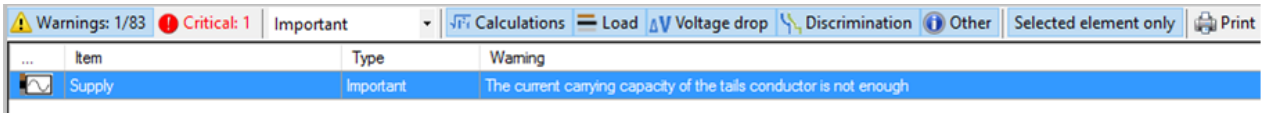


## Current Carrying Capacity of the Tails Conductor Check

If the engineer chooses to set the tails conductor and use the protection device from the supplier, the software checks that the current carrying capacity of the tails conductor agrees with the rating of the supplier's protective device.

**Recommendation to resolve the error:**
Revise the tails conductor so that It >= In.




## Simple

Simple warnings have to do with minor issues that won't cause serious problems to the project and that do not have to be resolved, but that could indirectly bring about more serious issues in the later stages of implementation.

Load Balance Check

Power Factor Correction Unit Usage Check

Existing Installation - Exclude from the Checks

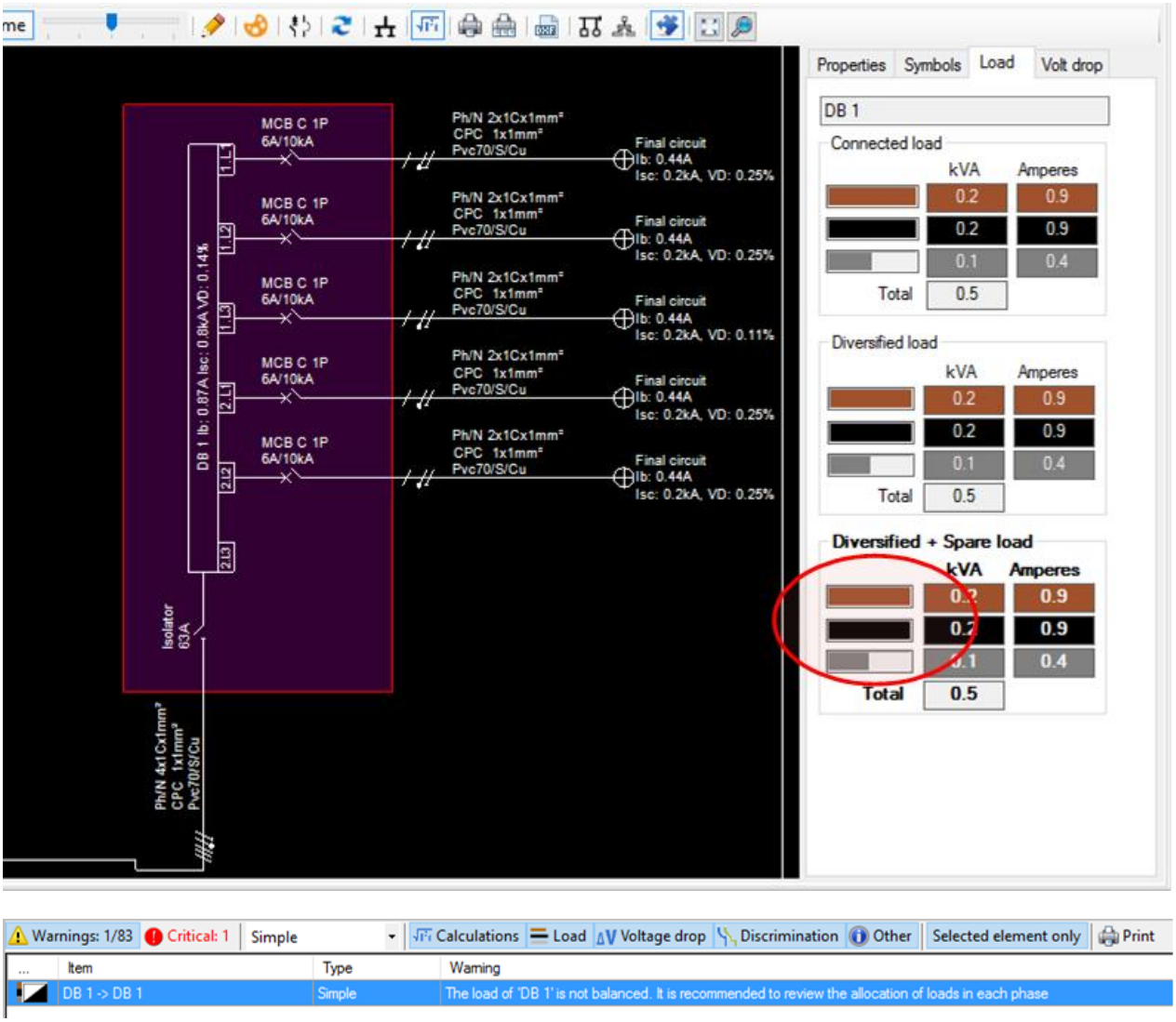
Inactive Circuit Check

### Load Balance Check

The software provides a warning if the load in the distribution circuit is not balanced.

**Recommendation to resolve the error:**
Review the allocation of loads in each phase.

See more details here



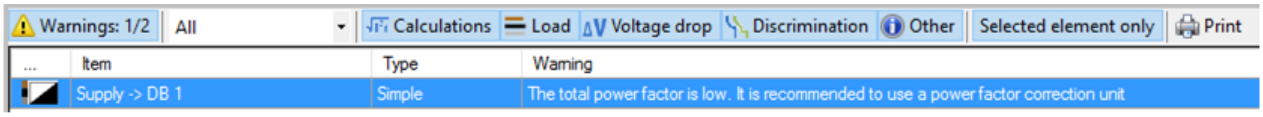


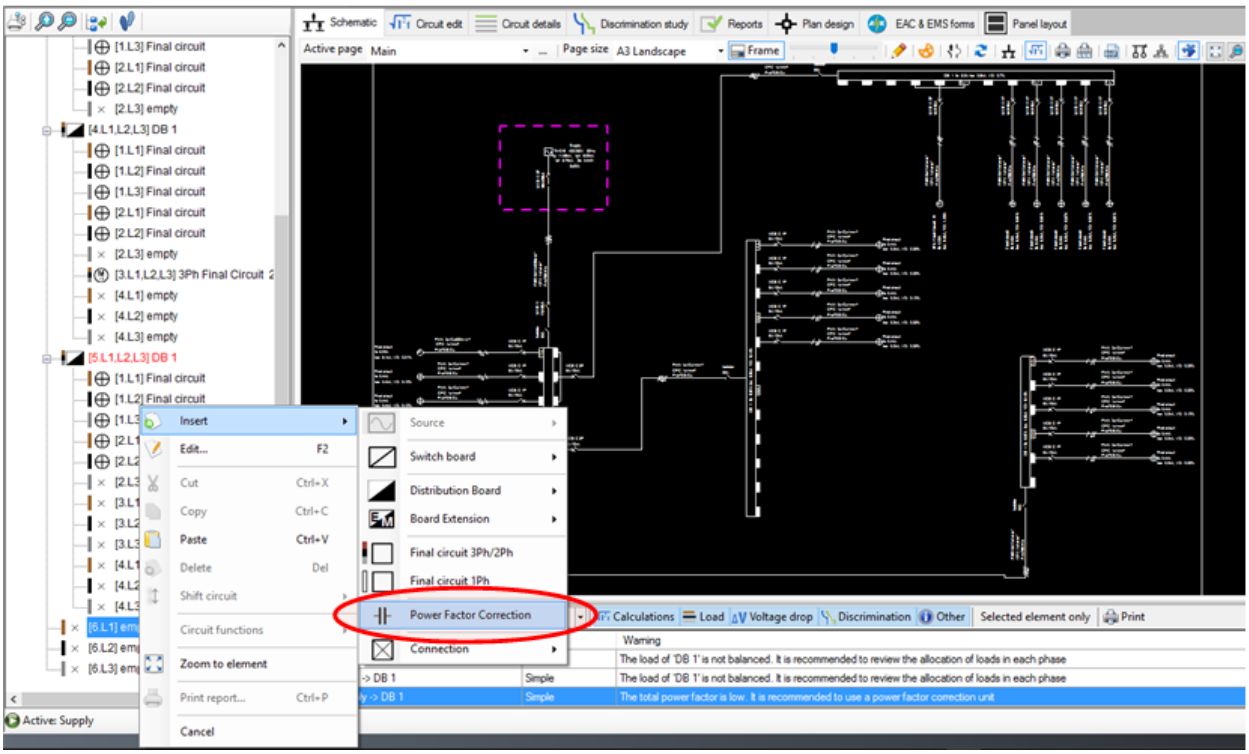


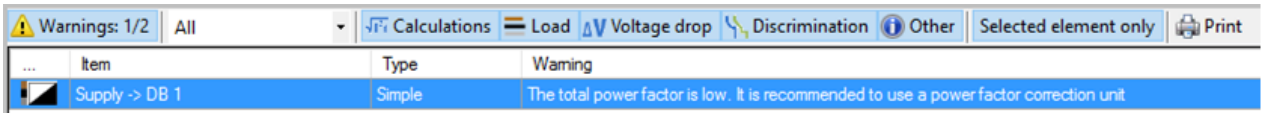
## Power Factor Correction Unit Usage Check

When the calculated power factor (cos ϕ) at the main distribution circuit is calculated to be less than 0.85, the software notifies the designer that it is appropriate to install a power factor correction unit.

**Recommendation to resolve the error:**
Install a power factor correction unit to correct the total power factor (cos ϕ).

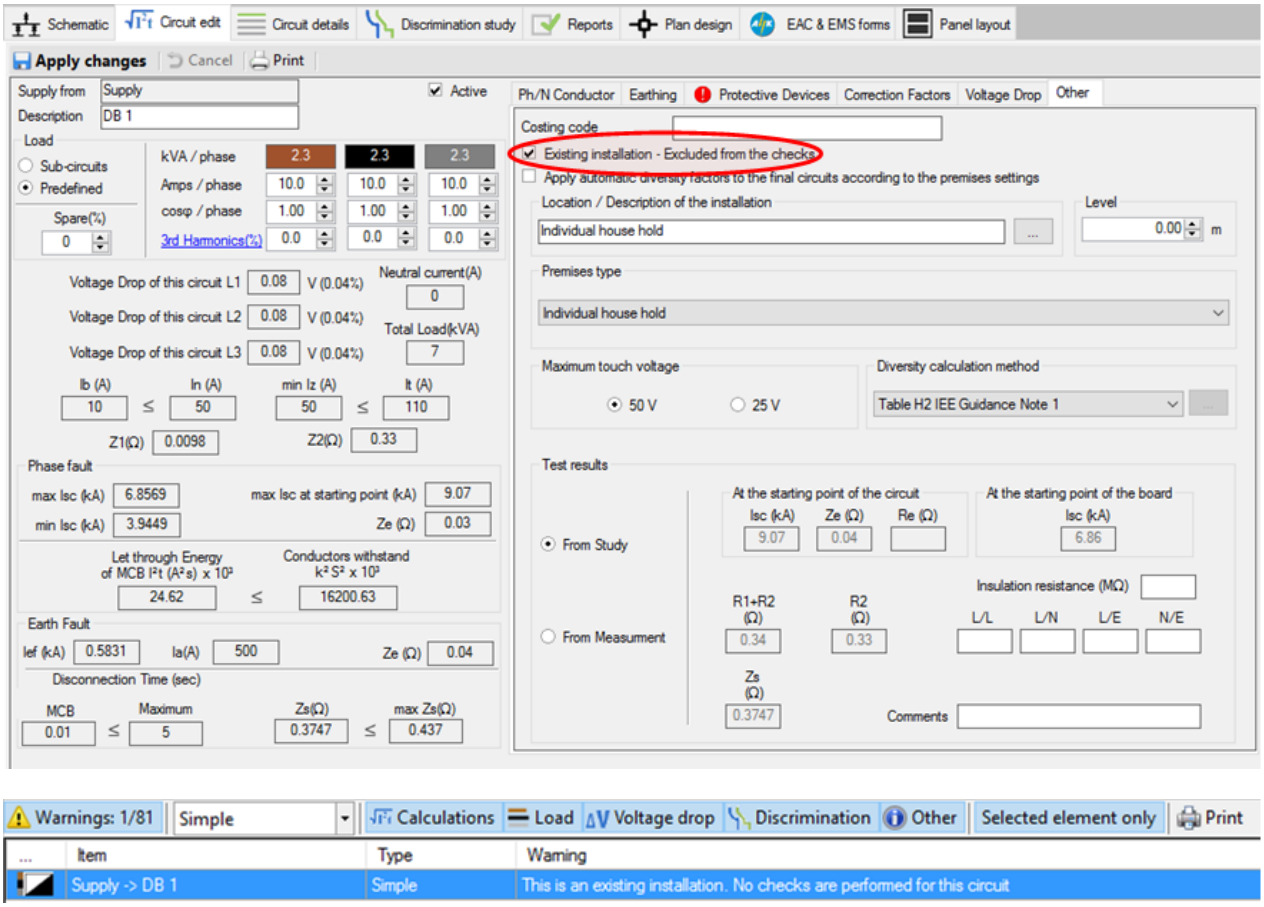



## Existing Installation Warning

If the user sets a distribution circuit as an existing installation then no checks are performed. A warning indicates that this distribution circuit has been excluded from calculations and checks.

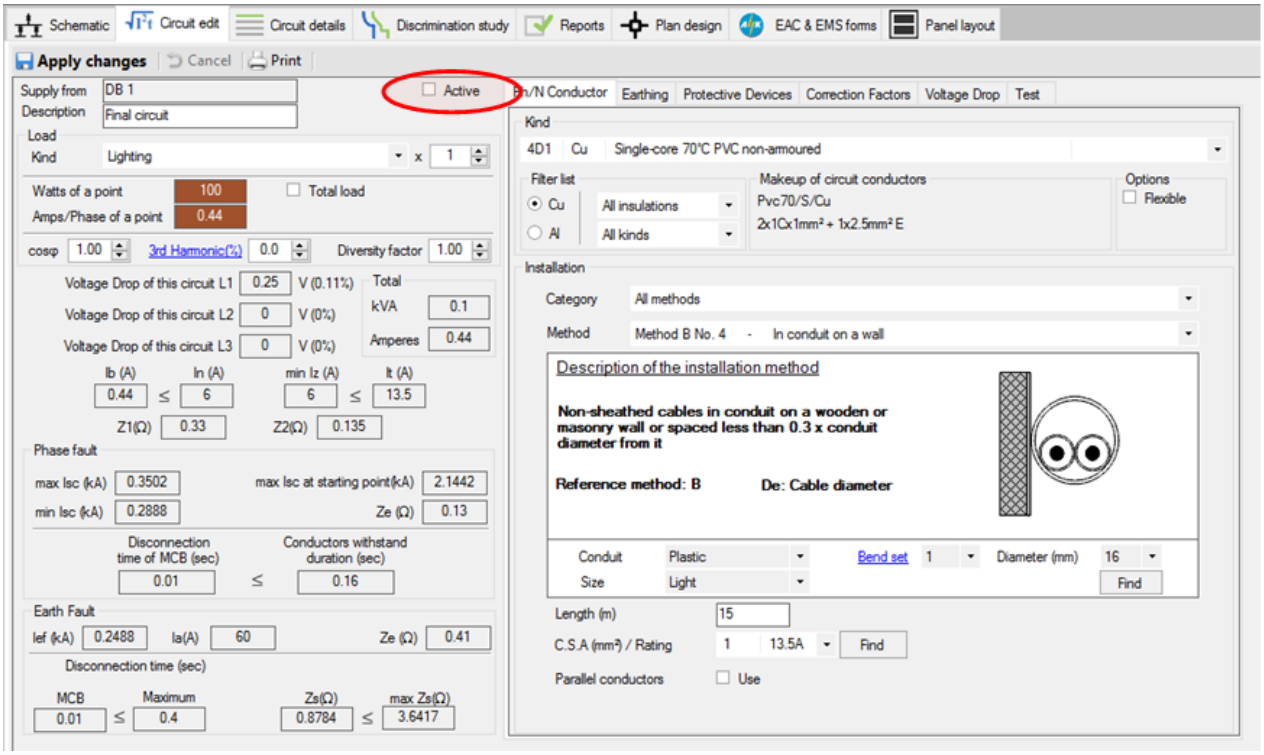


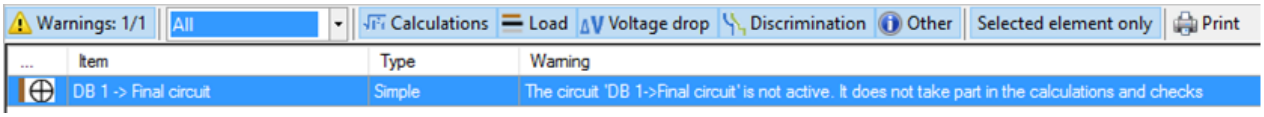




## Inactive Circuit Warning

When a circuit is marked as inactive, the softwares warns the engineer about this state. Inactive circuits are excluded from the load summations, calculations and checks. This functionality allow the designer to model the on/off state of a circuit for a particular scenario.




Warnings: 1/1
All
Calculations
Load
Voltage drop
Discrimination
Other
Selected element only
Print
...
Item
Type
Warning
DB 1 -> Final circuit
Simple
The circuit 'DB 1->Final circuit' is not active. It does not take part in the calculations and checks