ElectricalOM Getting Started

ElectricalOM



POWERFUL - INTELLIGENT - AUTOMATED BS7671 - 18TH EDITION ELECTRICAL DESIGN & CERTIFICATION SOLUTION

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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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Project tole Project to	P		
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Designer office info			
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MOI	DECSOFT	5	Predefined
Calculations scenario			
Scenario			
Project revisions			
Revision by	Revision date	Comments	

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.

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Project info User del	ault info Checks Program defaults	
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Use 2.5mm ²	(1.5mm²for MICC) as the minimum C.S.A of the phase/N conductor for ring circuits tive device rating of 30A or 32A for ring circuits	
	3	
Project info Use	r default info Checks Program defaults	
🗌 Auto save	project every 15 🗼 min to the auto save folder	
Language	English ~	
Color scheme	Brown Black Gray \sim	

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.

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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.

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1 2

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.

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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.

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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).

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~			
	2		
Command:			

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).

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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: 16mm², installed underground
- Up to the meter: Al Multicore XLPE 90oC armoured, length: 10m, cross sectional area: 16mm², installed on a surface

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

Distribution circuits:

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

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	Cut	Ctrl+X		Distribution Road						
	Сору	Ctrl+C	Ed	Board Extension						
	Paste	Ctrl+V			_					
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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:

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Supp	ly			
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	1	Edit	F2	
	x	Cut	Ctrl+X	
		Сору	Ctrl+C	
		Paste	Ctrl+V	
	0	Delete	Del	
	\$	Shift circuit		•
		Circuit functions		•
	11	Schematic functions		,
		Zoom to element		
	ä	Print report	Ctrl+P	
		Cancel		

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: 16mm², installed underground
- Up to the meter: Al Multicore XLPE 90oC armoured, length: 10m, cross sectional area: 16mm², installed on a surface

puori [ooppiy		
ce properties Earth	ning Premises & Diversity Other	
ase to N Voltage	230 0	Maximum values of voltage drop from the origin of the installation Maximum values of voltage drop from the origin of the installation Public supply (Lighting 3%, Other uses 5%)
rthing system	TN + TN-C-S + 3	Private supply (Lighting 6%, Other uses 8%)
oply frequency	50Hz - 4	O Other (user defined limit) 4.0 ‡ %
ource characteristics	kVA 500 ♀ Calculate Z (%) 6.00 ♀ fault	Load capacity (A) 721.7 Set extra cables up to the origin point of the installation 8
ospective symmetrica	al fault current at the origin point 3.1445 Ζρ(Ω) 0.0731	Prospective Phase to N/Earth fault current at the origin point 10 Ipn(kA) 1.8166 Zpn=Ze(Ω) 0.1266
Power factor	Rp(Ω) 0.0585 0.8 Xp(Ω) 0.0439	Power factor 0.8 Xpn(Ω) 0.1013 Xpn(Ω) 0.076 0.076 0.076
Power factor	Rp(Ω) 0.0585 0.8 Xp(Ω) 0.0439	Powerfactor 0.8 Xpn(Ω) 0.1013 Yourgan 0.076 0.076

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).

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Select style Din Rail Select style Din Rail Select style Select style Select st	Wa	ays	4	~			
Din Rail	1		Sele	ct style	8		
 Ceneral Description Way position Uascription WDB MDB 1,L1,L2,L3 Design load L1 0 A L2 0 A L3 0 A Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Voltage drop 	Din	Rail					
 [General] Description Way position 1.L1,L2,L3 Design load L1 0 A L2 0 A L3 0 A Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Voltage drop 	•	₹↓					
Description MDB Way position 1.L1,L2,L3 V Design load L1 0 A L2 0 A L3 0 A Y Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Y Voltage drop	~	[Gen	eral]		0		
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 Design load L1 D A L2 D A L3 D A Fault currents Earth D.29 kA Phase max D.69 kA Phase min D.3 kA Voltage drop 		Way	position	1.L1,L2	,L3		
L1 0 A L2 0 A L3 0 A ✓ Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA ✓ Voltage drop	~	Desi	gn load	0.4			
L2 0 A L3 0 A V Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Voltage drop		12		0 A			
 Fault currents Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Voltage drop 		13		0A			
Earth 0.29 kA Phase max 0.69 kA Phase min 0.3 kA Voltage drop	~	Fault	currents	20			
Phase max 0.69 kA Phase min 0.3 kA Voltage drop	1	Earth	Currente	0.29 kA			
Phase min 0.3 kA Voltage drop		Phase	e max	0.69 kA			
 Voltage drop 		Phase	e min	0.3 kA			
	~	Volta	age drop				
L1 OV		L1		0V			
L2 0V		L2		0V			
L3 0V		L3		0V			
✓ Zs	~	Zs					
Max Zs 3.64 Ω		Max 2	Zs	3.64 Ω			
Zs calculated 0.76 Ω		Zs ca	lculated	0.76 Ω			
Description	De	scrint	ion				

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.

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× [3.L2] empty
× [4.L2] empty
× [1.L3] empty

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)**.

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2.1.2] empty Edit	F2 Switch board	
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× [3.L2] empty Copy		
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X [4.L1] empty Paste	Final circuit 3Ph/2Ph	Way section
- × [4.L2] empty Delete	Del Final circuit 1Ph	The way position of the circuit
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	- - Power Factor Correction	
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	DB 2 Important The protective device is not suitable for selective use during overcurrent	
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Cancel	P.D. 2 Internal Intellinguese Intellinguese ou seecond rise of an and an an and an	·
Active: Supply (Circuits 0		~ ~ ~



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 🙄 Cancel 👝 Print	
Supply from DB 1 Active	Ph/N Conductor Earthing I Protective Devices Correction Factors Voltage Drop Test
Description P1 COOKER	Kind
Load Kind Cooker control unit 🔹 x 1 🖨	4D1 Cu Single-core 70°C PVC non-armoured
Watts of a point 6000 Total load Amps/Phase of a point 26.09	Filter list Makeup of circuit conductors Options • Cu All insulations • Pvc70/S/Cu 2x10x1mm² + 1x1mm² E • Pvc70/S/Cu
cosφ 1.00 ♀ <u>3rd Hamonic(%</u> 0.0 ♀ Diversity factor 1.00 ♀	
Voltage Drop of this circuit L1 17.22 V (7.49%) Voltage Drop of this circuit L2 0 V (0%) KVA 6	Category All methods •
Voltage Drop of this circuit L3 0 V (0%) Amperes 26.09	Method Method B No. 59 - In conduit in a wall
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Description of the installation method
Z1(Ω) 0.33 Z2(Ω) 0.33 The cu Phase fault max lsc (κA) 0.2062 max lsc at starting point(κA) 0.7 Revise	irrent inequalities are not satisfied irrent i
min lsc (kA) 0.1708 Ze (Ω) 0.68	Comply with regulations:
Disconnection Conductors withstand time of MCB (sec) duration (sec)	Conduit Plastic
0.01 ≤ 0.45	Size Light • Find
Earth Fault Image: Image for the state of	Length (m) 15 C.S.A (mm ³) / Rating 1 13.5A ▼ Find
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Parallel conductors Use

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.

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× [1.L2] empty	Load P1 COOKER
× [1.L3] empty	Kind Cooker control unit 🔹 🗴 1 蒙

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**.

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						 Voltage drop 11 12 52V /5 44
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			Print report	Cutt	-	
			Cancel			
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To paste the copied circuit, right click on empty way 1.L2 (1) and select Paste (2).

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è-12 DB 1	5.#5	Properties Symbols Load Volt drop
- (1.1.1) P1 COOKER	4 M 4 M 4	Board DB 1
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	Cold 1-2 PT COOKER Catcal The test at votage drop of the final across PT COOKER's is over the maximum list \$50	
	Province province of the product of the produc	
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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.

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	x	Cut	Ctrl+X		V [General] Description Supply
		Сору	Ctrl+C	1 2 1964, spr 1 1964 art 1964, 2 2 0 30	Earthing system TN-C-S
		Paste	Ctrl+V	2ª # *	Votage 400/230V SUH2 Fault levels
	5	Delete	Del	200	Earth fault 1.81kA Earth Ze 0.13Ω
	Ť	Shift circuit			Phase fault lp: 3.15kA, lpn: 1.82kA
		Shint Circuit			
		Circuit functions	•	Calculate diversity factors	
	÷	Schematic function	s)	Change phase	
	53	Zoom to element			
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-		[2.L3] P1 FRIDGE		MO8	
		[3.L1] P5 A/C 1		ولاحم وتاجل وبالجل وحتم وبلاح ولاحم وتلحم والحم وحتم والحم ومحم	
		[3.L2] P5 AC 2 [3.L3] S1 RINC (v25)		공동이	
	÷	[4.L1] LIGHTS 1 (x15)		#S #S #S #S #S #S #S #S #S #S	
	lе́	(4.L2) LIGHTS 2 (x15)			Description
	×	[4.L3] empty			
				🔥 Warnings: 85/85 🕒 Critical: 36 🛛 All 🔹 🐨 🖓 Calculations 🚍 Load 🗚 Voltage drop 🏠 Discrimination 🕕 Other Selected element only 🔮 Print	
				tem Type Warning	
				There are errors in MDB. Please off the tem (1) The rating of the incomer switch/laciator used is less than the design current of the circuit (incomer rating(A) = 63 < b(A)=71.74) (1) The rating of the incomer switch/laciator used is less than the design current of the circuit (incomer rating(A) = 63 < b(A)=71.74)	
				 2) The current inequalities are not satisfied (b=/1.74 c h= 6, miniz=6 c t=12) 3) The protective device rating is lower that the Neutral Current 	
Active	Supply	Y		· · · · · · · · · · · · · · · · · · ·	

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:

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upply from Supply 🗹 Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other			
escription MDB	Туре			
Load kVA / phase 12.01 12.58 7.76	4D1 Cu Single-core 70°C PVC non-armoured			
> Jub-circuits Diversity 1 0.90 € 0.90 € Spare(%) cosp 1 1 1 0 € 3rd Harmonics(%) 0 0 0	Filter list Wiring Makeup of circuit conductors Options • Cu • Al All kinds • 3Ph • 3Ph + N • 3Ph • Voc70/S/Cu • 4x1Cx1mm ² + 1x1mm ² E • Options			
Voltage Drop of this circuit L1 19.81 V (8.61%) Neutral current(A)	Installation Category All methods			
Total Load(kVA)	Method Method B No. 59 - In conduit in a wall			
Voltage Drop of this circuit L3 4.61 V (2%) 32 Ib (A) In (A) min Iz (A) It (A)	Description of the installation method			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cables in conduit in masonry having a thermal resistivity not greater than 2 K.m./W			
Phase fault	Beference method: B De: Cable diameter			
max isc (κA) 0.555.3 max isc at starting point (κA) 3.15 min isc (κA) 0.3013 Ze (Ω) 0.07	Comply with regulations: 522.6.202 522.6.203 522.6.204			
Disconnection Conductors withstand time of MCB (sec) duration (sec)	Conduit Plastic • <u>Bend set</u> 1 • Diameter (mm) 16 •			
0.01 ≤ 0.15	Size Light • Find			
Earth Fault	Length (m) 15			
ef (kA) 0.2857 la(A) 60 Ze (Ω) 0.13	C.S.A (mm ²) / Rating 1 12A - Find			
Disconnection Time (sec)	Parallel conductors Use			
$\begin{tabular}{c c c c c c c } \hline MCB & Maximum & Zs(\Omega) & max Zs(\Omega) \\ \hline 0.01 & \leq & \hline 5 & & 0.7649 & \leq & 3.6417 \\ \hline \end{tabular}$				

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).
ElectricalOM Getting Started

ElectricalOM Getting Started







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.

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[2.L1] P1 A/C	Sub-circuits Discretize O 90 1 O 90 1 O 90 1	Manufacturer Generic	Breaking Capacity
- [3.L1] S1 RING (x15)	O Predefined Diversity 0.50 C 0.50 C 0.50 C	Tune Miniature Orovit Resikers	lcu (kA) 10
(4.L1) DGHTS 1 (X10)	Spare(%) 3rd Hamonica(%) 0 0 0	Device BS EN 60898 10kA MCB Type C	Ics (kA) 7.5
(5.1 1) ampty		In(A) 6 Poles 3 • Observe	At earth fault
× [7] 11 empty	Voltage Drop of this circuit L1 19.81 V (8.61%)		
× [8.L1] empty	Voltage Drop of this circuit L2 18.68 V (8.12%)	U U	maxZs (Ω) 3.6417
0-12 [1.L2] DB-F	Voltage Drop of this circuit L3 7.8 V (3.39%) 32	RCD / Earth fault protection Use	disconnection time (sec)
[1.L2] P1 A/C 1	lb (A) In (A) min Iz (A) It (A)		Auto O Manual 5.00
- [2.L2] S1 RING (x15)	522 ≤ 6 ≤ 12 ●		
- (3.L2) LIGHTS 1 (x15)	Z1(0) 0.3291 Z2(0) 0.33		Discrimination study
× [4.L2] empty	Phase fault		2
- [1.L3] P1 COOKER	max lsc (kA) 0.6853 max lsc at starting point (kA) 3.15		
- [2.L1] P2 DISH WASHER	min lsc (kA) 0.3013 Ze (Ω) 0.07	12	
(2.L2) P3 DRIER	Disconnection Conductors withstand		
[2L3] P1 FRIDGE	time of MCB (sec) duration (sec)		
	0.01 <u>≤</u> 0.15		
□ [3.12] P5 NG 2		Cable	Board
A 141 111 (GHTS 1 (x15)	HE (KA) U.2007 Id(N) UU UU		
× [412] empty	1000 Moder 7:00 mm 7:00		
A 14 L 31 LIGHTS 2 (x15)	M_{CB} maximum $\frac{2.5(2)}{0.01}$ $\frac{1}{5}$ $0.7649 \le 3.6417$		
	🚯 Warnings: 85/85 🕚 Critical: 36 🛛 All 🔹 👻 🖅 Calculations	= Load AV Voltage drop	ment only
	tem Type Warning		
	There are error	is in 'MDB'. Please edit the tem	
	Suppy S MDB Unical 1) The current	inequalities are not satisfied (b=52.2 ≤ in= 5, miniz=5 ≤ t=12)	

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).

MCBs	MCCBs	Manufacturer		Rating
RCBOs	ACBs	Generic	^	5 A
Fuses		ABB		6 A
RCDs	BCCBs	Crabtree		15 A
THODE	110000	Eaton		16 A
lcu (kA) >=	0 ≑	Hager	~	20 A
		Туре		30 A
ABB		Miniature Circuit Breakers (2)		32 A
Schnoidor		Air Circuit Braskers		40 A
Electric		Moulded Case Circuit Breakers		63 A
() TERASAKI		Fuses		80 A
.	0			100 A
hager	0	Device		12071
The second i		BS EN 60898 10kA MCB Type B	^	
liegrand		BS EN 60898 10kA MCB Type C		
Crahtree		BS EN 60898 15kA MCB Type B		
Ciabuce		BS EN 60898 15kA MCB Type C		
F.T.N		BS EN 60898 15kA MCB Type D		
	N35 33	BS EN 60898 20kA MCB Type B		
SIEMENS	Generic	BS EN 60898 20kA MCB Type C BS EN 60898 20kA MCB Type D	~	
				-
				Selec

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

Overcurrent pro	tection	🖌 Us	se				
Manufacturer	Generic						
Туре	Miniature (Miniature Circuit Breakers					
Device	BS EN 60	898 10ka MCB	Туре	С			
In(A)	63	Poles	3	•	Change		

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.

ElectricalOM Getting Started

Ph/N Conductor	Earthing	Protective Devices	Correction Factors	Voltage Drop	Other	
cuit protection	Incomer discon	nection/isolation	•			
Overcurrent prote	ction	Use				
RCD / Earth fault	protection	Use				
Isolation/Disconn Type AC21	ection 🔽 Use	← 63	A 3			
_		– Cable –	~	****	Board	

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:

1 Schematic 12 Circuit edit	y 📝 Reports 🔶 Plan Design
🖬 Apply changes 🗇 Cancel 🚔 Print	
Supply from DB-G ✓ Active Description S1 RING ✓ Load Kind Switch socket outlet ring circuit • x 15 ♀ Watts of a point 200 Total load Amps/Phase of a point 0.87 cosp 1.00 ♀ 3rd Harmonic(%) 0.0 ♀ Diversity factor 1.00 ♀ Votage Drop of this circuit L1 1.6 V (0.69%) Total	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Test Selection of circuit protective devices Overcurrent protection Image: Correction of circuit protection of circuit protection Image: Correction of circuit protection Image: Correctin protection Image: Correction<
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	RCD / Earth fault protection Image: Construction Image:
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	In (A) 32 Type AC Change 2 Maximum touch voltage 50 Real (V) 0.01
0.01 3 0.4 0.323 5 7203.3333	

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).

Pile Edit Insert	Functions	Windows	Support	Help	
C:\eom\tutorial.eom*	Calcu	lations	•		
le 🖓 🖉 🛃	Minir	num conductor	sizes 🚺	vatic 뒛 C	
Supply	Mate	rials cost		changes	
E [] [1.L1] DB-0	Opera	ation scenarios	9	MDB LIGHTS 2	
	Find	Find circuit		Lighting	
D- [3.L1]	Note:	5		a point	
	JGHTS 1 (X	10)	Amps/P	hase of a point	
🕀 [5.L1] L	JGHTS 2 (X	15)	cosφ	1.00 🖨 <u>3rd</u>	

From the minimum conductor sizes dialog the engineer can choose the minimum conductor size per circuit kind. In our example we have chosen 1.5mm² 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.

1Ph 3Ph	Coope	r conducto (mm²)	rs Aluminiu	um conduc (mm²)	tors
Circuit type	Phase/N	CPC	Phase/N	CPC	^
Lighting	1.5	1.5	N/A	N/A	
Lighting with gear losses (lb x 1.8)	1.5	1.5	N/A	N/A	
Switch socket outlet ring circuit	1.5	1.5	N/A	N/A	
Switch socket outlet radial circuit	1.5	1.5	N/A	N/A	
Electric heating element	1.5	1.5	N/A	N/A	
Cooker control unit	1.5	1.5	N/A	N/A	
Cooker control unit with socket	1.5	1.5	N/A	N/A	
Water instant heater	1.5	1.5	N/A	N/A	
Electric boiler with thermostat	1.5	1.5	N/A	N/A	
Electric under floor heater	1.5	1.5	N/A	N/A	
Storage heater	1.5	1.5	N/A	N/A	~
2	N/A 🔻	N/A 🔹	N/A 🔻	N/A 🔻	
OK Cancel	N/A 1 1.5 2.5 4 6 10	s are appli	ed during circ	uit configu	ration

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 16mm² / 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.*

🛨 Schematic 🐠 Circuit edit* 🧮 Circuit details 🦙 Discrimination stud	Reports 🔶 Plan Design	
🖬 Apply changes သ Cancel 🔚 Print	1	
Supply from Supply Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop	Other
Description MDB	Туре	
Load kVA / phase 12.01 11.69 8.65	4E4 Cu Multicore 90°C XLPE armoured	Armour: Steel - 💙
Sub-circuits Predefined Diversity 0.90 0.90	Filter list Wiring Makeup of circuit conductors	Options
Soare(%) cosp 1 1 1 1	Cu All insulations • • 3Ph + N SwaXipe90/M/Cu	4) Bun to 70°C (5)
0 - 3rd Hamonics(%) 0 0 0	Al kinds Al kinds	
Voltage Drop of this circuit L1 4.69 V (2.04%) Neutral current (A)	Installation	0
Voltage Deep of this circuit 12 (442) V (1 92%) 13.96	Category In ground	- 0
Votage Drop of this circuit L2 (1.52 A) Total Load(kVA)	Method D No. 70 - In underground single way ducts	•7
Votage Drop of this circuit L3 1.65 V (0,8%) 32	Description of the installation method	
10 (A) in (A) min iz (A) it $(A)52.2 \le 63 70 \le 21$		
Z1(D) 0.0779 Z2(Q) 0.0594	Cables in underground single way ducts	
Phase fault		
max lsc (kA) 1.8081 max lsc at starting point (kA) 3.15	Reference method: D De: Cable diameter	(239)
min lsc (κA) 0.8576 Ze (Ω) 0.07		
Disconnection Conductors withstand	Conduit Plastic • Bend set 1 • D	kameter (mm) 16 •
time of MCB (sec) duration (sec)	Size Light -	Find 😏
Earth Fault	Length (m) 10 5 Set the ne	utral conductor
lef (kA) 0.8699 la(A) 630 Ze (Ω) 0.13	C.S.A (mm ³) / Rating 1.5 21A · Find 12	
Disconnection Time (sec)	Parallel conductors	
MCB Maximum Ζs(Ω) max Zs(Ω)	4 36A	
0.01 ≤ 5 0.2512 ≤ 0.3468	6 44A	
	16 75A	
	25 96A 35 115A	
All • Tri Calculations	Load AV Voltage drop 50 135A Other Selected element	conly 🙀 Print
tem Type Warning	p MDB' Please edit the term	
Supply -> MDB Critical 1) The current i	equalities are not satisfied (b=52, 120 223A =12)	
2) The protection		
	240 324A 300 365A	

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.

Apply change	S Cancel Print									Three-phase 400V and N 230V 50Hz
Supply from Supp	У	🗹 A	ctive 🧃	Ph/N Conductor Ear	thing Protective D	evices Correction F	actors Voltage Drop Oth	a.		
Description MDB				Туре						
Load	kVA / phase 12.01	11.69 8.	5	4E4 Cu Multicore	90°C XLPE amoun	be		Amour: Steel		
Sub-circuits Predefined	Diversity 0.90	0.90 🗢 0.90		Filter list Ou All insulations	• Wiring • 3Ph	Makeup of c + N SwaXpe90/	ircuit conductors M/Cu	Option	ns	
Spare(%)	3rd Harmonics(%) 0			Al Al kinds	• 0 3Ph	1x4Cx16mm	* + E(armour)		un to 70°C SF	
Voltage Dr	op of this circuit L1 0.39 V	(0.17%) Neutral curren 13.96	t(A)]	Installation Category In gro	und				•	
Voltage Dr	to of this circuit L2 0.37 V	(0.16%) Total Load(k (0.06%) 32	/A)	Method Meth	od D No. 70 -	In underground single	way ducts		•	
lb (A) 52.2 Z1(¢	ln (A) min lz ≤ 63 70 2) 0.0072 Z	(A) It $(A)\leq 752(\Omega) 0.0202$		Description of t	he installation m ground single wa	ethod y ducts			8	
Phase fault max lsc (kA) 2 min lsc (kA) 1	9592 max lsc at s	tarting point (kA) 3. Ze (Ω) 0.0	5	Reference meth	od: D D	e: Cable diameter				
Let of MC	hrough Energy Condu	uctors withstand		Conduit	Plastic	• Bend s	zt 1 • Diameter (m	m) 16 •	0	
	11.83 ≤	5234.94		Size	Light			Find	The cond	duit diameter is not enough
Earth Fault				Length (m)	5]	Set the neutral cond	uctor	Calculati	on is based on the IEE Guidance Note 1, Appendix A
lef (kA) 1.455	la(A) 630	Ze (Ω) 0.	13	C.S.A (mm ²) / Rating	16 75	Find			Recomm	endation:
Disconnection	Time (sec)		_	Parallel conductors	Use				Revise th	e installation method

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**.

'N Conductor Earthing Protective Devi	ces Correction Factors	Voltage Dro	p Other	
Only cable armour will be used	as the CPC			
Installation	Cable armour			• 2
	Cable amour Separate conductor			
Cable's amour C. S. A. (mm ^a)	Core of the cable			
Cable's amour resistance (O)	Cable armour and sepa Cable armour and core	of the cable	r	
Adjubation abandular CDC				
Total CPC C S	S A (mm ²)		16.08	8
Mai of C C.	C C A (2		0.71	×
	C.3.A (mm*)		0.71	
- Local Earthing 🔲 Use 👩		R(Ω)	X(Ω)	
		0.000	0.000	
Local Earthing Electrode Impedance		0.000	0.000	
Local Earthing Electrode Impedance Other Local Earthing Impedances		0.000	0.000	÷

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.

Ph/N Conductor	Earthing	Protective Devices	Correction Factors	Voltage Drop	Test	
The CPC	; will be a	2 separate conductor				
C.S.A d	f separate o	Installation Separ conductor (mm²) 2.5	ate conductor Find	Use parallel c	conductors	- 3
	Ad	abatic check of CPC Total CPC C.S.A (mr Minimum CPC C.S.A	n²) (mm²)	2.5 0.36	5	

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.

upply from Supply			Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop	Other
lescription MDB Load Sub-circuits Predefined Spare(%) 0 ÷ Votage Drop Votage Drop Votage Drop Votage Drop Votage Drop Votage Drop Z1(Q)	kVA / phase Diversity cosφ of this circuit L1 0 of this circuit L2 0 of this circuit L3 0 in (A) ≤ 63 0.0072	12.01 0.90 ♀ 1 0 1 0 138 V (0.18%) 135 V (0.07%) min Iz (A) 78.65 Z2(Ω)	11.69 8.65 90 ⊕ 0.90 ⊕ 1 1 0 0 Neutral current(A) 13.96 Total Load(kVA) 32 It (A) 5 75 1	Ca - Correction factor of the current carrying capacity of the cable due temperature Ground temperature (°C) Ground temperature (°C) Cc - Correction factor for the cable's current carrying capacity in the group Cd - Correction factor for soil thermal resistivity Depth (m) 0.7 Ground resistivity (Km/W) 2.5 Cg - Correction factor for groups for more than one circuit Grouped circuits	e to the ground Ca = 0.83 ground Cc = 0.90 Cg = 1.00 Cg =
max Isc (kA) 2.9 min Isc (kA) 1.6 Let th of Fuse Earth Fault f (kA) 1.455 Disconnection Fuse 1 0.01 <	592 ma 612 mough Energy 1 ² t (A ² s) × 10 ² 24.15 ≤ Ia(A) 280 Time (sec) Aximum 5	x lsc at starting p Conductors wi k ² S ² x 1 5234.9 2s(Ω) 0.1502	orint (kA) 3.15 Ze (Ω) 0.07 thstand 0^{2} Ze (Ω) 0.13 Ze (Ω) 0.13 $\max Zs(\Omega)$ ≤ 0.7804	A correction for the cable operating temperature C - Correction for the cable operating temperature C - Correction factor for use of BS3036 Fuse Ch - Correction factor for triple harmonic currents	0.93

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 1mm², causing high voltage drops in the downstream circuits. We will take care of this error when we set the Main Distribution Board's conductor.

9 💽 🖬 🛛 Ə C 🔹	Untitled1*-ElectricalOM
P File Edit Insert Functions Windows	Support Help
Untitled1*	0
la p p 😝 📢	🕂 Schematic 🐠 Circuit edit 🚃 Circuit details 🦞 Discrimination study 📝 Reports 🔶 Plan Design
Supply	Apply changes Voltage drop over the maximum limit
□ DB 1 [].L1] P1 COOKER	Supply from DB 1 Active Ph/N Conductor Earthing I Protective Devices Correction Fa
× [1.L2] empty	Load Kind
X [1.L3] empty	Kind Cooker control unit • x 1 ÷ 4D1 Cu Single-core 70°C PVC non-armoured
× [2.L1] empty	Watts of a point 6000 Total load Filter list Makeup of circuit conduct
× [2.L2] empty	Amps/Phase of a point 26.09
× [2.L3] empty	cosφ 1.00 ≑ 3rd Harmonic(%) 0.0 ≑ Diversity factor 1.00 ≑
× [3.L1] empty	Voltage Drop of this circuit L1 10.97 V (4.77%) Total
× [3.L2] empty	Voltage Drop of this circuit 12 0 V (01/2) kVA 6 Category All methods
× [3.L3] empty	Voltage Drop of this circuit 12 0 V (04) Amperes 26.09 Method Method B No. 59 - In conduit in a wall
× [4,L] empty	Ib (A) Ib (A) min z (A) Ib (A) Description of the installation method
× [4.L3] empty	$26.09 \leq 30 \qquad 30 \leq 32$
1	$Z_{1}(\Omega)$ 0.22 $Z_{2}(\Omega)$ 0.36 Cables in conduit in masonry having a thermal
	Phase fault
	max lsc (kA) 0.5261 max lsc at starting point (kA) 3.2243 Reference method: B De: Cable diameter
	min lsc (kA) 0.4315 Ze (Ω) 0.08 G22 6 204 0
	Disconnection Conductors withstand
	0.01 < 1.14 Size Light •
	Fath Fault
	lef (kA) 0.2249 (Δn(A) 0.3 (from supply) Ze (Ω) 0.39 (C C A (wa? (D the A 23A - C D the
	Disconnection time (sec)
	RCD Parallel conductors Use
	$0.15 \le 0.4$ $0.9716 \le 728.3333$
	Warnings: 3/3 ● Critical: 1 All Fi Calculations = Load △V Voltage drop △ Discrimination ④ Other Select
	tem Type Wanning
2	DB 1-> P1 COOKER Control Ine total voltage drop of the tinal circuit P1 COOKER is over the maximum limit 54! Ine total voltage drop of the tinal circuit P1 COOKER Ine total voltage drop of the tinal circuit P1 COOKER
	DB 1 > P1 COOKER Important The protective device is not suitable for selective use during overcurrent The protective device is not suitable for selective use during Earth fault
I	

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 <u>split limit set</u>. To take care of this and eliminate the warning we will increase its conductor size from 6mm² to 10mm². After applying the change to the circuit editor the warning disappears.

ElectricalOM Getting Started



Voltage Drop Limits

The voltage drop limits are defined when <u>editing the Main Supply</u>. 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).

TT Schematic Trut edit Circuit details 🙌 Discrimination study	y 📝 Reports 👍 Plan Design	
🖬 Apply changes သ Cancel 🛛 🚔 Print	1	
Supply from MDB Active	Ph/N Conductor Earthing	
Description DB-F Load kVA / phase 0 6.99 0 Sub-circuits Diversity 1.00 ♀ 1.00 ♀ 1.00 ♀ Spare(%) 0 ♀ 1 1 1 1 0 ♀ 3rd Hamonics(%) 0 0 0 0 Voltage Drop of this circuit L1 0 V (0%) Neutral current(A) 30.39	Without split of the voltage drop limit Split the voltage drop limit between the distribution circuit and to its connected final circuits Voltage drop limit per phase of the distribution circuit (%)	
Voltage Drop of this circuit L2 3.13 V (1.36%) Total Load(kVA) Voltage Drop of this circuit L3 0 V (0%) 7 Ib (A) In (A) min Iz (A) It (A) 30.39 32 32 41	1.50 ⊕ = 3.45 V Votage drop limit per phase of the connected final circuits (%)	6
Z1(L) 0.0945 Z2(L) 0.0623 Phase fault max lsc (kA) 1.3776 max lsc at starting point (kA) 2.7885 min lsc (kA) 0.9673 Ze (Q) 0.09	3.50 ¢ = 8.05 V	
$\begin{tabular}{ c c c c c } \hline Disconnection & Conductors withstand duration (sec) & 0.01 & duration (sec) & 0.51 & \hline \hline \hline & 0.7877 & Ia(A) & 320 & Ze(\Omega) & 0.15 & \hline \hline & Disconnection Time (sec) & & & & & & & & & & & & & & & & & & &$	Total voltage drop limit per phase (%) 5.00 🗼 = 11.5 V	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		

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 16mm² to 70mm² 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 16mm² to a 25mm² 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).

Untitle	ed1*-ElectricalOM (ULTIMATE)	
upport Help		
🛨 Schematic 👫 Circuit edit 🧮 Circuit details 🍾 Discrimination study 💽 Reports 🔶 Plan Design		
Active page Main Page size A4 Portrait - Frame	🔌 🔞 🚯 🍣 开 🛲 🖨	🔒 📾 JJ 🚣 📝 🖾 🗩
Let up the second secon	Insert > Edit F2 Cut Ctrl+X Copy Ctrl+C Paste Ctrl+V Delete Del Shift circuit > Circuit functions >	
++	Schematic functions	Create page 2
	Zoom to element	Rotate left Rotate right
	Print report Ctrl+P	Mirror
	Cancel	

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.

1 Schematic 11 Circuit edit Circuit de	etails 📉 Discrimination study	Pepots		
3 Generate report Export to Pdf Export to Rtf	4			
Cover page	B 🕈 🖶 🖂	Q (1) / 43	?	Sign In
Man suppy Circuits schedule Of bird calculations Of bird calculations Of analytical calculations O				Â
	•	Client Client		
		Date 24/11/2016 Company Consultant		
				~

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).

💡 🗟 🖻 🖥 🔰 📿 🔹 🚽			C:\eom\tutorial.eom*-ElectricalOM (ULTIMATE)
Pile Edit Insert Functions	Windows	Support Help	
C:\eom\tutorial.eom*			
😩 🔎 🔎 😭	3	Schematic	🕂 Circuit edit 🗮 Circuit details 📉 Discrimination study 📝 Reports 🔶 Plan Design
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- [3.L1] S1 RING (x15)			
	Insert		
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Print Active Page of Schematic

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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:

ElectricalOM Getting Started

	Plot Margins
	● mm) inches
	Top: 0.0000 Bottom: 0.0000
	Left: 0.0000 Right: 0.0000
	Upside-Down Center To Paper
	Orientation O Portrat O Landscape
9	Number of Copies : 1
A case by	Paper
11	A4 ~
	Custom 210.05 by 296.92 mm
h	Scale
	Printer Units: 1 mm
	Drawing Units: 0.200709
	Scale to Fit
	Output Options
	Black and White III Pen Assignment
	Greyscale As bitmap
	Ignore gradient background color
	Print Area
	O Extents Window

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.



mirror axis

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.



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.



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

Voltage Drop Calculation

Maximum Phase Fault Current Calculation

Minimum Phase Fault Current Calculation

Earth Fault Current Calculation

Protective Device Disconnection Time at Earth Fault

Calculation of Touch Voltage

Maximum Earth Fault Loop Impedance (maxZs) Calculation

Transformer short circuit fault current calculation

References

Design Current and Current Carrying Capacity Calculations

Design Current and Calculation of the Minimum Required	Checks
Value of the Cable's Current Carrying Capacity	
$(I_b and min I_z)$	$I_b \leq I_n$
	and the I of I

With:

I_b

 I_n

min I_z

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

$$\min I_z \leq I_t$$

the design current of the circı
under consideration in Amper
the nominal current or current
of the protective device prote
the circuit against overcurrent

Amperes 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

$$min \, I_z = \frac{OL}{CorrectionFactors} \qquad \qquad C_d$$

Star-Delta Motor Circuits

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

OL

 I_t

 C_a

 C_i

Cg

 C_{f}

 C_c

Сs

With:

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

In	the design current of the circuit under
5	consideration in Amperes
	the nominal current or current setting of
I_n	the protective device protecting the circuit
	against overcurrent in Amperes
min I_z	the minimum required value of the cable's
	current carrying capacity

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:

- the value of current tabulated in cable tables
- Correction factor for ambient
- temperature
- Correction factor for thermal insulation
- Correction factor for grouping
- Correction factor for using BS3036
- Correction factor for ground installations
- Correction factor for
 - underground installation depth
 - Correction factor for ground
 - soil thermal resistivity
 - Correction factor for triple
- harmonic currents
 - Motor starter overload. By default

 $OL = I_b$

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:

Ib	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
Ct	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:

$$I_{cu} > max I_{sc}$$
$$I_{sc} = \frac{C_{max} \cdot U_{ph}}{Z_{e} + Z_{1}^{20^{\circ}C} + Z_{N}^{20^{\circ}C}}$$

For three phase circuits:

$$I_{sc} = \frac{C_{max} \cdot U_{ph}}{Z_{e} + Z_{1}^{20^{\circ}C}}$$

With:

U _{ph}	the phase to neutral voltage
$Z_x^{20°C}$	the impedance corrected at 20 oC
<i>Z</i> ₁	the impedance of the phase conductor
Z_N	the impedance of the neutral conductor
Ze	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 (l^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

k

S

1

the maximum permissible
disconnection time in seconds

- the cable factor
- the cross sectional area of the
- conductor mm2
- 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	
<i>Z</i> ₁	the impedance of the phase conductor	
Z_N	the impedance of the neutral conductor	
Ze	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_

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
<i>Z</i> 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 .	the minimum cross-sec
min	the protective conduct
k	the cable factor

If the operating time is less than 0.1 sec, then

	Is the let-through ene
$I^2 t$	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
Ze	the exterior impedance
<i>Z</i> 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 curre
 is the operating time
 t 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:

 $Z_A = Z_a + Z_2$ $Z_s = Z_s + Z_1 + Z_2$

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
Ze	the external impedance
Za	the impedance of the earthing electrode
<i>Z</i> 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
1	

Note: max Z_A

For TT earthing system, the so 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 $(max Z_s)$

Maximum Earth Fault Loop Impedance Check

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:

 $Z_s \leq max Z_s$

with:
$$Z_s = Z_s + Z_1 + Z_2$$

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.

mar7e –	Uo x Cmin
mux2s –	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 _{maxZs}	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.

lsc: assumed symmetrical short-circuit kA (rms value)	Assymetric factor k
4.5≤1≤6	1.5
6 < I ≤ 10	1.7
10 < I ≤ 20	2.0
20 < I ≤ 50	2.1
50 < I	2.2

Standardized table for calculating the asymmetrical short-circuit

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: lp (kA) = $(S \times 100)/(\sqrt{3} \times V \times Z\%)$

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.

	0 0	2			4 5
🔔 Wa	rnings: 89/89 🌖 Crit	ical: 9 All		-	📅 Calculations 🚍 Load 😰 Voltage drop 🖏 Discrimination 🕕 Other 🛛 Selected element only 🕼 Print 🧿
	Item Supply -> DB 1 Supply -> DB 1	All Criti Imp Simp	cal ortant ple		Warning Trunking size is not enough The service breaking capacity and protective device los + 10kA is less than the maximum phase fault maxisc + 11.03kA
	Supply -> DB 1 None		e		The service breaking capacity of the incomer protective device ics = 6kA is less than the maximum phase fault at one of its sub circuits sub-maxisc = 10.11kA
	Supply -> DB 1		Critical		There are errors in 'DB 1'. Please edit the circuit 1) The rating of the incomer switch/isolator used is less than the design current of the circuit (incomer rating(A) = 63 < lb(A)=100) 2) The current inequalities are not assisted (lb=100 c ln= 50, minlz=50 \leq t=611) 3) The ultimate breaking capacity of the incomer protective device lou = 20k/is less than the maximum phase fault maxisc = 11.03kA 4) The rating of the incomer overcurrent protective device is lower than the design current lb

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.

<u>Critical</u> Important

<u>Simple</u>

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.

Voltage Drop Check Voltage Drop Within Final Circuit for a Private Supply **Touch Voltage Limit Check Ring Sockets Check RCD Device Required for Circuit Check** Maximum Permitted Disconnection Time at Earth Fault Check **CPC Adiabatic Check** Maximum Earth Fault Loop Impedance Check **Design Current and Current Curring Capacity Checks Phase Conductor Adiabatic Check** Busbar Trunking System Short-Circuit Peak Withstand Check Ultimate Breaking Capacity of the Circuit's Protective Device Check Ultimate Breaking Capacity of the Incomer Protective Device Check Rating of the Incomer Switch/Isolator Check **Rating of the Incomer Overcurrent Protective Device Check** Neutral Conductor Current Carrying Capacity Check **Neutral Current Protective Device Rating Check Motor Starter Overload Check**

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.

upply from DB 1 lescription Final circuit	Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Test	
Load		Kind	
Kind Fixed device	▪ x 1 🜩	4E4 Cu Multicore 90°C XLPE armoured	Amour: Steel
Watts of a point 4500 Amps/Phase of a point 19.57	Total load	Fitter list Makeup of circuit conductors O Cu All insulations SwaXipe90/M/Cu All All kinds 1x2Cx6mm² + E(armour)	Options Run to 70% LSF
cosφ 1.00 🚔 3rd Harmonic	(%) 0.0	Installation	
Voltage Drop within circuit L Voltage Drop within circuit L	1 12.85 V (5.59%) Total 2 0 V (0%) kVA 4.5	Category All methods	•
Voltage Drop within circuit L	3 0 V (0%) Amperes 19.57	Method Method C No. 20 - Clipped direct	•
$\begin{array}{c c} \text{in } (v) \\ \hline 19.57 &\leq 20 \\ \hline 21(\Omega) & 0.395 \end{array}$ Phase fault max lsc (kA) & 0.3385 min lsc (kA) & 0.2131 \\ \hline \end{array}	$\begin{array}{c c} \min \left \mathcal{I}\left(\boldsymbol{\gamma} \right) & \cong \left(\boldsymbol{\gamma} \right) \\ \hline 20 & \leq & \boxed{62} \\ \hline 22(\boldsymbol{\Omega}) & 0.9179 \end{array}$ max lsc at starting point(kA) $\boxed{1.5913}$ Ze ($\boldsymbol{\Omega}$) $\boxed{0.15}$	Cables fixed on (clipped direct), or spaced less than 0.3 x cable diameter from wooden or masonry wall Reference method: C De: Cable diameter	•• <0.3De
Disconnection time of MCB (sec) 0.01 Earth Fault lef (kA) 0.1179 la(A) Disconnection time (sec) MCB Maximum	Conductors withstand duration (sec) \leq 16.21 100 Ze (Ω) 0.55 Ze(Ω) max Ze(Ω)	Length (m) 100 C.S.A (mm [*]) / Rating 6 62A • Find Parallel conductors Use	

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

C:\eom\tutorial_w.eom	
2000	🕂 Schematic 🐠 Circuit det 🗮 Circuit details 🦞 Discrimination atudy 🐨 Reports 💠 Plan Design 🔕 EAC & EMS Forms
Supply MDB IL11]DB-G IL11]P1 FRIDGE	Apply changes Cancel Print Single-phase and N 230V 50Hz Supply from MD8 Image: Apply changes Other Image: Apply changes Other Supply from MD8 Image: Apply changes Other Image: Apply changes Other Decorption Image: Apply changes Image: Apply changes
□ [12,1191 AC □ [13,11]S1 RING (115) □ [14,11]LGHTS 2 (115) □ [5,11] empty □ [11,12] empty □ [11,12] empty □ [11,12] empty □ [11,2] P1 AC 1 □ [12,2] D8-F □ [11,2] P1 AC 1 □ [12,2] S1 RADAL (115) □ [12,2] D1 AC 1 □ [12,2] D1 P2 C01HWSHER □ [12,1] P2 C00KER □ [12,1] P5 AC 2 □ [13,2] HANG (425) □ [14,1] UGHTS 1(15) □ × (4,12] empty □ [4,12] UGHTS 2(x15)	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
	🔔 Warnings: 1/19 🕒 Critical: 13 All - 🕅 Calculations 🗮 Load 🔬 Voltage drop 🏷 Discrimination 🕕 Other Selected element only 🕋 Print
	Em Iype Warng There are errors in DB-0: Prese exit the choid There are errors in DB-0: Prese exit the choid There are errors in DB-0: Prese exit the choid (ficult) V at5 04 - Touch Viant - a25 (2) RA-50 07512 is greater than the maximum RA-Inst marRA-500 (2) RA-50 07512 is greater than the maximum RA-Inst marRA-500
A Warnings: 1/19 Critical:	I3 All ▼
MDB -> DB-G	Type Twaining There are errors in 'DB-G'. Please edit the circuit 1) Touch voitage over the maximum limit (Touch V = 25.04 < Touch V limit = 25)

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

Project info and options	×
Project info User default info Checks Program defaults	
Discrimination check between the backup protection from supplier and the main protective device	
Ring socket circuits Image: Use 2.5mm² (1.5mm² for MICC) as the minimum C.S.A of the phase/N conductor for ring circuits Image: Use a protective device rating of 30A or 32A for ring circuits	
Close	

Protective Device Rating Check

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

Recommendation to resolve the error:

Use a 30A or 32A protective device.

	🔢 🕂 Schematic 🐗 Circuit edit 🗮 Circuit details 🧏 Discrimination stud	ly 📝 Reports 👍 Plan Design 🍈 EAC & EMS Forms	
Supply Supply Supply I [1L1] DB-G I [1L1] P1 FRIDGE I [1L1] P1 AC I [1L1] P1 AC I [1L1] DB-G I [1L1] P1 AC I [1L1] DI AC I [1L1] IGHTS 1 (x10) I [1L1] IGHTS 2 (x15) X [6L1] empty X [6L1] empty I [1L2] DF F I [1L2] DF F I [1L2] DF F I [1L2] P1 AC 1 I [1L2] DF F I [1L2] DF F I [1L2] DF F I [1L2] P1 AC 1 I [1L2] DF F I [1L2] P1 AC 1 I [1L2] DF AC 1 I [1L2] P1 AC C1 I [1L2] P1 P2 DISH WASHER I [1L2] P3 DRIER I [1L2] P3 DRIER I [1L2] P3 AC 1 I [3L2] P5 AC 2 I [3L3] P1 RING (o25) I [3L3] P1 KRING (o25) I [3L1] D5 KRING (o25) I [3L1] UGHTS 1 (x15)	Apply changes Cancel Print Scoph from DB-G Active Description DB-G Active Load Arter of the socket outlet ring circuit * x 15 • Watts of a point 200 Total load Ampu/Phase of a point 200 Total load Ampu/Phase of a point 200 Total load Votage Drop of this circuit 11 15 V(0,59%). Total Votage Drop of this circuit 12 0 V(0%). Amperes 13.04 5 20 20 24 21(µ) 0.6575 Z2(µ) 0.088 1.7382 min loc (A) 0.705 22(µ) 0.1088 1.7382 min loc (A) 0.706 2e (µ) 0.15 0.17 Earth Fault 60/4 ≤ 0.03 Ze (µ) 50.22 Deconnection Earth Fault Earth Fault Earth Fault Earth Fault Ide (kA) 0.0043 10.013 Ze (µ) 50.22 Deconnection Earth Fault Earth Fault 200 50.124	Ph/N Conductor Earthing Protective Devices Correction Factors Volta Selection of circuit protective devices Overcurrent protection ✓ Use Manufacturer Genesic	ge Drop Test Breaking Capacity Icu (kA) 10 Ics (kA) 7.5 At earth fault Service must have inal rating on: ve device with In = 30A or 32A Other Menual 0.20 Discrimination study
Letive: Supply [(Circuits Distribution: 3 / Final: 17	▲ Warnings: 1/20 Critical: 14 All - \/\\Tr. Calculations ▲ m Type Warning ▶ DB-G > 51 RING Critical: 14 Nm	Load ∆V Voltage drop Discrimination Other Selected elem In 10 DBG > 51 BMG' Please cell this cloud, Protective device rating. Use an overcurrent protective device with rating 30A or	ent only 🔐 Print

	Item	Туре	Warning		
D-	DB-G -> S1 RING	Critical	There are errors in 'DB-G -> S1 RING'. Please edit the circuit 1) Ring Sockets - Protective device rating. Use an overcurrent protective device with rating 30A or 32A		

Ph/N Conductor C.S.A Check

Ring sockets require 2.5mm² phase conductor (or 1.5mm² for MICC). To bypass the check and accept any rating see the <u>ring sockets check options</u>.

Recommendation to resolve the error:

Use a 2.5mm² phase conductor (or 1.5mm² for MICC).

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P P 😝 📢	👖 🛨 Schematic 📲 Circuit details 🦞 Discrimination stur	dy 📝 Reports 👍 Plan Design 📀 EAC & EMS Forms	
Supply	Reply changes Cancel A Print		
MDB	Supply from DB-G Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Test	_
e-[[1.L1] DB-G	Description S1 RING	Kod	
	Load	4D1 Or Societore 2010 PVC provemoured	
- [2.L1] P1 AC	Kind Switch socket outlet ring circuit • x 15 👽		
- [3.L.1] S1 RING (x15)	Watts of a point 200 Total load	Hiterist Makeup of circuit conductors Pyc70/S/Qu	Flexible
- [4.L1] LIGHTS 1 (x10)	Amps/Phase of a point 0.87	2x2x10x1.5mm ² + 2x1.5mm ² E	
[5.L1] LIGHTS 2 (x15)	cosp 1.00 ⊕ 3rd Hamonic(%) 0.0 ⊕ Diversity factor 1.00 ⊕	O A Alkinds •	
× [6.L1] empty	Voltana Dana of this circuit 1 257 V(1151) Total	Installation	
— × [7.L1] empty	KAN Design and a start and the start of the	Category All methods	
[8.L1] empty	Votage Drop of this circuit L2 0 V (0%)	Method Method B No. 59 - In conduit in a wall	
- [1.L2] DB-F	Voltage Drop of this circuit L3 0 V (0%) Amperes 13.04		
[1.L2] P1 A/C 1	b (A) ln (A) min lz (A) tt (A)	Description of the installation method	×
D= [2.L2] S1 RADIAL (x15)	$Ring$ 13.04 \leq 30 20 \leq 17.5	Caller is such a local state of the set of t	æ
[3.L2] LIGHTS 1 (x15)	Z1(Q) 0.1088 Z2(Q) 0.1088	resistivity not greater than 2 K.m/W	*
4.L2] empty	Phase fault		₩.
[1.L3] P1 COOKER	max lsc (kA) 0.7438 max lsc at starting point(kA) 1.7382	Reference method: B De: Cable diameter	×
[2.L1] P2 DISH WASHER	min lsc (kA) 0.5659 Ze (Q) 0.15	Comply with regulations:	æ –
[2.L2] P3 DRIER	Disconnection Conductors withstand	522.6.202 522.6.203 522.6.204 SODODODODODODODODODODODO	, KOKG
[2.L3] P1 FRIDGE	time of MCB (sec) duration (sec)	Conduit Plastic • Bend.set 1 • Diameter (mm) 16	•
- [3.L1] P5 A/C 1	0.01 ≤ 0.09	Size Ught • Rr	nd
[3.L2] P5 A/C 2	Earth Fault	Length (m) 20	
D- [3.L3] S1 RING (x25)	lef (kA) 0.0043 ΙΔn(A) 0.03 Ze (Ω) 50.22	C.S.A (mm ³) / Rating 1.5 17.5A > Find	
— (4.L1) LIGHTS 1 (x15)	Disconnection time (sec)	The phase conductor must have C.S.A.k	
— × [4.L2] empty	RCD Maximum RA(Ω) max RA(Ω)	2.5mm ² (1.5mm ² for MICC) or greater	
[4.L3] LIGHTS 2 (x15)	0.04 ≤ 0.2 50.1844 ≤ 200	Recommendation	
		Revise the phase conductor C.S.A	
	A Warnings: 1/20 Critical: 14 All Clicitical: 14	= Load AV Voltage drop & Discrimination D Other Selected element only AP Print	
	hem Type Warring		
	There are end	m in 108-G -> S1 RING'. Please edit the circuit	
	Dr. DB-G -> S1 RING Critical 1) Ring Socker 2) The current	ets - Ph/N conductor C.S.A = 1.5mm2 < ring minimum = 2.5mm2 t inequalities am not satisfied (lb=13.04 < ln= 30 minlz=20 < t=17.5)	
	zy me conen		_

🔔 Wai	nings: 1/20 🌗 Critical: 14 🛛 All	- 1	7 Calculations 🗮 Load 🗚 Voltage drop 🦎 Discrimination 🕦 Other 🛛 Selected element only 🕼 Print
	Item	Туре	Warning
D-	DB-G -> S1 RING	Critical	There are enors in 'DB-G -> S1 RING'. Please edit the circuit 1) Ring Sockets - Ph/N conductor C.S.A = 1.5mm2 < ring minimum = 2.5mm2
			2/ me curerii inequaliles are nui salisireu (u=15.04 2 in= 50, mintz=20 2 in= 17.5)

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.

ElectricalOM Getting Started

Apply changes Cancel C Print		Single Phase and N 230V 50Hz	
Description S1 RING	Ph/N Conductor Earthing UProtective Devices Correction Factors Vo	tage Drop Test	
Load	Selection of circuit protective devices		
Kind Switch socket outlet ring circuit • x 15 👽	Overcurrent protection Vise	Breaking Capacity	
Watts of a point 200 Total load	Manufacturer Generic	lou (kA) 10	
com 100 1 24 Hamaric (1) 0.0 1 Dearth factor 100 1	Type Miniature Circuit Breakers	los (rA) 7.5	
Votane Drop of the circuit 11 16 V (0.69%) Total	In(A) 30 Poles 1 • Observe	Alcost for A	
Votage Drop of this circuit 12 0 V (05) kVA 3	Charge		
Votage Drop of this circuit L3 0 V (0%) Amperes 13.04		maxZs (Ω) 100	
lb (A) In (A) min Iz (A) It (A)	DCD / Earth for it contraction	Maximum permitted disconnection time (sec)	
Ring 13.04 \leq 30 20 \leq 24	NCO / Catinade polecidari de la lose la lice nechaed	O Manual (120) (51)	
Ζ1(Ω) 0.0675 Ζ2(Ω) 0.1088	RCD / Earth fault device must be use Switch socket outlet ring circuit	d for the markar to the total tota	
Phase fault	Recommendation	Discrimina Regulations Cormation 85 7671:2008 + A3:2015	
max isc at starting point(xA) 1.7362	Use RCD / Earth fault device	Reg 411.3.3	
Disconnection Conductors withstand		411.3.3 Additional protection	
time of MCB (sec) duration (sec)	Marca 10 10 10 10 10 10 10 10 10 10 10 10 10	In a.c. systems, additional protection by means of an RCD in accord	ance with Regulation 415.1
0.01 S 0.17	Maximum touch votage 50 • 5 Heal (V) 23.05	shall be provided for:	
earn Faut lef (kA) 0.0043 (An(A) 0.5 from supply) Ze (D) 50.22		(i) socket-outlets with a rated current not exceeding 20 A, and	
Disconnection time (sec)		C mobile continue of with a surrout optice and surroutine 22.4 feature	
RCD (from supply) Maximum RA(Ω) max RA(Ω)		(ii) mobile equipment with a current rating not exceeding 32 A for use	outdoors.
0.15 ≤ 0.2 50.1844 ≤ 100		An exception to (i) is permitted:	
		(a) where, other than for an installation in a dwelling, a documented i	isk assessment determines
Warnings: 1/20	E = Load ∆V Voltage drop \ Discrimination () Other Selected ele	ment only at the RCD protection is not necessary, or	
tem Type Warning	un in 1987: S. C. 218421 Basen est the second	(b) for a specific labelled or otherwise suitably identified socket-outle	t provided for connection of a
DB-G → S1 RING Celocal 1) RCD / East	In fault device required for Switch socket outlet ring arout	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 use investor of Department of 11.2.2 do not evolve to FE	1 V - store and store to
		Regulation 411.7 or reduced low voltage systems according to Regulation	lation 411.8.
		NOTE 2. See Assessing 2 June 10 is second of sight assessment	
		NOTE 3. See Appendix 2, item 10 in respect of risk assessment.	
		1	
Warnings: 1/20 🔴 Critical: 14 🛛 All	- Ji Calculations - Load A	V Voltage drop \\ Discrimination (1) Other Selected ele	ement only
· · · · · · · · · · · · · · · · · · ·			

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.

There are errors in 'DB-G -> S1 RING'. Please edit the circuit 1) RCD / Earth fault device required for Switch socke<u>t outlet ring circuit</u>

Recommendation to resolve the error:

DB-G -> S1 RING

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

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🛎 🔎 😝 📢	🛨 Schematic 🐠 Circuit edit 🚞 Circuit details 📉 Discrimination study 📝 Reports 🔶 Plan Design 🥥 EAC & EMS Forms	
Supply	Apply changes Cancel C Print	
B-IMOB	Supply from Supply Of Active Ph/N Conductor Earthure Devices Connection Earthure Order	
⊨— 🔁 [1.L1] DB-G	Description MDB	
	Load 100 Millions 90° VI PE amound Amous Said	
[2.L1] P1 A/C	Sub-circuits KVA / phase 12.01 11.69 8.65 Photo Watching Of Call Balance of Call Material and Large Call Photo Phot	
	Predefined Diversity 0.90 ⊕ 0.90 ⊕ 0.90 ⊕ Predefined Winner Warkup or circuit conductors Uptions Warkup or circuit conductors Uptions Warkup or circuit conductors Uptions Warkup or circuit conductors Uptions	,
	Spare(%) cosp 1 1 1 1 Out All insulations • O 3rh + N Jimarge Source Cut	to 70°C
	0 3rd Hamonics(%) 0 0 0 0 Al Alkinds O 3Ph and the second seco	:
— × [6.L.1] empty	Veters Day of this size it 1.1 0.29 v. o. 179. Neutral current (A) Installation	
— × [7.L1] empty	Volage Lido of this circuit L1 0.33 V (0.17.4) 13.96 Category In ground	*
× [8.L1] empty	Voltage Drop of this circuit L2 0.37 V (0.16%) Total Load(kVA) Method Mathed D No 20 a loundermond sinde way during	
□	Votage Drop of this circuit L3 0.15 V (0.06%) 32	_
[1.L2] P1 A/C 1	b (A) ln (A) min Iz (A) tt (A) Description of the installation method	
- [2.L2] S1 RADIAL (x15)	$\boxed{522} \leq \boxed{63} \qquad \boxed{70} \leq \boxed{75}$	
(3.L2) LIGHTS 1 (x15)	71(0) 0.0022 Z2(0) 0.0202 Cables in underground single way ducts	
× [4.L2] empty		
-IT IL3] P1 COOKER	Reference method: D De: Cable diameter	
[2.L1] P2 DISH WASHER		
[2.L2] P3 DRIER	min tec (kA) 0.48// 2.6 (L) 0.23	_
12.L31 P1 FRIDGE	Disconnection Conductors withstand Conduct Plastic • Bend set 1 • Diameter (mm) 32 •	
- [] [3,L1] P5 A/C 1	6.65 < 22.01 Size Light * Find	
13.L21 P5 A/C 2	Earth Fault Length (m) 5	
D- [31,3] S1 BING (x25)	lef 6/4) 0.4525 la(4) 530 Za (0) 0.45 C S 4 (mm) / Ration 15 Z54 + End	
- (4,L1) LIGHTS 1 (x15)		
× (4.L2) empty	Paralel conductors Use	
(A 1413) (GHTS 2 (x15)		
	I he disconnection time of the protective device is greater than the maximum disconnection time set	_
	A Warnings: 1/11 () Critical: 2 Voltage drop \ Discrimination () Other Selected element only 🛱 Print	
	tem Revise the protective device or the conductor Revise the protective device or the conductor	
	I free are emps in Hub Processed of the circuit Speeds - MIDB Official 17 See 0.4290 (constructions free means read of the circuit	
	2) Device decompetition that a set if fault	
		-
🔔 Warnings: 1/11 🕕 Critical: 2	All 🔹 Voltage drop h Discrimination 🛈 Other Selected element only	🗿 Print
Item	Type Warning	
	There are serve to MDDP. Please with the strengt	

CPC Adiabatic Check

Supply -> MDB

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.

2) Device disconnection time at 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.

	Apply changes Cancel C Print
(1.L.1) DB-G	Supply from Supply from Supply from MDB Load kVA / chase 1201 1150 855
[2.1] P1 A/C [2.1] P1 A/C [3.1] S1 RING (x15) [4.1] LIGHTS 1 (x10) [5.1] LIGHTS 2 (x15)	⊙ Sub-circula NH/ (plate Cosp Cosp <thcosp< th=""> Cosp Cosp<!--</td--></thcosp<>
	Votage Drop of this circuit L2 0.37 V (0.17%) 13.56 Votage Drop of this circuit L2 0.37 V (0.16%) Total Load(kVA)
[1.12] DB-F [1.12] P1 A/C 1 [1.12] P1 A/C 1 [2.12] S1 RADIAL (x15) ⊕ [3.12] LIGHTS 1 (x15) × [4.12] empty [3.12] LIGHTS 1 (x15)	Wotage Drop of this circuit 1.3 0.15 V (0.051) 32 Installation Separate conductor • b (A) min lz (A) t (A) t (A) t (A) t (A) C.S.A of separate conductor (mm ³) 1.5 • Find Use parallel conductors 21(D) 0.0072 22(D) 0.0775 Cable's amour C.S.A (mm ³) 50 Phase fault Cable's amour concent 0.0202 0.0202 0.0202
[11.3] P1 COOKER [2.1] P2 DISH WASHER [2.12] P3 DRIER [2.13] P1 FRIDGE [3.13] P5 A/C 1	max loc (kl) 0.9907 max loc at starting point (kl) 1 min loc (kl) 0.4877 Ze (Q) 0.23 Disconnection time of Fue (sec) Conductors withstand duration (sec) Minimum CPC C.S.A (sm?) 1.5 0.99 ≤ 22.01 Minimum CPC C.S.A (sm?) The total C.S.A of the CPC
[3.L2] P5 A/C 2 [C [3.L3] S1 RING (x25) [G [4.L1] LIGHTS 1 (x15) × [4.L2] empty [G [4.L3] LIGHTS 2 (x15)	Each Fault Does Earning Does R(L) Revise the CPC or the protect Isf (4J) 0.4116 Is(A) 332.57 Ze (2) 0.46 Local Earling Declarice 0.000 ♀ 0.000 ♀ Disconnection Time (sec) Maximum Za(2) max.Zs(2) Other Local Earling Impedance 0.000 ♀ 0.000 ♀ QU33 ≤ 5 0.5309 ≤ 0.657 Total Local Earling Impedance 0.000 ♀ 0.000 ♀
	• Marnings: 1/8 • Critical: 2 • Kem • Type • Warning
	Supply > MDB Otical There are more in MDB. Please old the crouit. 1) CPC adabatic check env (pc = 1.5 mm² < Adabatic check min cpc required = 4.1 mm²)

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:

Supply -> MDB

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.

	Apply changes Cancel Cancel	
MOB	Supply from Supply Active p	Ph/N Conductor 🥚 Earthing Protective Devices Correction Factors Voltage Drop Other
€-[[1.L1] DB-G	Description MDB	
[1.L1] P1 FRIDGE	Load 1201 1201 015	Canada
[2.L1] P1 A/C	Sub-circuits KVA / phase IZUI III III III III III IIIIII	B B
- [3.L1] S1 RING (x15)	○ Predefined Diversity 0.90 0.90	
- [(4.L1] LIGHTS 1 (x10)	Spare(%) COSIP 1 1 1	The CPC will be a separate conductor
(5.L1) LIGHTS 2 (x15)	0 - 3rd Hamonics(%) 0 0 0	
— × (6.L.1) empty	Voltana Dana of this circuit 1 0.25 V (0.111) Neutral current(A)	
[7.L1] empty	13.96	
× [8.L1] empty	Voltage Drop of this circuit L2 0.22 V (0.1%) Total Load(kVA)	
0-12 [1.L2] DB-F	Voltage Drop of this circuit L3 0.09 V (0.04%) 32	Installation Separate conductor
[] [1.L2] P1 A/C 1	Ib (A) In (A) min Iz (A) It (A)	CS & d conserts conductor long 15
- [2.L2] S1 RADIAL (x15)	<u>52.2</u> ≤ 80 88.89 ≤ 96	C.3.4 di separate conductor (nim)
- (A) [3.L2] LIGHTS 1 (x15)	7100 0000 7300 00775	Cable's amour C.S.A (mm ⁻) 70
× [4.L2] empty	Phase fault	Cable's amour resistance (Ω) 0.0145
-IT-H [1.L3] P1 COOKER		Adiabatic check of CPC
12 L 1) P2 DISH WASHER	max iso as a satisfy point (KA)	Total CPC C.S.A (mm ²)
12 L21 P3 DRIER	min lisc (kA) 0.4916 26 (kJ) 0.23	
I I2 L31 P1 FRIDGE	Disconnection Conductors withstand	Minimum CPC C.S.A (mm ⁻) 8.55
10 131 11 P5 A/C 1	3.76 < 52.89	
13.L21.P5 A/C 2	Earth Fault	Local Earthing Use Dich with
D- 131 31 S1 BING (x25)	W 44) 04131 WAI 4635 74 (0) 046	(0.000 *) 0.000 *)
A 141111GHTS 1 (x15)	Disconnection Time (sec)	Local Eating Electrode Inpedance
× [412] empty	5 Maximum 2x(0) may 2x(0)	Other Local Eathing Impedances 0.000 💠 0.000 💠
A 141 31 (GHTS 2 (x15)	875 < 5 0 0.5289 < 0.4714 0	Total Local Earthing Impedance 0.000 (0.000 (0.000 (0.000 (0.000)))
IC respectively		hannan did hanna did
	The	Zs impedance (0.5289Ω) is over the limit(0.4714Ω)
	Warnings: 1/7 Critical: 2 All Critical: 2 All Reco	mmendation:
	ham Time Warnes	

🔔 Wa	rnings: 1/7 🕕 Critical: 2 🛛 All	•	In Calculations
	Item	Туре	Warning
			There are errors in 'MDB'. Please edit the circuit
	Supply -> MDB	Critical	2) $Z_s=0.5309\Omega$ is greater than the maximum Z_s limit max $Z_s=0.4714\Omega$
			4) The current inequalities are not satisfied (lb=52.2 ≤ ln= 80, min1z=88.89 ≤ lt=75)

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.

	Supply from Supply Supply Active Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other	
(11) (1050 (111) P1 FRIDGE (111) P1 FRIDGE (121) P1 AC ($ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Amour: Steel Options Plun to 70%
	🛕 Warnings: 1/8 🔴 Critical: 2 All 🔹 🖓 Calculations 🚍 Load 🛔 Voltage drop 🦙 Discrimination 🚯 Other Selected element only 🖨 Price	nt
	tem Type Waning There are errors in MDB' Pease edit the circuit	
	Supply >> MDB Official 1) The current inequalities are not satisfied (b=52.2 ≤ h= 60, min1z=66.67 ≤ b=58)	

Phase Conductor Adiabatic Check

Supply -> MDB

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.

C:\eom\tutorial_w.eom*			
Superior	TT Schematic 🔸 Circuit edit 🧮 Circuit details 🦒 Discrimination study 📝 Repo	ots - 🔶 Plan Design 🍈 EAC & EMS Forms	
	Apply changes D Cancel C Print		
	Supply from MDB Ref. Active Ph/N Conduct	ctor Earthing Protective Devices Correction Factors Voltage Drop Test	1
[1.L1] DB-G	Description P5 A/C 2 Kind		
[1.L1] P1 FRIDGE	Load 4D1 Cu	Single-core 70°C PVC non-armoured	
[2L1] P1 A/C	Kind Air conditioning • x 1 v		0.0
Dr [3.L1] S1 RING (x15)	Watts of a point 3000 Total load	Pue?ID/S/Cu	Bexble
- [4.L1] LIGHTS 1 (x10)	Amps/Phase of a point 13.04	2x1Cx1 5mm ² + 1x4mm ² E	
- [5.L1] LIGHTS 2 (x15)	com 1.00 (c) 3rd Hamonic(1) 0.0 (c) Diversity factor 1.00 (c)	All kinds	
— [6.L1] empty	Installation		
× [7.L1] empty	Votage Drop of this circuit L1 U V (U%) Total	ry All methods	
	Votage Drop of this circuit L2 17.79 V (7.74%)		
8-12 [1.L2] DB-F	Voltage Drop of this circuit L3 0 V (0%) Amperes 13.04	Method B No. 53 • In conduit in a wall	•
[1.L2] P1 AC 1	Ib (A) In (A) min Iz (A) It (A) Des	cription of the installation method	
D- [2.L2] S1 RADIAL (x15)	13.04 ≤ 15 15 ≤ 17.5		
- (A) [3.L2] LIGHTS 1 (x15)	Z1(Ω) 0.725 Z2(Ω) 0.275 Cabl	es in conduit in masonry having a thermal	
× [4.L2] empty	Phase fault Phase fault	Rivity hot greater than 2 K.m/W	
ID: 11131P1 COOKER	max les 441 01623 max les at station spiritiká) 0.939 Bate	many method R Du Calla damates	
121 11 P2 DISH WASHER		De: Cable diameter	
	mn isc (kii) 0.1235 Ze (Li) 0.25	22.6.202 522.6.203 522.6.204	
	Disconnection Conductors withstand	onduit Plastic • Bendiset 1 • Damet	ver (mm) 16 •
		ize Light •	Bod
[] [JLI]FS ACT	Euch Euch	4 ka) [70	
	The disconnection time	ne of the protective device	
- (3.L3) ST KING (025)	is greater than the fau	alt duration the conductors can safely withstand	
⊖ [4,L1,L2,L3] MS	Disconnection time (sec) Recommendation:		
[1.L1,L2,L3] Motor	MCB Maximum Zs(Ω) max Zs(Ω Revise the protective	device or the conductor	
	0.01 \$ 0.4 1.4193 \$ 1.4567		
	🛕 Warnings: 1/12 🔮 Critical: 4 🛛 All 🔹 🗸 🐼 Calculations 🚍 Load 🛆 V	Voltage drop 4 Discrimination () Other Selected element only	🖨 Print
	tem A Type Warning		
	MD8 -> P5 A/C 2 Ortical There are errors in 'MD8 -> P	5 A/C 2. Please edit the circuit	
	I) Phase conductor adviousc	check (usconnection time or Mub.(b) > Conductors withstand duration (d))	
Warnings: 1/12 🌓 Critical: 4	All	Selected elements Selected elements	nt only 🖨 Print
Item	 Type Warning 		
	Calical There are errors in 'MDB -> P5 A/C 2'. Pleas	se edit the circuit	
MDB->P570C2	1) Phase conductor adiabatic check (Disco	nnection time of MCB (s) > Conductors withstand durati	on (s))

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.

Apply chang	es 🗇 Cancel 🚔 Print		Three-phase 400V and N 230V	50H				
Supply from Supp	ply	Active	Phr/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other					
Description MDB	B		Туре					
Load	kVA / phase 6.54 6.85	4.71	BBAR Cu Busbar trunking system -					
Sub-circuits Predefined	Diversity 0.49 0.49	0.49 0	Filter lat Wring Makeup of circuit conductors Options					
Same (%)	- cosp 1 1		Cu Al insulations • • 3Ph + N Busbar trunking system					
0 ¢	3rd Harmonics(%) 0 0	0	Al kinds - O 3Ph BTS 42A					
1	Ner Ner	Aral current(A)	Installation					
Voltage Dr	rop of this circuit L1 0.23 V (0.13%)	8.71	Manfathan a					
Voltage Dr	rop of this circuit L2 0.33 V (0.14%) To	tal Load(kVA)	Schneider Electric					
Voltage Dr	rop of this circuit L3 0.11 V (0.05%)	18	Family Canals KBB - Cu (Cas.)					
Ib (A)	In (A) min Iz (A)	It (A)	Busbar tunking system					
29.8	≤ <u>30</u> <u>33</u> ≤	42						
Z16	(Ω) 0.01 Z2(Ω) 0.004							
Phase fault			Short-circuit Mozomani Short-circuit Peak Peak Value (k/) Withstand (k/)					
max lac (kA) 1	3.9126 max lsc at starting point (cA) 25	27.83 ≤ 9.6 0					
min lac (kA)	7.3697 Ze	Ω) 0.01						
Let	t through Energy Busbar themal limit		The short-circuit maximum peak value is greater than the busbar's short-circuit peak withsta	nd				
d Fu	use IPt (APs) x 10 ^p IPt (APs) x 10 ^p		Recommendation:					
	5.13 ≤ 900		Change the busbar trunking system	_				
Eath Fault		-						
lef (kA) 8.7075	la(A) 125.92 Ze	(Ω) 0.01	Rating 42A • And					
Disconnection	n Time (sec)		Parafel conductors Use					
Fuse	Maximum Zs(Ω) r	nax Zs(Ω)						
001 5	5 0.0201 5	1.1302						
Minutesia 4 (98	• COLUMN 10	The second second	The subscript N products A pro-	-				
Warnings: 1/3/	Criticat 13 All	Nex Calculations	ns = Load AV voltage drop TV Discrimination TO Other Selected element only Print	_				
tem	∽ Туре	Warning	emps in MDB ¹ Resse with the dense					
Supply > ME		1) The short-	Account material pack value > 27.83kA is greater than the busbar's short-arout peak withstand = 9.9kA					

🚹 Wa	rnings: 1/37 Critical: 13	All		🔹 👫 Calculations 🚍 Load 🗚 Voltage drop 🦙 Discrimination 🕦 Other Selected element only 🖨 Print
	Item		Туре	Warning
	Supply -> MDB		Critical	There are errors in 'MDB'. Please edit the circuit 1) The short-circuit maximum peak value = 27.83kA is greater than the busbar's short-circuit peak withstand = 9.6kA

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

11 Schematic 🐠 Crcuit edit 🗮 Crcuit details 🍾 Discrimination study	📝 Reports 🔶 Plan Design 🥝 EAC & EMS Forms 🔳 Panel layout	
🕞 Apply changes 🛸 Cancel 🖾 Print		Three-phase 400V and N 230V 50Hz
Supply from Supply ✓ Active Description DB 1 Active Load Sub-circuits kVA / phase 2.9 1.8 1.4 O Fredefined Diversity 1.00 ♀ 1.00 ♀ 1.00 ♀ 1.00 ♀ Spare(1) cosp 1 1 1 1	Ph/N Conductor Earthing Protective Devices Correction Factors Votage Drop Other Orcut protection Incomer disconnection/solation Overcurrent protection Ise Manufacturer Generic Type Ministure Circuit Breakers Ise Incomer Disconnection Ise Ise	Ultimate Breaking Canacity
0 • 3rd Harmonics(%) 0 0 0 Voltage Drop of this circuit L1 0.15 V (0.07%) Neutral current(A) Voltage Drop of this circuit L2 0.04 V (0.02%) Total Load(kVA) Voltage Drop of this circuit L3 0.03 V (0.01%) 6	Device BS EN 60838 10kA MCB Type C In(A) 40 Poles 3 RCD / Earth fault protection Use	Control Control of Control Con
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Auto Manual 5.00 (c) Decrimination study	
$\label{eq:constraints} \begin{array}{ c c c c c } Let through Energy of MCB Pt (AFs) x 10^{2} & K^{1}S^{2} x 10^{2} \\ \hline & & K^{2}S^{2} x 10^{2} \\ \hline & & K^{2} x 10^{2} $	Cable Board	

🔔 Wai	rnings: 1/25 🌗 Critical: 4 🛛 All	- 1	Fi Calculations 🗮 Load 🗚 Voltage drop 🦙 Discrimination 🕕 Other 🛛 Selected element only 🕼 Print
	item	Туре	Warning
	Supply -> MDB	Critical	There are errors in 'MDB'. Please edit the circuit 1) The ultimate breaking capacity of the protective device Icu = 20kA is less than the maximum phase fault maxIsc = 21kA at the starting point

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.

🛨 Schematic 🐗 Circuit edit 🚞 Circuit details 🦙 Discrimination stu	dy 📝 Reports 👍 Plan Design 🤨 EAC & EMS Forms
🖬 Apply changes 👘 Cancel 🛛 🚔 Print	Three-phase 400V and N 230V 50Hz
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Pr/N Conductor Earthing Protective Devices Connection / Sectors Votage Drop Other
🛕 Warnings: 1/10 🌒 Critical: 1 Critical 🔹 🗐 🖅 Calculations	= Load AV Voltage drop 1/5, Discrimination () Other Selected element only APrint
tem Type Warning	ons in MDR'. Reases with the circuit
Supply -> MDB Critical 1) The ultimat	e breaking capacity of the incomer protective device. Icu = 20kA is less than the maximum phase fault maxisc = 10.34kA
L	
🔥 Warnings: 1/10 🌒 Critical: 1 Critical 🔻	√Fr Calculations ➡ Load △V Voltage drop \\\\\\\\Discrimination ③ Other Selected element only ⊕ Print
Item Type	Warning
Supply -> MDB Critical	There are errors in 'MDB'. Please edit the circuit 1) The ultimate breaking capacity of the incomer protective device Icu = 20kA is less than the maximum phase fault maxisc = 10.34kA

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) .

3 Supply	Apply changes 🗇 Cancel 🚔 Print			Three-phase 400V and N 23
MDB IL1]DB-G [1.L1]P1 FRIDGE [1.L1]P1 FRIDGE	Supply from Supply Description MDB Load kVA / phase	✓ Active 11.69 8.65	Ph/N Conductor Earthing Protective Devices Correction Factors Votage Drop Circuit protection Overcurrent protection	Other
	10000 fbits chout 13 0.15 1 0 (A) 16(A) 16(A) 77 2 (C) 0.072 2 Phase fazt max loc (A) 2.5592 max loc (A) max loc (A) 1.6512 Let through Energy of MCE PH (A'A) × 10 ¹⁰ Cond	$\begin{array}{l} (00^{-1}) & \hline & 20 \\ (0^{-1}) & \hline & 20 \\ (k) & k(k) \\ \hline & 5 \\ (2k) & 0 \\ \hline & 2(k) \\ 0 \\ content \\ c$	RCD / Earth failt protection Use Isolation/Disconnection Rating must be grater than Design Current (Ib) Isolation/Disconnection than Design Current (Ib)	The nominal rating of the disconnector/isolator is lower than the ib
[3.12] P5 AC 2 [3.13] S1 RING (x25) [4.1] LIGHTS 1 (x15) [4.1] LIGHTS 2 (x15) [4.12] empty [⊕ [4.13] LIGHTS 2 (x15)	Each Fault lef (kA) 1.455 Disconnection Time (sec) MCB Maximum 0.01 ≤	Ze (Ω) 0.13 Ω) max Zs(Ω) 302 ≤ 0.3468	Cable	Recommendation: Revise the normal rating of the disconnector/isolator
	Warnings: 1/10 Critical: 1 All		Load AV Voltage drop 1/2 Discrimination 1 Other Selected element only	igu Print
	Thinks (Section 1997)	yes wankig	on in MOR. Pease and the term	

🔔 Wa	rnings: 1/10 🕧 Critical: 1 🛛 All	- 16	Calculations = Load 🗚 Voltage drop 🌾 Discrimination 🕦 Other Selected element only 🖨 Print
	Item	Туре	Warning
	Supply -> MDB	Critical	There are errors in 'MDB'. Please edit the item 1) The rating of the incomer switch/isolator used is less than the design current of the circuit (incomer rating(A) = 40 < lb(A)=52.2)

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.

] Supply	Apply changes Cancel CPrin	4					
MDB	Sundy from Supply	Active	Ph Al Candudata Ead	ina O Protective Devices Care	ation Frantam Makes	Dura Other	
- [1.L1] DB-G	Description MDB		Orguit protection	Incomer deconnection (solation	coon racions vocage	e brop Other	
[1.L1] P1 FRIDGE	Load						
- [2.L1] P1 A/C	Sub-circuits KVA / phase	11.69 8.65	Overcurrent protecti	on 🗴 Use		Breaking Capacity	
- [3.L1] S1 RING (x15)	O Predefined Diversity 0.9	0 0 0 0 0 0 0	Manufacturer C	senenc		ku (kA)	15
- (4.L1) LIGHTS 1 (x10)	Spare(%) Cosp		Type	Aniature Circuit Breakers		Ics (kA)	7.5
- (£ [5.L1] LIGHTS 2 (x15)	0 G And Harmonics(%)		Device	IS EN SUBSE TOKA MCB Type C			
- × [6.L1] empty	Voltage Drop of this circuit L1 0.19	V (0.08%) Neutral current(A)	In(A)		Change		
— × [7.L1] empty	Voltage Drop of this circuit L2 0.14	V (0.06%)	The	rating of the incomer protective	device is lower		
		Total Load(kVA)	DCD / Each fr	n the design current lb			
	Votage Drop of this circuit L3 0.07	J V (0.03%)	Rec	ommendation:			
	b (A) In (A) mir	n Iz (A) It (A)	[Nev	ise the rating of the incomer prot	ective device		
	322 3 123	120 5 130				Discrimination study	
	Ζ1(Ω) 0.0035	Ζ2(Ω) 0.0365					
	Phase fault					1 Y	
	max lsc (kA) 10.3384 max lsc	at starting point (kA) 11.98					
	min lsc (kA) 5.7275	Ze (Ω) 0.02	Isolation/Disconnec	tion 🗹 Use			
	Disconnection Co	inductors withstand	Type AC21	• 63 🗘 A			
131 11P5 A/C 1	0.01 <	198					_
13.L21P5 A/C 2	Eath Fault						- I
D- 13.L31 \$1 BING 025)	W (A) 0.0044 IAn(A) 0.03	7e (0) 50.03		Cable		Board	
+ (4,L1) LIGHTS 1 (x15)	Disconnection Time (sec)	20 (11/ 00000					1
- X [4.L2] empty	DCD Maximum F	RAIO) may RAIO)					
I ⊕ [4,L3] LIGHTS 2 (x15)	0.04 ≤ 1 50	0.0372 ≤ 200					
		nerror terrority and	-				
		1.10		the fact and the second second second	50	10.00	
	Warnings: 1/15 Octical: 1 Critical	driv Calculations	- Load AV Voltage d	rop S Discrimination () Othe	Selected elemen	t only in Print	
		Type Warning		000000			
	Supply -> MDB	Critical 1) The rating	of the incomer overcurrent	e circuit protective device is lower than the d	esign current lb		
	1						
Namings: 1/15 🙆 Critical: 1	Critical	tions = Load AV Vo	Itage drop	Discrimination 🕜 Otl	er Selected	element only	da p
	Childen		in a ge a op		Jereetee		alle .

Neutral Conductor Current Carrying Capacity Check

When the engineer chooses to size the neutral conductor separately, in a three-phase + neutral singlecore 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.

tubbil cumilan		Three-phase 400V and N 230V 50H
upply from Supply escription MDB Load KVA / phase 201 115 Predefined Divensity 0.90 ♀ Spare(1) 0 0 Spare(2) 3rd Hamonica(12) 0 Votage Drop of this circuit L1 0.25 V(0.11) Votage Drop of this circuit L2 0.22 V(0.11) Votage Drop of this circuit L3 0.09 V(0.042) b (A) in (A) min lz (A) 52.2 6.3 6.3 ≤ Z1(Ω) 0.0044 Z2(Ω) 0.01		
max lec (kA) 3.0048 max lec at starting point min lec (kA) 1.006 Zz Disconnection time of MCB (sec) Conductors withst duation (sec) Earth Fault 8.17 lef (kA) 0.004	(κA) 3.15 (Ω) 0.07 and [(Ω) 50.1	Reference method: A De: Cable diameter Image: Size Size Size Size Size Size Size Size
Disconnection Time (sec) <u>RCD</u> Maximum RA(Ω) 0.04 ≤ 1 50.019 ≤ Warnings: 1/9 ● Critical: 1 All	max RA(Ω) 200 777 Calculations = Lo	Parallel conductors Use Parallel conductors Use Parallel conductors Use The neutral conductor current carrying capacity is less than the calculated neutral current Revise the CSA of the neutral conductor or try to reduce the neutral current
tem Type	Warning	due to the high 3rd Harmonics current and/or unbalancing of the loads
Supply -> MDB Ortical	There are errors in	MDB'. Pease edit the circuit
	ty the needed cone	anna kanying capanyin tatar mena kanaling neuna kana s
🔥 Warnings: 1/9 🌗 Critical: 1 🛛 All	•	🖅 Calculations 🚍 Load 🗚 Voltage drop 🦏 Discrimination 🕦 Other Selected element only 🚑 Prin
Item	Туре	Warning

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.

upply from Supply	1.5 conce 1.		Active	0 F	Ph/N Conductor Earth	hing Pr	otective Devices	Correction Fac	tors Voltage Drop Other	
Vescription DB 1 Load Sub-circuits Predefined Spare(%)	kVA / phase Amps / phase cosp / phase	4.6 8.05 20.0 ≎ 35.0 1.00 ≎ 1.00 0.0 ≏ 0.0	2.76 2.76 12.0 ¢ 1.00 ¢ 0.0 ¢	Typ 4D Fib	e 1 Cu Single-con erlist Cu All insulations Al All kinds	e 70'C P	VC non-armoured Wiring ● 3Ph + N ○ 3Ph	Makeup of circ Pvc70/S/Cu 3x1Cx2.5mm²/	uit conductors 1Cx1mm²N + 1x1.5mm²E	Options Flexible
Voltage Drop Voltage Drop Voltage Drop	of this circuit L1 2.1 of this circuit L2 7.0 of this circuit L3 0	2 V (0.92 12 V (3.05%) V (0%)	otal Coadik VA) 15	e prote	allation Category All met ective device rating i	thods s lower	than the neutra	l current		
lb (A) 35 Z1(Ω) Phase fault	≤ 20 (0.1299	$\frac{\min z(A) }{20} \leq [$ $Z_2(\Omega) 0.217$	k (A) Rei	comm vise th	endation: e protective device r Cables in conduit resistivity not gre Reference metho	ating or tin mas ater the	reduce the new conry having a an 2 K.m/W De: Cab	thermal		
min lsc (kA) 0.4	733	Ze	(Ω) 0.02		Comply with reg. 522.6.202 522.6	lations: 203 522	.6.204	0		
Dis time of	connection of MCB (sec) 0.01 ≤	Conductors withsta duration (sec) 0.37	and		Conduit Size	Plastic Light	•	• <u>Bend set</u>	1 • Diameter (mm)	32 • Find
Earth Fault ef (kA) 0.5806 Disconnection 1 MCB M 0.01 ≤	la(A) 200 îime (sec) faximum 5] Z Zs(Ω) 0.3764 ≤ [e (Ω) 0.04 max Zs(Ω) 1.0925		Length (m) C.S.A (mm ²) / Rating Parallel conductors	15 2	5 21A Use	• Find	Set the neutral conductor C.S.A (mm ²) Parallel conductors U It (A)	• se 12

🔔 Wa	rnings: 2/2 🌗 Critical: 1 🛛 All	•	🕅 Calculations 🚍 Load 🗚 Voltage drop 📉 Discrimination 🕕 Other 🛛 Selected element only 🖨 Print
	Item	Туре	Warning
	Supply -> DB 1	Critical	There are errors in 'DB 1'. Please edit the circuit 1) The current inequalities are not satisfied (lb=35 ≤ ln= 20, minit=20 ≤ lt=21) 2) The neutral conductor current canving cancelity is lass than the calculated neutral current 3) The protective device rating is lower that the Neutral Current

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.

C:\eom\tutorial_w.eom*		
3 P P 😪 🚺	🛨 Schematic 🐠 Circuit edit" 🧮 Circuit details 🦎 Discrimination st	udy 📝 Reports 👍 Plan Design 🥝 EAC & EMS Forms
Supply	Apply changes 🔁 Cancel 🚔 Print	
E-MDB	Supply from MDB Supply from MDB	Ph/N Conductor Earthing Pentactive Devices Connection Factors Voltage Devo Other
0-12 [1.L1] DB-G	Description MS	
[1.L1] P1 FRIDGE	Motor stater	4D1 Cu Single core 70°C PVC non-amoured .
[2.L1] P1 AC		Filter list Wring Makeup of circuit conductors Octions
- D- [3.L1] S1 RING (x15)	Overload rating 1.0 © A	Cu All insulations O 3Ph + N Pvc70/S/Cu Resolution Resolution
- (4.L1) LIGHTS 1 (x10)		3x1Cx1mm²+ 1x1mm²E
(5.L1) LIGHTS 2 (x15)	The motor equal or on	starter overload setting must be set to a value reater than the design current (ib) of the motor circuit
(6.L1] empty	Voltage Drop of this circuit L1 1.26 V (0.55%) Neutral	
	Voltage Drop of this circuit L2 1.26 V (0.55%)	Idation: • rating of the set overload setting
× (8.L1) empty	Total booupvery	Method Method B No. 59 - In conduit in a wall
	Votage unop or this circuit L3 (1.26) V (0.55%) 3	Description of the installation method 8000000000000000000000000000000000000
	10 (A) In (A) min Iz (A) It (A)	
C [212] ST RODICE ((15)		Cables in conduit in masonry having a thermal
V [412] ampty	Ζ1(Ω) 0.3291 Ζ22(Ω) 0.33	
IT (11 3) P1 COOKER	Phase faul	Reference method: B De: Cable diameter
12 12 L11 P2 DISH WASHER	max isc (kA) U.4/21 max isc at starting point (kA) U.5055	Comply with regulations:
12.L2] P3 DRIER	min lisc (κA) 0.212 Ze (Ω) 0.25	[™] 522.6.202 522.6.203 522.6.204 ● R000000000000000000000000000000000000
[] [2.L3] P1 FRIDGE	Disconnection Conductors withstand time of MCB (sec) duration (sec)	Conduit Plastic • Rend.tet 1 • Diameter (mm) 16 •
[3.L1] P5 A/C 1	0.01 ≤ 0.29	Size Light • Find
[] [3.L2] P5 A/C 2	Earth Fault	Length (m) 15
D- [3.L3] S1 RING (x25)	lef (kA) 0.2011 la(A) 60 Ze (Ω) 0.48	C.S.A (mm ³) / Rating 1 12A • Find
⊨ [4.L1,L2,L3] MS	Disconnection Time (sec)	Parallel conductors U Lies
(1.L1,L2,L3] Motor	MCB Maximum Zs(Ω) max Zs(Ω)	
	0.01 ≤ 5 1.0868 ≤ 3.6417	
	🔔 Warnings: 1/12 🕚 Critical: 4 🛛 All 🔹 😽 Calculations	E Load AV Voltage drop 🌾 Discrimination 🕕 Other Selected element only
	MDB -> MS Critical There are en	rom in 'MS'. Please edit the circuit estanter works of setting must be part to a value any of or resister than the design reverset (Ib) of the endor size it
		and the second second more second to a second balance all soles that the people contacts for an and spool. (2) (2)
Warnings: 1/12 🌓 Critical: 4	All - JFr Calculations = Load AV V	oltage drop 📉 Discrimination 🕦 Other Selected element only 🚑 Print
Item	 Type Warning 	
	Calcel There are errors in 'MS'. Please	e dit the circuit
MDB -> MS	1) The motor starter overload s	etting must be set to a value equal or greater than the design current (lb) of the motor circ

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.

The motor starter overload setting must be set to a value equal or greater than the design current (lb) of the motor circuit

Recommendation to resolve the error:

Revise the UPS apparent power value.

🛨 Schematic 😽 Circuit edit 🧮 Circuit details 🦞 Discrimination study	📝 Reports 🔶 Plan Design 😳 EAC & EMS Forms	
Apply changes D Cancel		
Supply from DB 1 Use conductor Active	Ph/N Conductor Earthing 4 Protective Devices Correction Factors Voltage Drop Other	
Description UPS	Туре	
UPS OPS Apparent Power 10.00 + kVA	4E4 Cu Multicore 90°C XLPE amoured Amour: Steel •	
UPS Rating 14.43 A	Filter list Winng Makeup of circuit conductors Options	
UPS Chairing General 5.00 2 A Harmonics 3.00 2 X The UPS	Cu Al insulations O 3Ph + N SwaXipe90/M/Cu Power Rating is not adequate 3Ph tx4Cx16mm ² + E(armour) LSF	
Voltage Drop of this circuit L1 0.24 V (0.11%) Neutral curren Revise th	nendation: he UPS Rating	
Voltage Drop of this circuit 2 0.24 V (0.11%)	Category All methods	
Votage Drop of this Circuit L2 0.24 V (0.114) Total Load(kVA)	Method C No. 20 - Clipped direct -	
Voltage Drop of this circuit L3 0.24 V (0.11%) 28	Description of the installation method	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Cables fixed on (clipped direct), or spaced less than 0.3 x cable diameter from wooden or masonry wall	
Phase fault max lsc (kA) 1.7719 max lsc at starting point (kA) 1.8521 min lsc (kA) 0.4596 Ze (Q) 0.28	Reference method: C De: Cable diameter	
Disconnection time of MCB (sec) Conductors withstand duration (sec) 7.24 ≤ 24.78	Length (m) 5 Set the neutral conductor	
Left A(A) 05/12 (A=(A) 0.2 7- (D) 0.29		
Iter (K) U.SH12 Iter (K) U.S Ze (L2) U.S Disconnection Time (sec)	C.S.A (mm) / Hating	
DCD Maximum Ze(O) max Ze(O)	Parallel conductors Use	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		

	🔔 War	nings: 3/8 🌗 Critical: 4 🛛 All	- JFi C	alculations 🚍 Load 🗚 Voltage drop 📉 Discrimination 🕦 Other 🛛 Selected element only 🖨 Print
ĺ		Item	Туре	Warning
	UPS	DB 1 -> UPS	Critical	There are errors in 'UPS'. Please edit the circuit 1) The UPS Power Rating is not adequate (UPS Rating = 14.43 A < lb = 40)

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.

Active DB 1	Ph/N Conductor Earthing 9 Protective Devices Correction Factors Voltage Drop Other	
Vescription TS Transfer switch	Type 4E4 Cu Muticore 90°C XLPE amoured	Amour: Steel
Load 10.00 C A	Fitter list Wring Makeup of circuit conductors O Cu All insulations • 3Ph + N SwaXpe90/M/Cu rating is not adequate • 3Ph tx4Cx6mm² + E(amour)	Options Run to 70' LSF
Voltage Drop of this circuit L1 1.54 V (0.67%) Recommendation: Revise the transfer s	witch rating I methods	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Description of the installation method Cables fixed on (clipped direct), or spaced less than 0.3 x cable diameter from wooden or masonry wall Reference method: C De: Cable diameter	
$\begin{tabular}{l l l l l l l l l l l l l l l l l l l $	Length (m) 15 Set the neutral condu C.S.A. (mm?) / Rating 6 53A • Find Parallel conductors Use	ctor

	🔔 War	nings: 4/15 🌗 Critical: 7 🛛 All	 ▲ ▲ ↓ ↓	Calculations 🚍 Load 🗚 Voltage drop 📉 Discrimination 🕕 Other Selected element only 🖨 Print
I		ltem	Туре	Warning
	Ø	DB 1 -> TS	Critical	There are errors in 'TS'. Please edit the circuit 1) The transfer switch load rating is not adequate (Transfer switch load rating = 10 A < lb = 30)

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 properties Earthin	g Premises & Diversity Other	4
	11111111111111111111111111111111111111	Maximum values of voltage drop from the origin of the installation
ase to N Voltage	230 🖨	Public supply (Lighting 3%, Other uses 5%)
ithing system	TN • TN-C-S •	O Private supply (Lighting 6%, Other uses 8%)
pply frequency	50Hz •	O Other (user defined limit)
Method of supply	User defined source	
ource characteristics		
/	kVA 500 1	Load capacity (A) - Set extra cables up to the
	Z (%) 6.00 . fault	re 721.7 0 origin point of the installation
	Contraction and Paral	The total network design current exceeds the transformer's load capacity.
rospective symmetrical fault	current at the origin point	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point
rospective symmetrical fault	current at the origin point	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point
rospective symmetrical fault lp(kA) 11.98	current at the origin point Zp(Ω) 0.0192	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332
tospective symmetrical fault	current at the origin point Zp(Ω) 0.0192 Rp(Ω) 0.0154	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Rpn(Ω) 0.0266 Remote the 0.8
rospective symmetrical fault lp(cA) 11.96 Power factor 0.8	current at the origin point Zp(Ω) 0.0192 Rp(Ω) 0.0154 Xp(Ω) 0.0115	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Prower factor 0.8 Xpn(Ω) 0.0199
rospective symmetrical fault Ip(kA) 11.98 Power factor 0.8	current at the origin point Zp(Ω) 0.0192 Rp(Ω) 0.0154 Xp(Ω) 0.0115	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Power factor 0.8 Xpn(Ω) 0.0199
rospective symmetrical fault (p(kA) 11.98 Power factor 0.8	current at the origin point Zp(Ω) 0.0192 Rp(Ω) 0.0154 Xp(Ω) 0.0115	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Ipn(kA) 6.92 Rpn(Ω) 0.0266 Power factor 0.8 Xpn(Ω) 0.0199
rospective symmetrical fault lp(kA) 11.98 Power factor 0.8	current at the origin point Zp(Ω) 0.0192 Rp(Ω) 0.0154 Xp(Ω) 0.0115	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Rpn(Ω) 0.0266 Power factor 0.8 Xpn(Ω) 0.0199 Three phases: 400V, 220V 2Pb + N
rospective symmetrical fault ip(kA) 11.98 Power factor 0.8 OK Cancel	current at the origin point 2ρ(Ω) 0.0192 Rp(Ω) 0.0154 Xρ(Ω) 0.0115	The total network design current exceeds the transformer's load capacity Prospective Phase to N/Earth fault current at the origin point Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0332 Ipn(kA) 6.92 Zpn=Ze(Ω) 0.0266 Power factor 0.8 Xpn(Ω) 0.0199 Three-phase: 400V , 230V 3Ph + N

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.

rce properties	Earthing Premises	& Diversity Oth	er				
arthing conductor	🗹 Use 🛛 🌔						
		thing conducto	or adiabatic check fail	ITE. I			
Cable	Cu - Multicore 9 S ≤	Sqrt(lef ² x t) / I	k = 7.05			_	•
Installation	On a surface S =	2.5 mm ^e = 10077 A		Parallel	1 🜩	Length 1	
	b (A) 21 t =	0.01 sec			,	(0) 0.0092	
	k i	: 143				0.0032	
esistance of the ea	arthing electrode (Ω) 0.000 🗢 Calculate						
esistance of the ea	arthing electrode (Ω) 0.000 🚖 Calculate						
lesistance of the ea	arthing electrode (Ω) 0.000						
lesistance of the ea	arthing electrode (Ω) 0.000 © Calculate Earth fault current a	t the starting poin	nt with the earthing cond	uctor and/or ele	ctrode (kA) 1	0.077	

	🔔 War	nings: 1/16 🌗 Critical: 11 🛛 All	 ▲ ▲ ↓ ↓	Calculations 🚍 Load 🗚 Voltage drop 📉 Discrimination 🕦 Other Selected element only 🖨 Print	
		Item	Туре	Warning	
	\sim	Supply	Critical	The adiabatic check of earthing conductor in source is not satisfied	
1					

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.

pply from Supply Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other
ad bad kVA / phase 230 184 207	O Without split of the voltage drop limit
Predefined Amps / phase 1000.0 ♀ 800.0 ♀ 900.0 ♀ Spare(%) cosφ / phase 1.00 ♀ 1.00 ♀ 1.00 ♀	$\textcircled{\ensuremath{\mathfrak{O}}}$ Split the voltage drop limit between the distribution circuit and to its connected final circuits
Voltage Drop of this circuit L1 0.34 V (0.15%) Neutral current(A) Voltage Drop of this circuit L2 0.17 V (0.08%) Total Lead(kVA) Voltage Drop of this circuit L3 0.38 V (0.17%) 621 Voltage Drop of this circuit L3 0.38 V (0.17%) 621	Votage drop limit per phase of the distribution circuit (%)
1000 ≤ 1220 416.57 ≤ 472 Z1(Ω) 0.0006 Z2(Ω) 0.0095 hase fault max lsc at starting point (cA) 23.96	[4.90 [♀] = [11.27] V
min lise (kA) 12.34.35 26 (s.2) 0.01 Let through Energy Conductors withstand of MCCB IPt (A²s) × 10 ² k² S² × 10 ² 1584.65 ≤ 12188160 arth Fault (s.4) (§ 2105 (s.4)) 2250 7. (0.02)	Total voltage drop limit per phase (%) 5.00 [©] = 11.5 V
(kA) 0.2103 18(A) 2230 Ze (Ω) 0.02 Disconnection Time (sec)	

	🔔 War	rnings: 1/1 All 🔹	Calculations	E Load 🗚 Voltage drop 🦏 Discrimination 🕡 Other Selected element only 🖨 Print
I		Item	Туре	Waming
I		Supply -> DB 1	Important	The total voltage drop of 'DB 1' is over the split limit set ($0.1\% = 0.23V$) per phase
I				

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.

ElectricalOM Getting Started



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 <u>Discrimination</u> <u>During Overcurrent.</u>

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 <u>Discrimination During Earth Fault.</u>

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.

TI Schematic 12 Circuit edit Circuit details	tudy 📝 Reports 🔶	- Plan Design 👍 EAC	& EMS Forms P	Panel layout		
🕞 Apply changes 🗇 Cancel 🖾 Print						Single Phase a
Supply from DB 1 Rescription Final circuit Addition Rescription Final circuit Addition Rescription Rescripti Rescription Rescription Rescription Rescription Rescr	Ph/N Conductor Ear	Type	Correction Factors	Motor Settings \	Voltage Drop Test	
Amps./Phase of a pointAmps./Phase of a point522cosep1.00 \textcircled{l} 3rd Hamonic(X)0.0 \textcircled{l} Diversity factor1.00 \textcircled{l} Voltage Drop of this circut L13.05 V (1.33%)TotalVoltage Drop of this circut L20 V (0%)KVA1.2Voltage Drop of this circut L30 V (0%)Amperes5.22Ib (A)In (A)min Iz (A)1.521(Ω)0.33Z2(Ω)0.33Phase faultmax lsc (kA)0.3055Ze (Ω)min lsc (kA)0.3055Ze (Ω)0.08		Usage Motor eficiency Starting current Starting duration ✓ Use motor starter Motor starter settings Overload setting Installation	1.00 ÷ 6.5 ÷ x b = 2.00 ÷ sec i 5.22 ÷	33.93 A A	Inadvertent operation caused by high curren Recommendation: Revise the protective d	of protective device may occur t during the motor starting period levice
$\label{eq:constraint} \begin{array}{ c c c } \hline Disconnection & Conductors withstand duration (sec) \\ \hline 0.01 & \leq & \hline 0.14 \\ \hline \\ $						



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.

🛨 Schematic 🔸 Grout edit 🔤 Grout detals 📉 Discrimination study 📝 Reports 🔶 Plan Design 😮 EAC & EMS Forms 📕 Panel layout	
🛃 Apply changes 🗇 Cancel 🔄 Print Three	-phase 400V and N
Image: Science of the could deals Three Supply changes: Could deals Print Print Print Three Supply changes: Could deals Print Print Print Three Supply changes: Could deals Print Print Print Print Three Supply changes: Could deals Print Print	Breaking Capacity is lower e fault maxisc rice
$ \begin{array}{ c c c c c c } McB & Maximum & Zs(G) & max, Zs(G) \\ \hline 0.01 & \leq & 5 & 0.3686 & \leq & 0.5463 \\ \hline \end{array} $	
🚹 Warnings: 1/65 () Critical: 1 Important 🔹 🐨 Calculations 🚍 Load 🔊 Voltage drop 🏠 Discrimination () Other Selected element only	y 🔒 Print

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.

ium phase fault maxIsc = 8.48kA

Recommendation to resolve the error:

Supply -> DB 1

Revise the incomer protective device I_{cs}.

TI Schematic 🚺 Circuit edit 🧮 Circuit details 🏠 Discrimination stud	ly 📝 Reports 👍 Plan design 📀 EAC & EMS forms 🔳 Panel layout	
Gancel		Three-phase 400V and N 230V 50Hz
Supply from Supply ✓ Active Description DB 1 Active Load • Sub-circuits IVA / phase 2.9 1.8 1.4 • Predefined Diversity 1.00 ♀ 1.00 ♀ 1.00 ♀ • Spare(%) 0 0 0 0	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other Orout protection Ise Ise Ise Ise Ise Manufacturer Generic Ise Ise Ise Type Miniature Circuit Breakers Icu (kA) 6 Device BS EN 60898 6kA MCB Type C Ise	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	In(A) 15 Change The Ic: Service Breaking C Change AC21 Change AC21	pacity vices is lower ult maxfsc
$\begin{tabular}{l l l l l l l l l l l l l l l l l l l $	Cable Board	

4	🚹 War	nings: 1/82 🌔 Critical: 1	Important 🔻 👫	Calculations 🚍 Load 🗚 Voltage drop 🖏 Discrimination 🕕 Other 🛛 Selected element only 🖨 Print
Γ		Item	Туре	Warning
		Supply -> DB 1	Important	The service breaking capacity of the incomer protective device lcs = 6kA is less than the maximum phase fault at one of its sub-circuits sub-maxisc = 6.44kA

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.

Apply changes 🗇 Cancel 🚔 Print			Three-phase 400V and N 230V 50Hz
Supply from Supply Description DB 1	Active	Phr/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Type 401 Cu Single-core 70°C PVC non-amouned	Other
Sub-circuits KVn / prase Col Col ● Predefined Amps / phase 10.0 € 10.0 € Spare(t) cosp / phase 10.0 € 10.0 € 0 € 3rd Hamonicat°a 0.0 € 0.0 €	10.0 ♀ 1.00 ♀ 0.0 ♀	Fiter lat Wing Makeup of circuit conductors • Cu Al insulations • • • 3Ph + N Al kinds • • 3Ph Al kinds • • 3Ph Makeup of circuit conductors Pv:70/S/Cu 4x1Cx35mm ² + 1x1mm ² E	Options Fiesdble
Voltage Drop of this circuit L1 0.08 V (0.04%) Neutral of U0.04% Voltage Drop of this circuit L2 0.08 V (0.04%) Total Lo	(A) (A) (kVA)	Installation Category All methods Method Method B No. 59 - In conduit in a wall	•
	9.07	Description of the installation method Cables in conduit in masonry having a thermal resistivity not greater than 2 K m/W Reference method: B De: Cable diameter © Correly with regulations: © 202252 € 2035 226 204	
Let through Energy of MCB IPt (APs) x 10 ^p Conductors withistand k ² S ² x 10 ^p 24.62 <		Conduit Plastic • <u>Rend.set</u> 1 • Diameter Size Light •	m) 16 • 0 Prid
Earth Fault Image: Control of the second seco	0.04	Length (m) 15 Set the neutral conduct C.S.A (mm?) / Rating 35 110A Find Parallel conductors 1 to 1 to	Luctor Calculation is based on the IEE Guidance Note 1, Appendix / Recommendation: Revise the installation method
$\begin{tabular}{ c c c c c c } MCB & Maximum & Zs(\Omega) & max Zi \\ \hline 0.01 & \leq & \hline 5 & & 0.3747 & \leq & 0.43 \\ \hline \end{tabular}$	ε(Ω) 7	, and condition [1] (166	
A Warnings: 1/1 Important	- 1Fr C	Calculations 🚍 Load 🗚 Voltage drop 🌾 Discriminatio	on 🕕 Other Selected element only 🚔 Print
Item	Ty	pe Warning	

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.

Apply changes O cancer , Print			Single Phase and N 230V 50Hz
upply from DB 1	Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop	Test
Load		Kind	
Kind Lighting	• x 1 0	4D1 Cu Single-core 70°C PVC non-amoured	191
Watts of a point 100 T Amps/Phase of a point 0.44	otal load	Fiber list Makeup of circuit conductors O Cu All insulations • PVc70/S/Cu 2x10x185mm² + 1x2.5mm² E	Options Plexible
cose 1.00 ♀ 3rd Hamonic(%) 0.0 ♀ Votage Drop of this circuit L1 0 V(Votage Drop of this circuit L2 0 V(Votage Drop of this circuit L2 0 V(Diversity factor 1.00 Image: Constraint of the second sec	Installation Category All methods Method Method B No. 7 - In trunking on a wall run vertically	
$\begin{array}{c c} b(a) & h(b) \\ \hline b(a) & h(b) \\ \hline 0.44 \\ 21(2) \\ \hline 0.0028 \\ \end{array} \begin{array}{c} c \\ c$	(A)	Description of the installation method Cables in trunking on a wooden or masonry wall running vertically	3
max lsc (kA) 2.0745 max lsc at min lsc (kA) 1.621	starting point(kA) 2.1442 Ze (Ω) 0.13	Reference method: B De: Cable diameter	
Let through Energy Cond of MCB I ² t (A ² s) x 10 ³ 2.43 ≤	uctors withstand k ² S ² x 10 ⁹ I52625.62	Trunking Plastic	50x38 • 0
Earth Fault lef (kA) 0.3969 la(A) 60 Disconnection time (sec)	Ze (Ω) 0.41	Length (m) 15 C S A (mm?) / Rating 185 341A + Find	Calculation is based on the IEE Guidance Note 1, Appendix A Recommendation: Revise the installation method

🔔 Wa	rnings: 1/1 Important 🔹	Calculations	Load 🗚 Voltage drop 🏠 Discrimination 🕡 Other	Selected element only	🖨 Print
	ltem	Туре	Warning		
\oplus	DB 1 -> Final circuit	Important	Trunking size is not enough		

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.

TI Schematic TI't Circuit edit Circuit details	by 📝 Reports 🔶 Plan Design 📀 EAC & EMS Forms
Apply changes Cancel Print Supply from Supply Image: Cancel Print Load Description DB 1 Image: Cancel 200 Sub-circuits KVA / phase 200 184 207 Predefined Amps / phase 1000 0 ⊕ 800 0 ⊕ 900.0 ⊕ Spare(%) 3rd Harmonics(%) 55.0 ⊕ 1.00 ⊕ 1.00 ⊕ Votage Drop of this circuit L1 0.27 V (0.12%) Neutral current(A) Votage Drop of this circuit L2 0.13 V (0.06%) Total Load(kVA) Votage Drop of this circuit L3 0.32 V (0.14%) 621 b (A) Ir (A) min Iz (A) K (A) 1000 1250 416.67 545 Z1(Ω) 0.0006 Z2(Ω) 0.0095 Phase fault max Isc at starting point (kA) 23.96	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other Crout protection Incomer disconnection/isolation Incomer disconnection/isolation Incomer disconnection/isolation Overcurrent protection Imanufacturer Generic Incomer disconnection/isolation Device Adjustable MCCB 35c Incomer disconnection for the second disconnection time (sec) Incomer disconnection time (sec) RCD / Earth fault protection Use Use Disordination study Disordination study Incomer the second disconnection for the second disconnection
$\label{eq:constraint} \begin{array}{ c c c c c } \hline min isc (kA) & 13.018.3 & 22 (kJ) & 0.01 \\ \hline & Let through Energy of MCCB ^2t (A^2 s) \times 10^3 & k^2 S^2 \times 10^3 \\ \hline & 1602.39 & \leq & 19044000 \\ \hline & Let h Fault & lef (kA) & 22250 & Ze (\Omega) & 0.02 \\ \hline & Disconnection Time (sec) & \\ \hline & MCCB & Maximum & Zs(\Omega) & max Zs(\Omega) \\ \hline & 0.01 & \leq & 5 & 0.0266 & \leq & 0.0971 \\ \hline & \end{array}$	Cable Board
▲ Warnings: 1/1 All • √Fr Calculations	Load 🗚 Voltage drop 🥎 Discrimination 🕡 Other Selected element only 🚔 Print
Item Type	Warning
Supply -> DB 1 Important	The overcurrent CPD should provide protection to the neutral conductor. A 4pole CPD is recommended

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.

P ElectricalOM - Edit Source *		×
Description Supply		
Source properties Earthing Premises & Diversity	Other tective device) ✓ Use	
Cable Cu - Single-core 70°C thermony Installation In conduit/trunking • It (A) 21	c.s.A (mm ²) 2.5 • Parallel 1 • R (Ω) 0.0087 X (Ω) 0 Z (Ω) 0.0087	
Backup protection from supplier Manufacturer Generic Type Miniature Circuit Breakers Device BS EN 60898 10kA MCB Type In(A) 32 Poles 3	✓ Use Building bonding conductor C.S.A (mm ²) 10 ✓ Use C C ✓ Change Change	
OK Cancel	Three-phase: 400V , 230V 3Ph + N	
🔥 Warnings: 1/83 🌒 Critical: 1 Important 🔹 🐨	Calculations 🚍 Load 🗚 Voltage drop 🦎 Discrimination 🕕 Other Selected element only	Print
Item Type	Warning	
Supply Important	The current carrying capacity of the tails conductor is not enough	

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



DB 1 >> DB 1 Simple The load of 'DB 1' is not balanced. It is recommended to review the allocation of loads in each phase

Power Factor Correction Unit Usage Check

When the calculated power factor ($\cos \phi$) 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.

1 Schematic 12 Circuit edit Circuit details	Ciscrimination stud	udy 📝 Reports 👍 Plan design 😨 EAC & EMS forms 🔳 Panel layout		
🖬 Apply changes 🛸 Cancel 🛛 📛 Print				
Supply from Supply Description DB 1	Active	Ph/N Conductor Earthing I Protective Devices Correction Factors Voltage Drop Other Costing code		
Load kVA / phase 2.3 2.3 2.3 ○ Predefined Amps / phase 10.0 ♀ 10.0 ♀ 10.0 ♀ 10.0 ♀ Spare(%) 0 ♀ 3rd Harmonics(%) 0.0 ♀ 0.0 ♀ 0.0 ♀ Voltage Drop of this circuit L1 0.08 V (0.04%) 0 0 ♀ Voltage Drop of this circuit L2 0.08 V (0.04%) 0 Total Load(kVA) Voltage Drop of this circuit L3 0.08 V (0.04%) 7 0		Existing installation - Excluded from the checks Apply automatic diversity factors to the final circuits according to the premises settings Location / Description of the installation Individual house hold Premises type Individual house hold		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	lt (A) ≤ 110	Maximum touch voltage Diversity calculation method		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Test results At the starting point of the circuit At the starting point of the board Isc (kA) Ze (Ω) Re (Ω) Isc (kA) 9.07 0.04 6.86 Insulation resistance (MΩ) R1+R2 Insulation resistance (MΩ) Q1 UL UN UE N/E 7s (Ω) 0.33 0.3747 Comments 0.3747		
Warnings: 1/81 Simple	VPr Calculations	E Load AV Voltage drop h Discrimination O Other Selected element only		
Item	Туре	Warning		
Supply -> DB 1	Simple	This is an existing installation. No checks are performed for this circuit		

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.

1 Schematic 12 Circuit edit Circuit details	y 📝 Reports 🕂 Plan design 🤹 EAC & EMS forms 📘 Panel layout	
Reply changes 🗇 Cancel 🛛 😓 Print		
Supply from DB 1 Description Final circuit	N Conductor Earthing Protective Devices Correction Factors Voltage Drop Test	
Load Kind Lighting • x 1 🖨	4D1 Cu Single-core 70°C PVC non-armoured	•
Watts of a point 100 Total load Amps/Phase of a point 0.44	Filter list Makeup of circuit conductors O Cu All insulations • All kinds • 2x1Cx1mm²+ 1x2.5mm² E	Options Rexible
cosp 1.00	Installation Category All methods	
Voltage Drop of this circuit L2 0 V (0%) kVA 0.1 Voltage Drop of this circuit L3 0 V (0%) Amperes 0.44	Method Method B No. 4 - In conduit on a wall	•
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Description of the installation method Non-sheathed cables in conduit on a wooden or masonry wall or spaced less than 0.3 x conduit diameter from it	
max lsc (κA) 0.3502 max lsc at starting point(κA) 2.1442 min lsc (κA) 0.2888 Ze (Ω) 0.13	Reference method: B De: Cable diameter	
Disconnection Conductors withstand time of MCB (sec) duration (sec) 0.01 ≤ 0.16	Conduit Plastic • Bend set 1 • Diameter (mm) Size Light •	16 • Find
Earth Fault lef (κA) 0.2488 la(A) 60 Ze (Ω) 0.41 Disconnection time (sec)	Length (m) [15 C.S.A (mm?) / Rating 1 13.5A • Find Parallel conductors Use	
$\begin{tabular}{c c c c c c c c c c c c c c c c c c c $		

ElectricalOM Getting Started

🔔 Wa	rnings: 1/1 All 🔹	Calculations	- Load 🗚 Voltage drop 🔨 Discrimination 🕕 Other Selected element only 🖨 Print
	ltem	Туре	Warning
\oplus	DB 1 -> Final circuit	Simple	The circuit 'DB 1->Final circuit' is not active. It does not take part in the calculations and checks