CANECO BT

Calculation and diagrams for Low Voltage electrical installations

REFERENCE MANUAL

Caneco BT

Version 5.4

Calculation and diagrams for Low Voltage electrical installations

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2 Installation

2.1 Goal of this manual

This manual introduces the main functions of Caneco BT version 5.4 and gives you a detailed breakdown of new features. This manual allows you to learn Caneco BT. Nevertheless, to familiarize fully with this software, we recommend going through a training course.

2.2 Prerequisites

This manual and the program were prepared for qualified electricians and engineers.
Also, a good knowledge of Windows system and procedures is required.

2.3 Minimum system requirements

Caneco BT for Windows requires the following system configuration as a minimum:

Processor Intel® Pentium® IV, recommended (*):
RAM: 1 Gb
Screen: 17 »'
Graphic resolution: 1024x768
System: Windows NT SP6 / 2000 / XP / Vista or Windows 7

Espace disque requis: environ 500 méga-octets

The Windows environment requires significant disk space for temporary files storage. Optimizing your disk space is recommended in order to operate the required disk space on a permanent basis (about 30% of total disk space)

2.4 System recommended

Processor: Intel® 3.0 GHz or a more efficient processor
RAM: 2 Gb
Screen: 19"
Graphic resolution: 1280 × 1024
Windows 2000, XP / Vista or windows 7

2.5 Protection of Caneco BT

Caneco BT is protected by a «soft» Flexnet key or a dongle.
The «soft» key checks that you are authorised to use the software and its associated files on your PC, within the license terms of use.

2.6 Installation of Caneco BT

To install **Caneco BT** for Windows, you must operate as follows:

- Quit all running applications.
- Insert the CD-Rom in your CD-Rom drive
- The installation program starts.
- Please answer to the questions:
- Assess the limit of liability of the ALPI License Agreement.
- Click on *Yes* to approve these conditions.

To take into account the access constraint to directories with Windows NT 2000, XP, Vista and Windows 7, the software is installed in various directories.

C:\Program Files\ALPI\Caneco BT\5.4
This directory contains the main useful and essential files to run the software.

C:\Documents and Settings\All Users\Application Data\ALPI\Caneco BT\5.4
Installation is made also in three main sub-directories:
LABELS (contains the images and logos)
FOLIOS (which includes folios)
“Country”\Schema (contains the associated diagrams)
“Country”\\ ENG\Template (contains the project templates)
“Country”\\BASE (which includes Caneco BT database)
“Country”\\ ENG\CFG (one directory per installation language, so *ENG* means *English*)
A three-character code distinguishes each language.

It is compulsory to reach target directory for writing/reading. Frequently, Caneco BT reaches CFG directory to store its configuration.

If there is not enough space on your hard disk, or if you prefer to install the software somewhere else, choose another path to install the software. Click on *Browse* button. Click on *Next*

See separate appendix “Installing Caneco BT”

2.7 Uninstalling Caneco BT

To uninstall **Caneco BT**, you must proceed as follows:
Click on uninstall icon, the program will ask you to confirm and will delete all files linked to the software on the disk.

In order to uninstall **Caneco BT**, do not delete successively files and directories. You may forget to delete some files stored in the Windows system directory.

2.8 Contents of Caneco BT

2.8.1 CFG Directory

This is the configuration directory of **Caneco BT**

File	Function
*.dat	One file per Standard: manages installation coefficients
Caneco.bib	The symbol library for new projects
Caneco.blk	File of circuit blocks
Caneco.hlb	Symbols library for old projects
Caneco.cbt	General configuration file
Caneco.std	Standardised power
Caneco.sty	Circuit Styles
Caneco.wpa	Global parameters file (default options)
“Country”.cbl	Cable file: phase cross-section
Cantips.txt	Binary file which includes containing day tricks
Normes.nrm	File containing standards
Protect.nco	File of inconsistency rules for diagram - protection
Protect.ptc	File of creation rules for diagram - protection
*.pse	Installation method tables according to the standard
*.cof	Laying factors according to the standard
*.cbl	Cable file: Neutral and PE cross-sections
*.cab	Cable file: 4th conductor small cross-section

2.8.2 FOLIOS directory

Files *.inf
Description file for document models

File	Description
A0.inf	Network single-line A0
A3.inf	Network single-line A3
Fiche.inf	Detailed calculation sheet for each circuit
Folio.inf	Landscape Folio background
Foliov.inf	Portrait Folio background
Lfolio.inf	List of landscape pages
Lfoliov.inf	List of portrait pages
Pagedg.inf	Flyleaf
Param.inf	Parameter sheet
protesg.eng	Caneco BT secondary data file
protspc.eng	Caneco BT secondary data file
source.inf	Calculation sheet for sources
Tab10.inf	Board single-line with 10 circuits per page

2.8.3 Files *.WMF

Graphic files (**W**indows **M**eta**F**ile) corresponding to folio backgrounds.

File	Description
A0.wmf	Network single-line A0
A3.wmf	Network single-line A3
fiche.wmf	Calculation sheet
folio.wmf	Folio
foliov.wmf	Portrait Folio background
Param.wmf	Parameter sheet
pdg.wmf	Flyleaf
src.wmf	Sources (N & S) calculation sheet
Tab10.wmf	Board single-line with 10 circuits per page

2.8.4 BASE Directory

This directory contains all manufacturer files that **Caneco BT** can use

Fichier	Description
Files *.dug	General purpose circuit-breakers files (EN 60947)
Files *.dmi	Modular circuit-breaker files (EN 947-2)
Files *.dmd	Modular circuit-breaker files (EN 60 898)
Files *.dst	Circuit-breaker files without integrated thermal relays (EN 60 947)
Files *.dmt	Motor circuit-breaker files
Files *.dth	Circuit-breaker coordination files with contactors (EN 60947-4-1)
Files *.amt	Motor start coordination files protected by gM + thermal relay
Files *.g1t	Files of fuses g1 + thermal relays
Files *.fsb	Fuse files
Files *.fsa	aM fuse files
Files *.far	Ultra-fast aR fuse files
Files *.fgr	Ultra-fast gR fuse files
Files *.fgs	Ultra-fast gS fuse files
Files *.itr	Circuit-breaker files
Files *.ZTR	Files of transformer power and impedance
Files *.ZGE	Files of alternator power and impedance

2.9 Calculation reference

2.9.1 Technical Agreement

Caneco BT version 5 has obtained Compliance Approval Certificate no. 15L601 under these new terms of reference. This Approval Certificate arises out of an examination of the results that covered solely the above-mentioned calculation modifications together with the application of the symmetry factor fs.
Caneco BT version 5 has obtained Approval Certificates for C15-100 (Approval Certificate no. 15L601), for the RGIE, and for BS7671. These Approval Certificates arise out of an examination of the results that covered the calculations in compliance with these standards.

2.9.2 The different calculation standards and the different versions of Caneco

Principle:
Caneco BT 4 = standards and calculation standards prior to
Caneco BT 5 = new calculation standard

2.9.3 Caneco 4 project recovery into Caneco BT 5.4

All the circuits of a Caneco 4 project recovered into version 5 are locked.
Three separated cases must be considered:

2.9.4 Case 1: New installation for which the building permit is prior to 31 May 2003:

Projects must continue to be dealt with using Caneco 4

2.9.5 Case 2: New installation for which the building permit is later than 31 May 2003:

Projects must be dealt with using Caneco 5
If the project started to be designed using version 4.4, it must be started again using version 5 and converted to the new standard. Resizing of the cables and protective devices is required (full recalculation from the source). The circuits must previously be unlocked.

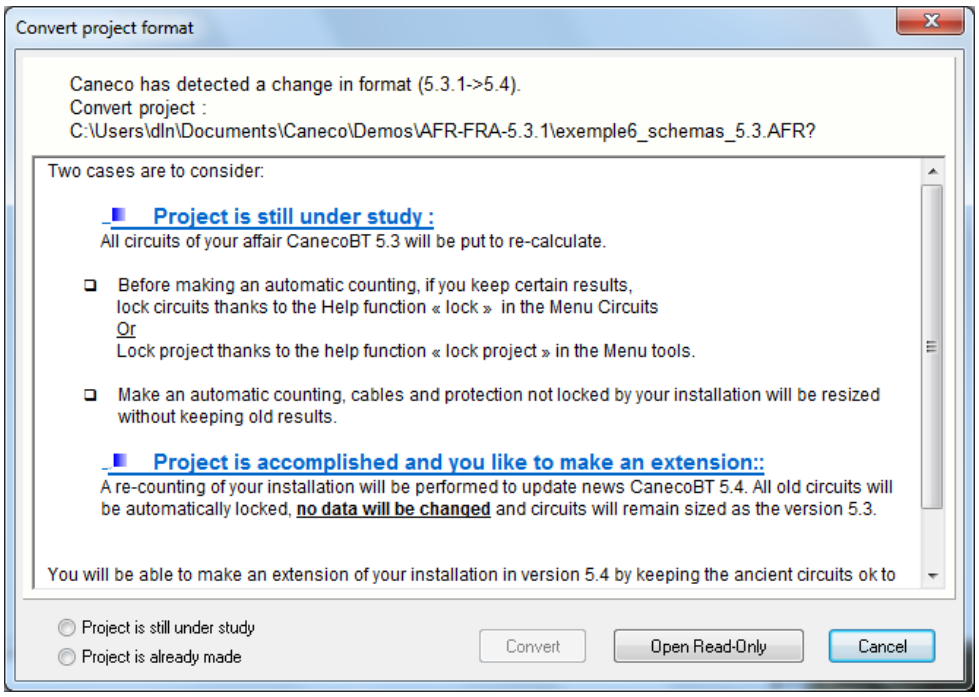
2.9.6 Case 3: Extension to an existing installation: dual calculation reference

The existing circuits must not be able to be modified. Protective devices and cables are in existence and were determined using an earlier calculation standard which is not in doubt (no retroactive changes).
New circuits, on the other hand, must be determined using the new standard. These extensions must be processed using Caneco BT 5. The existing circuits must be imported and locked. In this way, the protective devices and cables in these circuits will not be resized.
They must be recalculated to obtain IK values in accordance with the new standard. Caneco BT 5 will indicate, if necessary, that these existing circuits do not meet the new calculation standard. As for the new circuits, they will be sized in accordance with the new standard.

This dual standard makes it necessary to conserve the information concerning compliance with the earlier standard. It is highly advisable to archive the information in different formats (Caneco V4.4, .pdf and .dxf files, hard copies).
For greater clarity on the new Caneco BT V5 project, it also advisable, for circuits which previously were compliant but would not be so under the new standard, to show the earlier compliance in the text fields which Caneco BT makes available for each circuit

2.9.7 Recovering a Caneco BT 5.3 project in BT 5.4

All the circuits of a Caneco BTT 5.3 project recovered in version 5.4 are locked.
The project file format in Caneco BT 5.4 is not the same as in version 5.3
When loading a project calculated with version 5.3, two different cases must be considered:



Modification of specific processing (thermal constraint on Ik Max Upstream, discrimination, thermal management, single-pole breaking capacity of 2P2D protective devices protecting single-pole circuits, etc.) may result in changes in the calculations performed with version 5.4.

If you do not wish to interfere with the calculations made in version V5.3, completing the design note in that same version is recommended.

3 Database in EDIELEC format

3.1 « EDIELEC » format

Caneco BT version 5 uses a new data format for manufacturer files: the EDIELEC format. This format contains more information than earlier Caneco version format, called «Caneco4» format. Additional information of EDIELEC format allows:

- to «paste» more information in the manufacturer's catalogue enabling a more efficiently equipment choice.

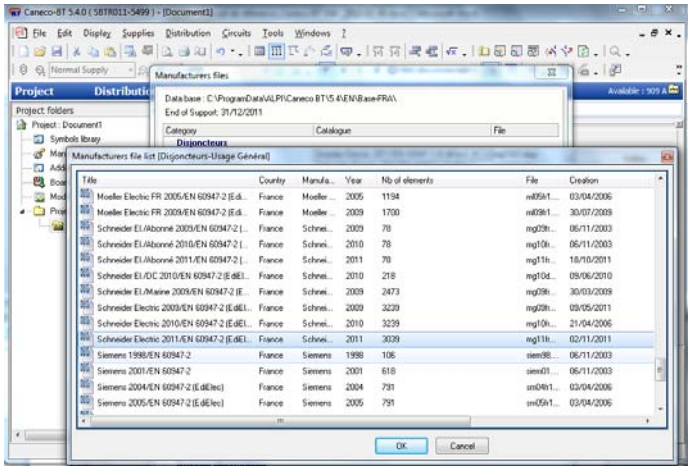
As the information workload in EDIELEC format is considerable, ALPI commits to provide with information on an EDIELEC format, ONLY the main manufacturers or those who has an agreement with ALPI.

The CTM software is offered:
either as separate tools (Tools menu) for determining equipment part numbers, unconnected with the equipment calculated within a Caneco BT project
or for automatically determining the part numbers for these items of equipment within Caneco. This possibility will be operational for users having optional features.

As the EDIELEC format involves a considerable volume of information, ALPI only undertakes to provide information in EDIELEC format for the main manufacturers or those who have an agreement with ALPI.

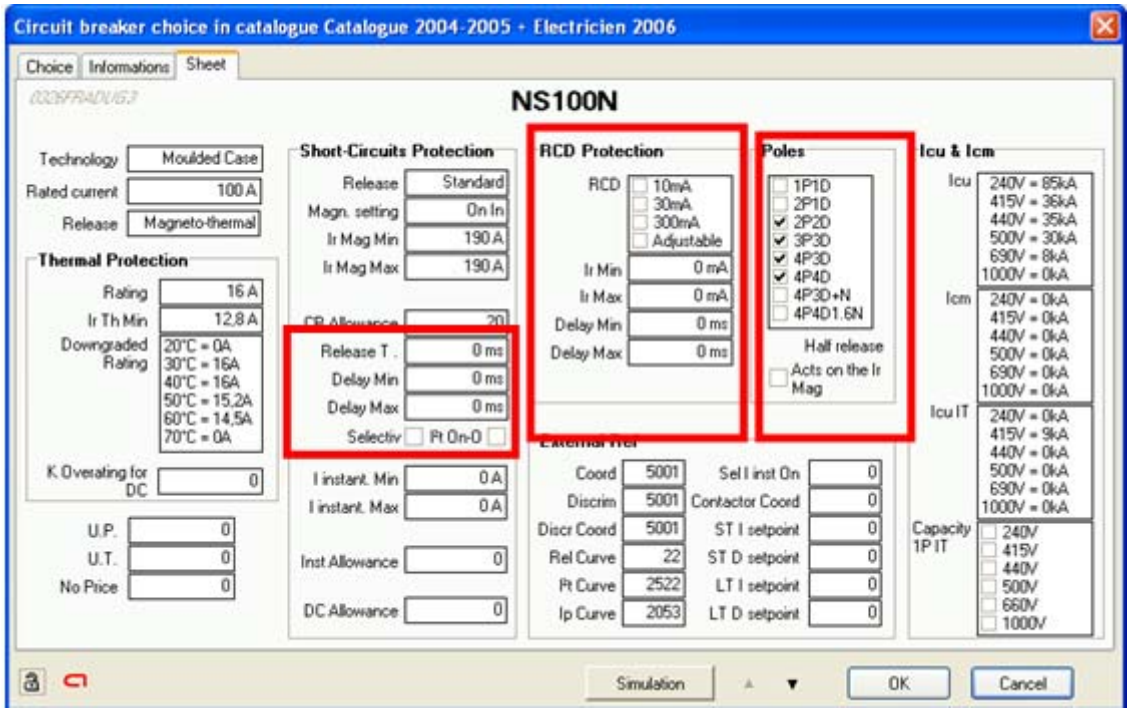
3.2 Identification of manufacturer format type

The manufacturer file you use for a given equipment defines its type. In the below picture, you can see the file type difference of general purpose circuit-breakers:



After you have chosen an equipment, the «Information» tab indicates the characteristics of the used file:

3.3 Differences between «Caneco 4» format and EDIELEC format



In this general purpose circuit-breaker example, the red surrounded information is:

- entered in the EDIELEC format
- non-existent in a Caneco 4 format. This means that this information is not taken into account for calculation.

.

3.3.1 Information about short-circuit protection

This concerns Min (20 ms) and Max (350 ms) delays on short-circuit protection. When you indicate the delay adjustment on a circuit-breaker of this model, Caneco BT checks if this adjustment is in possible limits (between 20 ms and 350 ms). Moreover, Caneco BT selects automatically the more appropriate adjustment value. This checking and this calculation cannot be made for the selected protections in a Caneco BT format file.

3.3.2 Information about RCD protection (Residual differential)

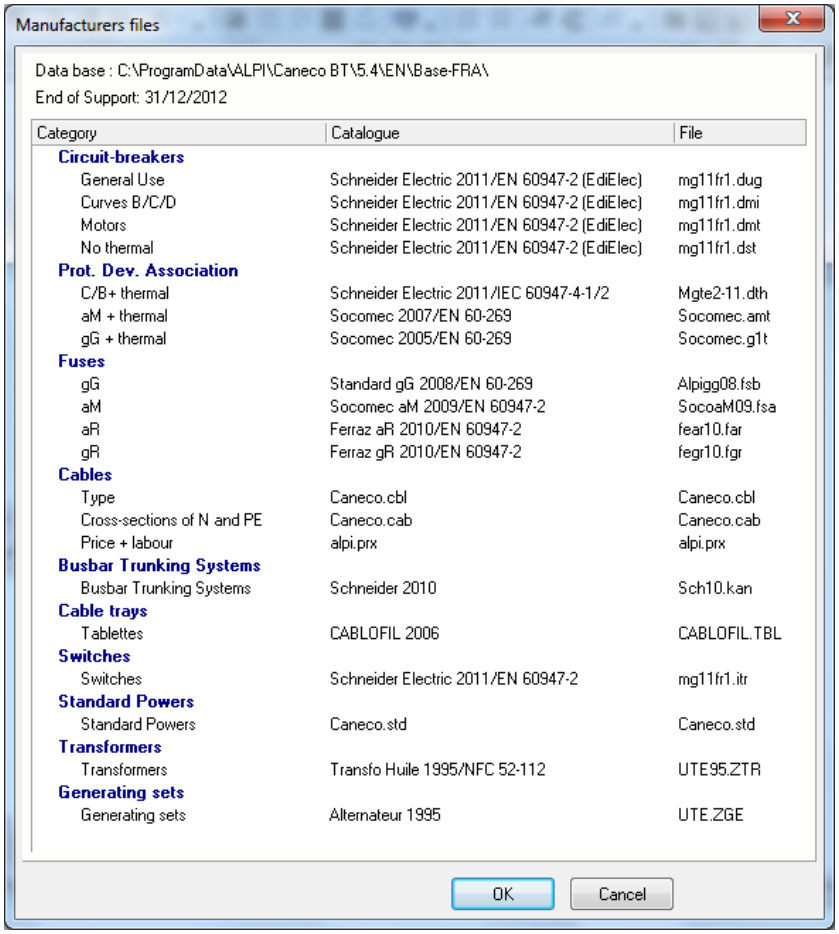
In the above example, you can see that the model has not a RCD release. In order to get a differential protection, it is mandatory to make cores and separated differential relay. If necessary, Caneco BT indicates this by means of an after calculation warning. With a Caneco BT format file, this process in not possible.

3.3.3 Information about tripped off/protected poles

In the above example, you can see that the model does not exist in 2P2D, i.e. in 2 tripped off poles presentation (2P), 2 protected poles (2D). P means «number of tripped off poles», D means Release, so «number of protected poles». Caneco BT does not allow to choose this circuit-breaker model in a 2P2D presentation. On the contrary, with a Caneco 4 format file, you can suppose that all presentation possibilities are possible. This can result in the impossibility of finding the wanted equipment in the manufacturer catalogue, while it was selected by Caneco BT.

3.4 Manufacturer file Information

The database of ultra-fast fuses is now available in Caneco BT.
Version 5.4 incorporates ultra-fast fuse curves into Caneco BT circuit design.

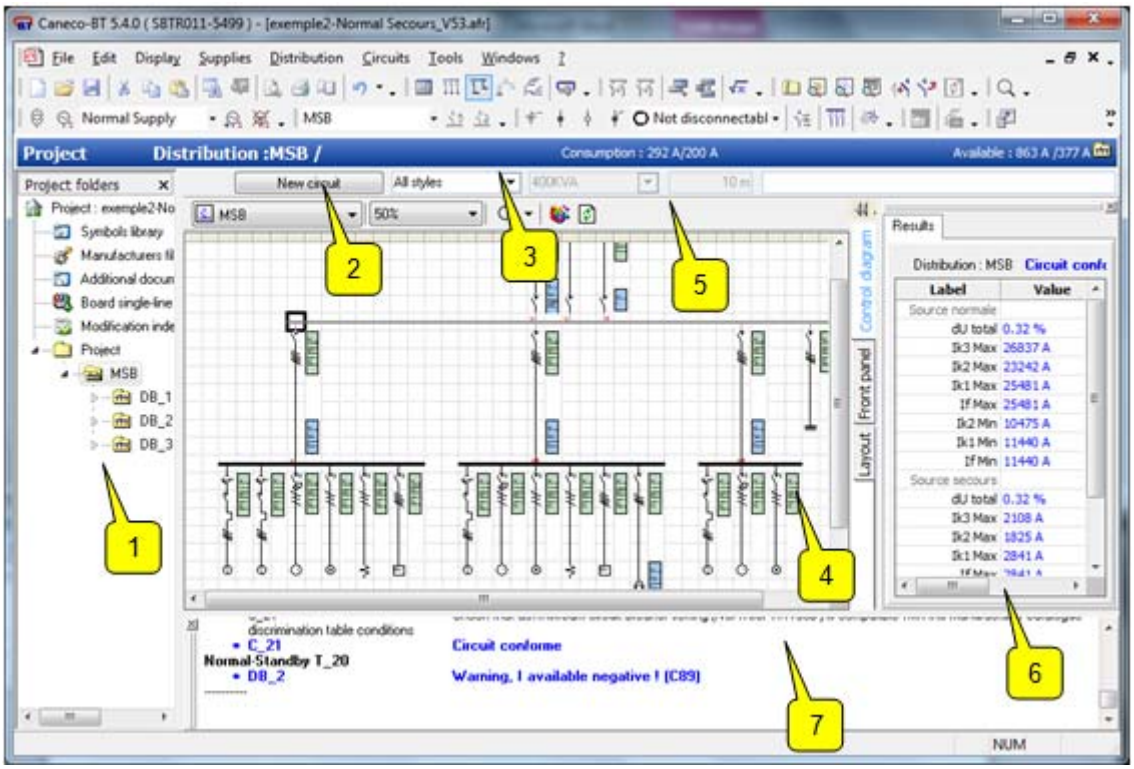


Category	Catalogue	File
Circuit-breakers		
General Use	Schneider Electric 2011/EN 60947-2 (EdiElec)	mg11fr1.dug
Curves B/C/D	Schneider Electric 2011/EN 60947-2 (EdiElec)	mg11fr1.dmi
Motors	Schneider Electric 2011/EN 60947-2 (EdiElec)	mg11fr1.dmt
No thermal	Schneider Electric 2011/EN 60947-2 (EdiElec)	mg11fr1.dst
Prot. Dev. Association		
C/B+ thermal	Schneider Electric 2011/IEC 60947-4-1/2	Mgte2-11.dth
aM + thermal	Socomec 2007/EN 60-269	Socomec.amt
gG + thermal	Socomec 2005/EN 60-269	Socomec.g1t
Fuses		
gG	Standard gG 2008/EN 60-269	Alpigg08.fsb
aM	Socomec aM 2009/EN 60947-2	SocoaM09.fsa
aR	Ferraz aR 2010/EN 60947-2	fear10.far
gR	Ferraz gR 2010/EN 60947-2	fegr10.fgr
Cables		
Type	Caneco.cbl	Caneco.cbl
Cross-sections of N and PE	Caneco.cab	Caneco.cab
Price + labour	alpi.prx	alpi.prx
Busbar Trunking Systems		
Busbar Trunking Systems	Schneider 2010	Sch10.kan
Cable trays		
Tablettes	CABLOFIL 2006	CABLOFIL.TBL
Switches		
Switches	Schneider Electric 2011/EN 60947-2	mg11fr1.itr
Standard Powers		
Standard Powers	Caneco.std	Caneco.std
Transformers		
Transformers	Transfo Huile 1995/NFC 52-112	UTE95.ZTR
Generating sets		
Generating sets	Alternateur 1995	UTE.ZGE

4 Caneco BT Interface

4.1 Caneco BT interface overview

Caneco BT user's interface looks like most programs functioning under Windows.
The action bar on top of the screen displays the eight **Caneco BT** *CANECO BT*. Actions contained in these menus make it possible to activate an action directly, or display a sub-menu or Dialog box.
The tool bar under this menu bar allows direct access to a command in one of the menus.

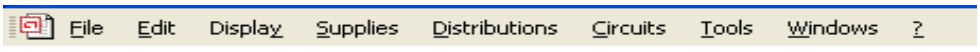


1: The project tree (old network graph, with additional information specific to the project)
2: The button for creating one or more circuits on the active switchboard
3: The buttons activating the 3 circuit data entry tools
4: Central screen for entering information.
This screen is different depending on the chapter selected in the project tree.
If the active chapter is one of the switchboards, the screen lets you enter the circuits with the help of the 3 data entry tools: network single-line, switchboard single-line, or table
5: Details of the active circuit
6: Results for the active circuit
7: Calculation report

4.2 Menus

4.2.1 Menus bar

Whatever is the used entry tool, the software has always, at top screen zone, the same tool bar.



It shows the nine **Caneco BT** menus. Each menu contains commands described in this manual.

To display a menu, click on its title in the action bar. The different options will appear.

.

The menus are:

File
Available commands concern create, edit, save and print a project.
The commands which are accessible relate to the creation, recovery, recording and printing of a project.

Edition
Circuit editing commands: Cut, Copy, Paste, Delete

Display
Display the different parts of the screen

Sources
To reach Sources windows (Normal and Standby)

Distribution
Searching of boards or LV/LV transformer feeding circuits

Circuits
Commands on circuits

Tools
Circuits calculation parameters or default values

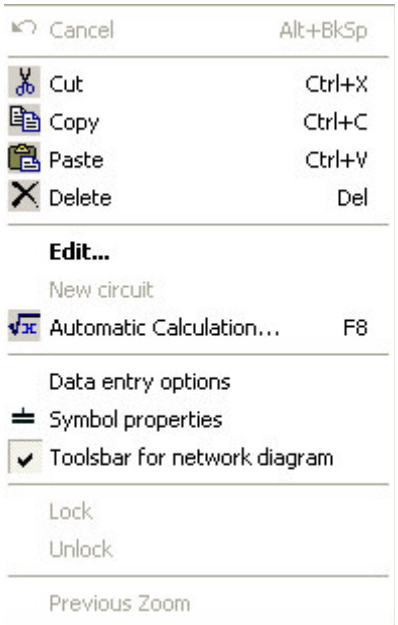
Windows
Windows standard menu to display project windows

Help
Help options

4.2.2 Local menus

Pop-up menus speed up certain operations. These are specific menus, adapted to the dialog box (window) in which you are.
These menus are activated by clicking the mouse right button.

Example of a local menu activated in the circuit calculation window:

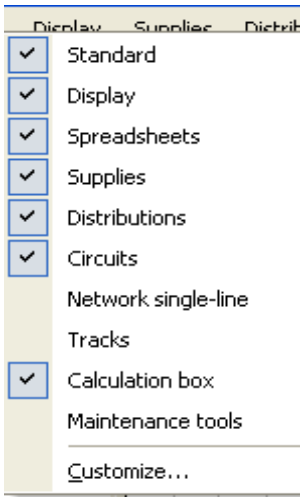


4.3 Buttons

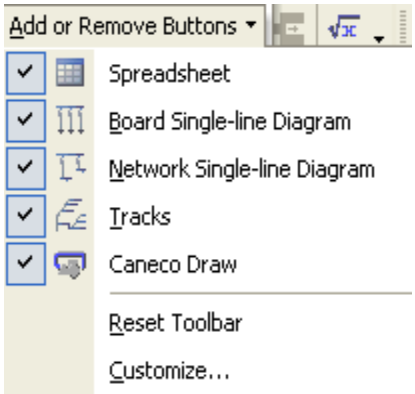
Under the menu bar you find the tool bar. Each button of this tool bar gives direct access to actions also existing in menus.

1: Cut – Copy - Paste
2: Search
3: Print preview
4: Print
5: Page setup
6: Circuit entry sheet
7: Board single-line diagram
8: General single-line diagram
9: Full calculation (F8)

These buttons may be customised in two different ways:
clicking on menu bar, you get access to the following pop-up menu allowing you to add or delete button groups:



by clicking on down arrow situated at right from each button group, you get access to a menu allowing you to modify this group:



4.4 Power requirement

If the Power requirement / Phase balancing function is present (Expert version), the automatic calculation will be preceded by a display of the power requirement window.
The user can then, if required, enforce the power value entered for one or more boards by ticking the «=IB» box and continue the calculation after validation of the window.
Caneco BT will display a list of the non-balanced distributions (if deviation >= 10%) before performing the calculation.

For the new way of operating, 3 options have been added:

- One option “Including sub-busbars” in the ‘Adjust currents’ box

If this option is checked (2), the current adjustment for sub-busbars is handled in the same way as for distributions at present.

- Two option defining the method for calculating the power requirement for distributions and sub-busbars:
- Calculation of the power requirement: using the average value of the I phases (3).

The calculation is performed as at present on the average currents, without taking phase imbalance into account.

- Calculation of the power requirement: using the I of the most heavily loaded phase (3).

The calculation is performed using the currents from the most heavily loaded phases, taking phase imbalance into account.

In terms of the power requirement, the adjustment is automatically performed using the average currents as in the earlier versions.
The adjustment for the I on the distributions’ most heavily loaded phases is carried out in the phase balancing, after the power requirement has been validated.
The sub-busbar power requirement is automatically produced during phase balancing after the power requirement has been validated, regardless of the calculation option selected under the power requirement
The move on to phase balancing is user-transparent.

As in the earlier versions, if no adjustment is requested and the power requirement is validated, the consumptions of the distribution circuits and sub-busbars that are at 0 are replaced by the consumptions calculated using the ‘Calculation’ option under power requirement.

- Note 1:

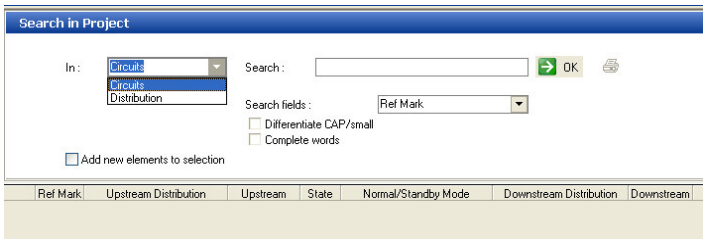
The desired availability value and the option “Including sub-busbars” are specific to each distribution and its sub-busbars if the “For the selected distribution” option is enabled and ‘Adjust’ is clicked.

- Note 2:

As at present, the desired availability is taken into account for the per-phase power requirement, but not for carrying out the actual balancing itself.

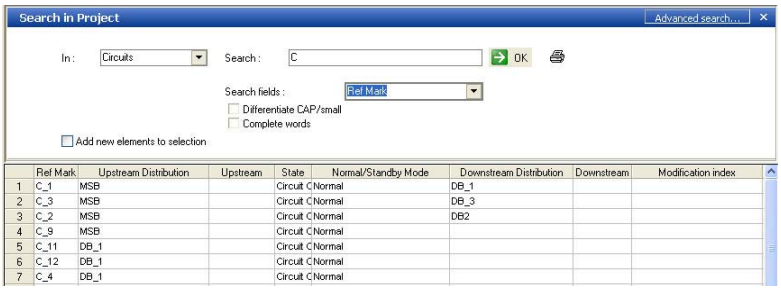
4.5 The search function

The search function offers various options to search for the distribution(s) in a project.

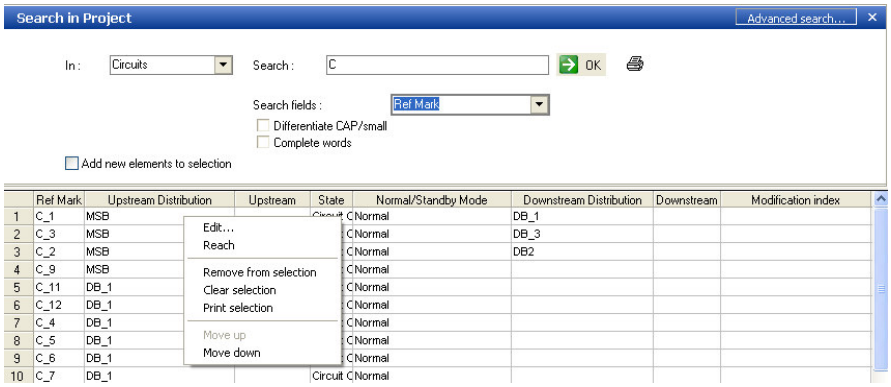


4.5.1 Searching for a circuit by its reference mark:

Simply enter the mark, or part of the mark preceded by a *, in the Search field



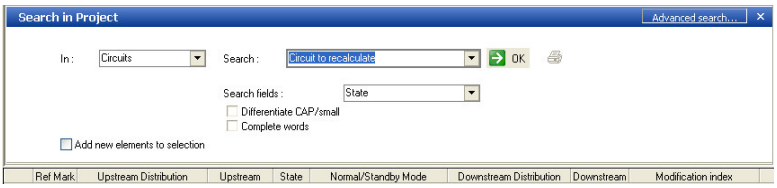
The OK button starts the search and the circuits matching the search criterion will be displayed in a list.
A right click on a circuit in the list displays a pop-up menu offering various commands.



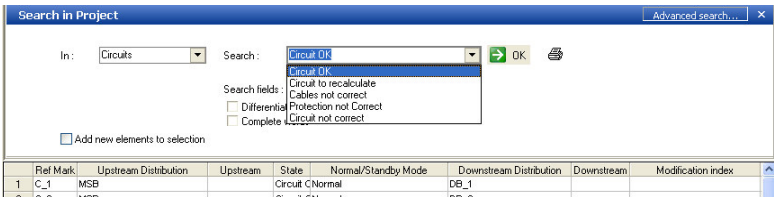
The «Edit» command activates the circuit sheet
The «Reach» command returns to the entry editor, selects the circuit and opens its sheet.

4.5.2 Searching for circuits on the basis of their status

Select the «Status» option in «Search Field»

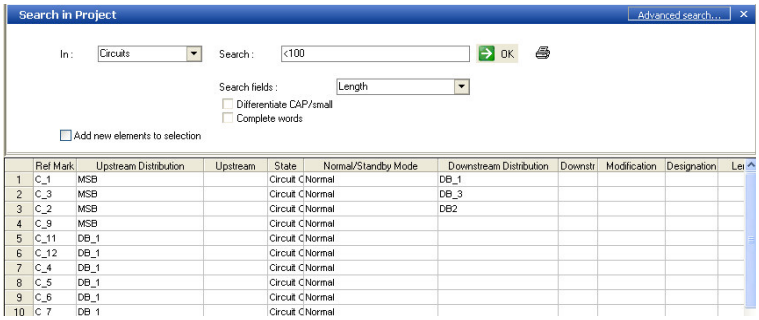


Select the status of circuits in «Search Field»



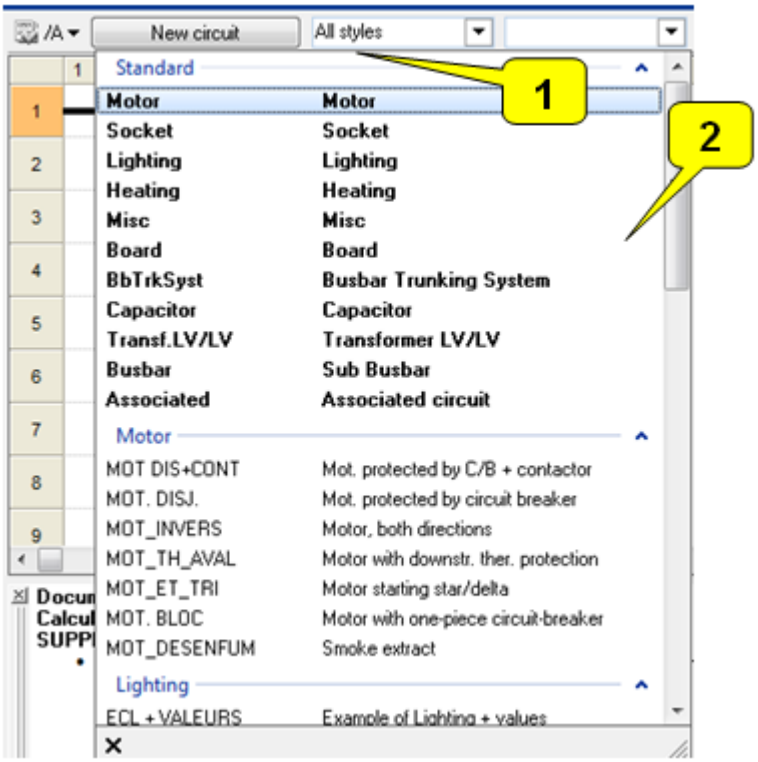
4.5.3 Searching for circuits on the basis of a condition

Example: search for all circuits of which the length is < 100m

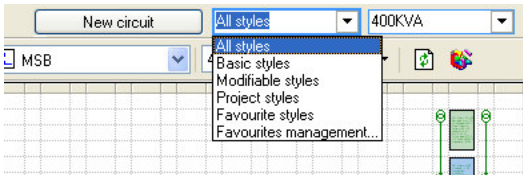


4.6 Organising the list of styles

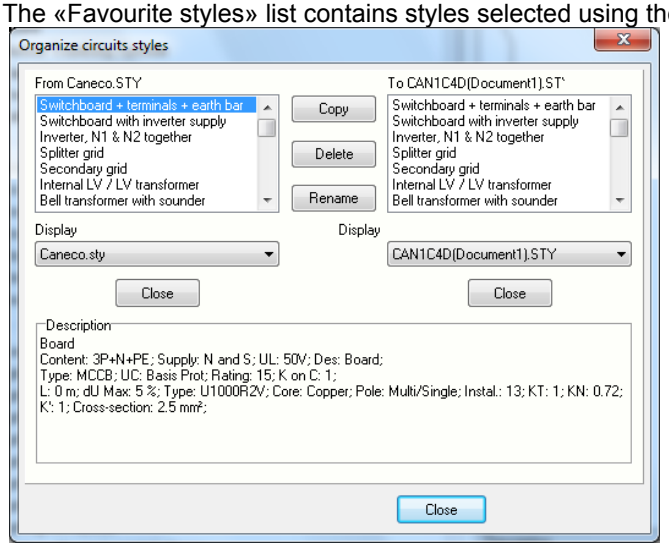
The style list (2) contents can be defined using the style filter (1)



Several options are available



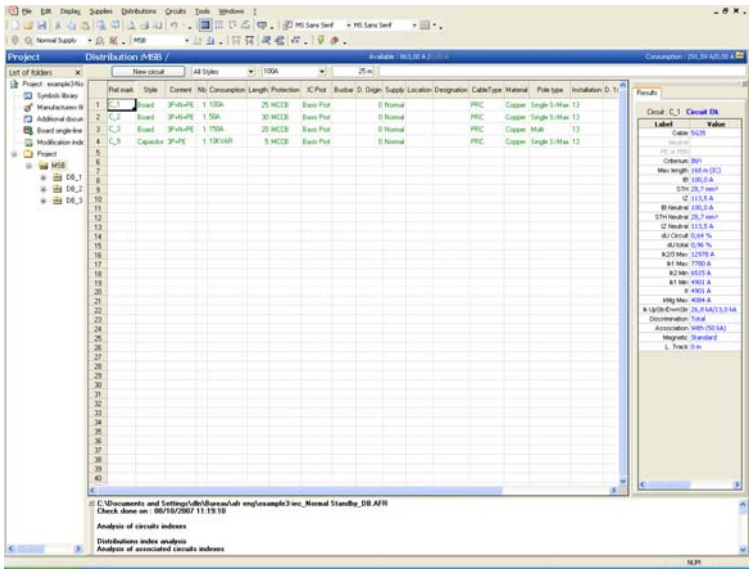
The «Favourite styles» list contains styles selected using the «Manage favourites» command



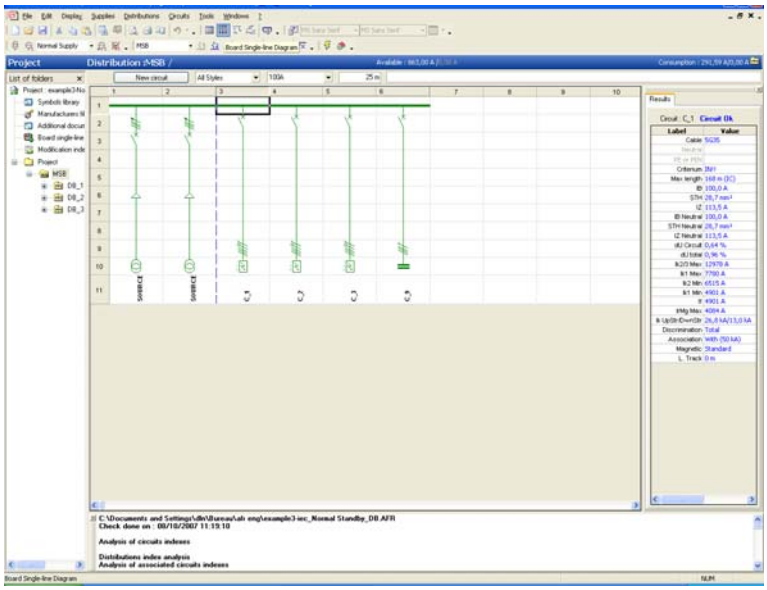
4.7 Circuit entry tools

These buttons are enabled by 3 buttons allowing to choose the circuit entry tools. This is a difference compared with the central zone of the Caneco BT screen:

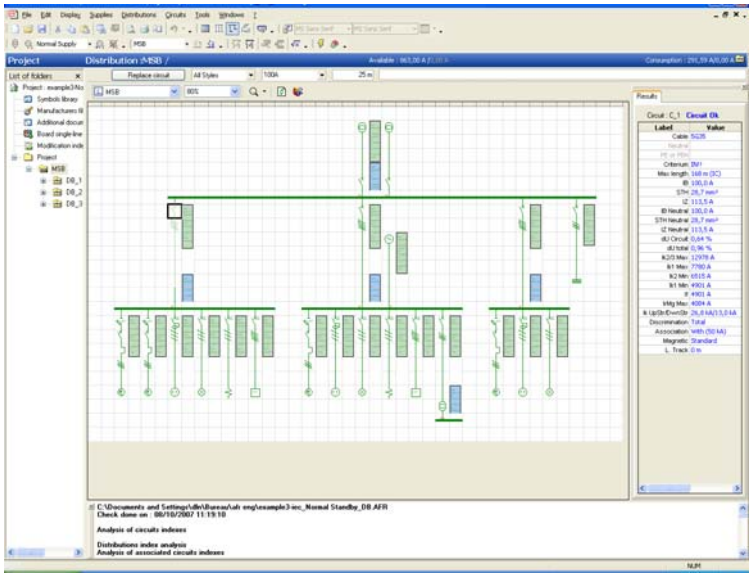
4.7.1 Entry spreadsheet: circuits from the active board



4.7.2 Board single-line: Circuits from the active board

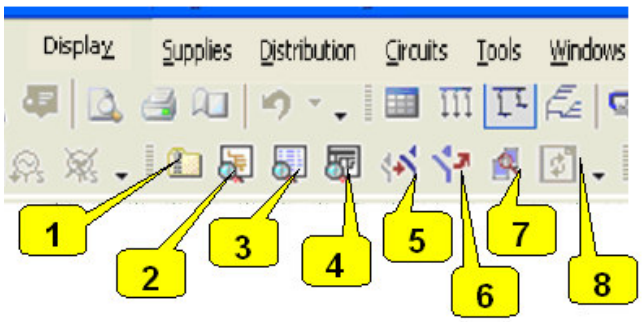


4.7.3 General Single-line Diagram: all project circuits



4.8 Maintenance toolbar

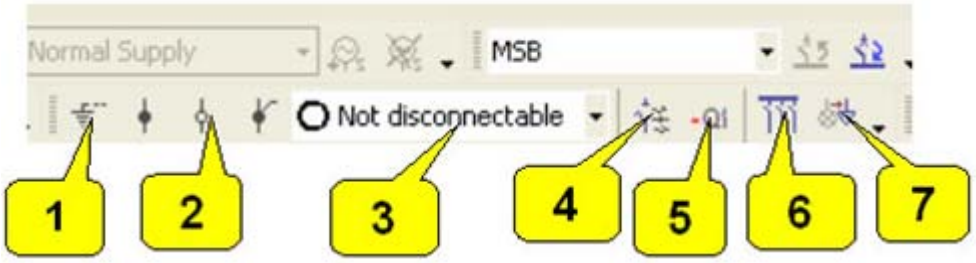
The «Maintenance» tool bar offers the following functions»
Conversion of the symbol library for the project (**5**)
Export of the symbol library for the project (**6**)
Archiving a project (**1**)
Verifying the integrity of a project (**2**)
Busbar check (**4**)
Redraw the single-line diagram (**8**)
Verify the index list (links between circuits and distributions) (**3**)
Compare the calculation results with those obtained in version V 5.3 (**7**)



4.9 Diagram toolbar

La barre d'outils « Schématique » permet de:

- The «Diagrams» toolbar allows you to:
- Draw the ground bar on single-line diagram for the board (**1**)
- Put terminals on the power circuits, the PE and the associated circuits (**2**)
- Specify the terminal technology (switchable or not) (**3**)
- Display text associated with symbols (**4**)
- Comply with the EN 60082 marking standard (**5**)
- Display the single-line diagram for the board in simplified or «print preview» mode (**6**)
- Allocate the same generic symbol to all the equipment (**7**)

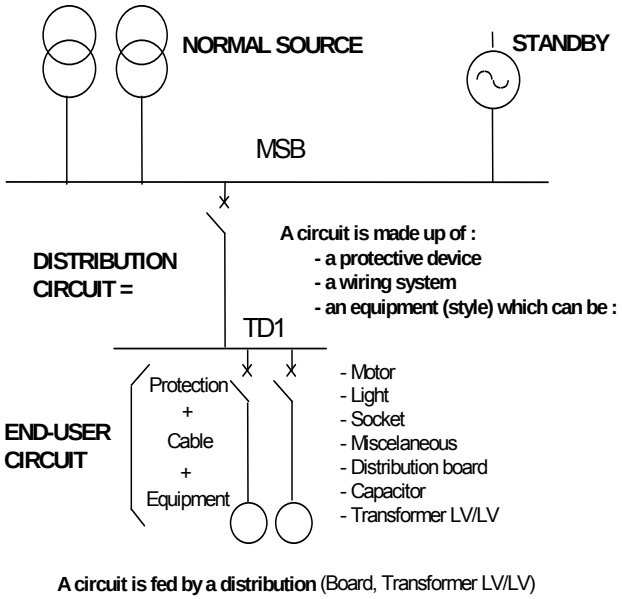


4.10 A project with Caneco BT

In **Caneco BT**, a project is done from Upstream (source supply) to Downstream (end-user circuits). This method is used to determine the protective devices and cable cross-sections. You must first define the Source and the general characteristics of the project, then the distribution circuits (Board style circuits) and finish by end-user's circuits.

This suppose that distribution circuit currents has been set.

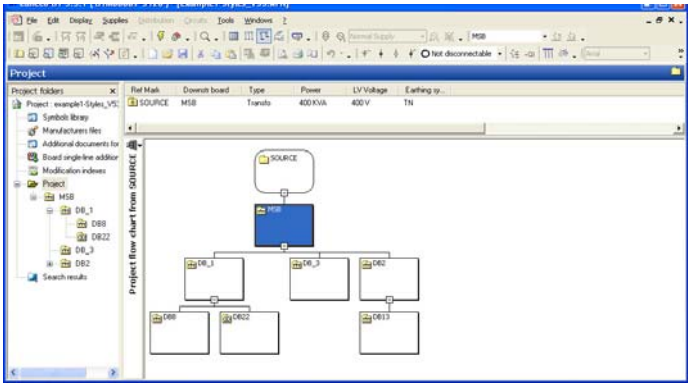
Otherwise, you can do a power checking with **Caneco BT**, this will determine the current for the distribution circuits depending on the circuits they supply and on possible capacitors.
In **Caneco BT**, at any time you can change the main circuits, then determine the protective devices and the size of the cables for the end circuits accordingly. The automatic calculation command from Circuits menu allows you to redefine automatically the protection devices and the cable cross-section size accordingly to upstream.



A circuit is fed by a distribution (Board, Transformer LV/LV)

4.11 Entry and analysis of distributions using a graph

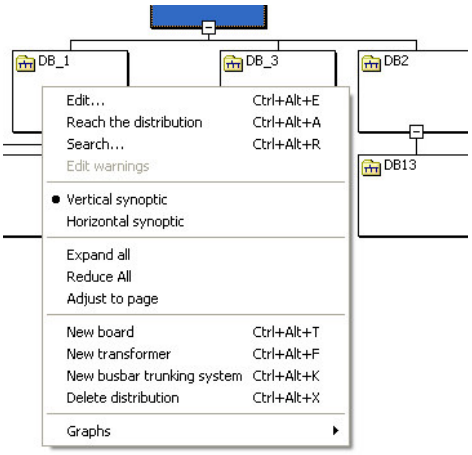
The distribution tree structure can be created using the «Graph» tool by selecting «Design» in the Network graph.



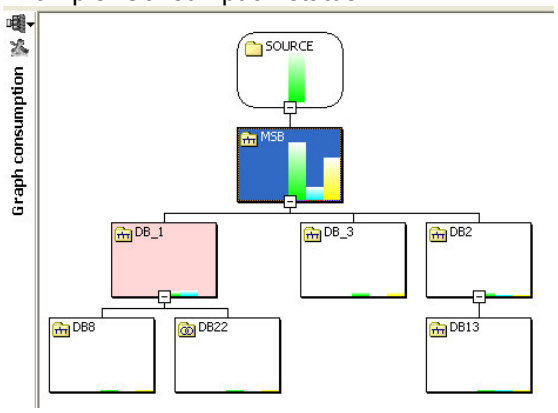
A pop-up menu contains the following commands:

Print distributions

Analyse status of distributions (balance, power requirement, etc.)



Example: Consumption status



5 Source creation

5.1 Source types

There are three possible choices:

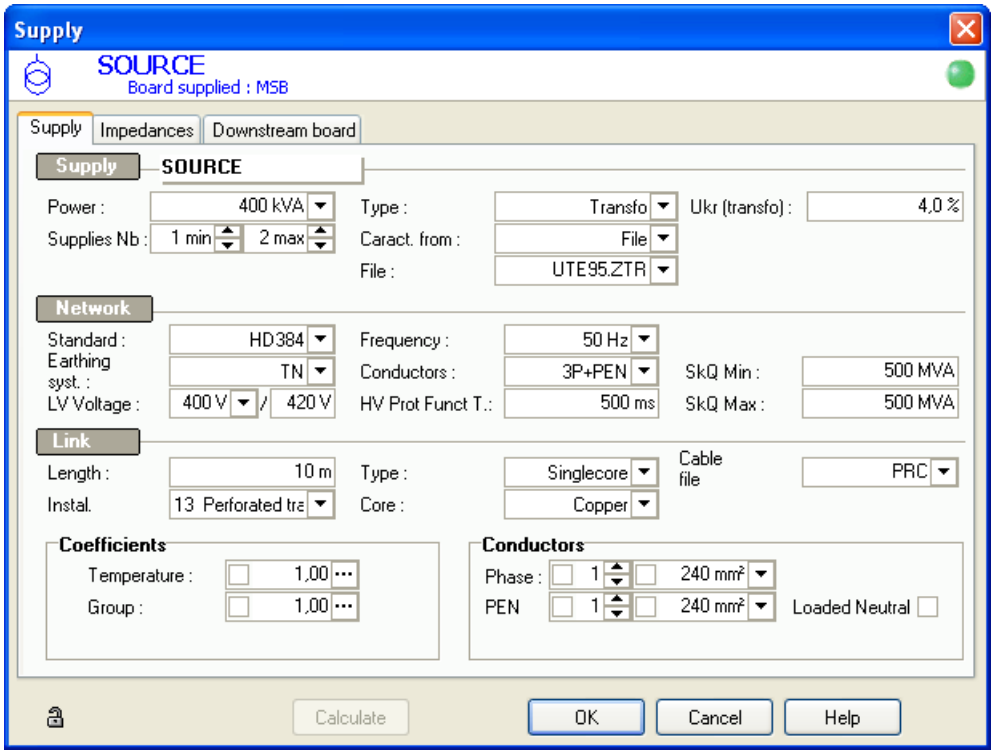
- Transformer HV-LV
- Alternators (genset) supplying a LV source,
- LV supplies (supervised power connection, yellow rate).

5.2 Definition of a Source in Caneco BT

A project done with **Caneco BT** can have a maximum of *two source types*, a Normal Source and a Standby Source, each being made up of one to 6 sources identical in parallel.

5.3 Presentation

The New option of File menu displays on the screen the *Sources Edition* Dialog box which concerns Normal sources.



5.4 Source Section

5.4.1 Source ref mark

The default proposed ref mark is *SOURCE*. It can be modified.

5.4.2 Source power

Standardized power if source characteristics are given from a file (click on the combo box arrow to get the list of standard powers). Power can be «not normalized» if you choose source characteristics from Ukr (see above).

5.4.3 Number of sources in parallel

Caneco BT proposes 1 by default, however several supplies may be installed in parallel but operate only in the event of failure of the primary supply

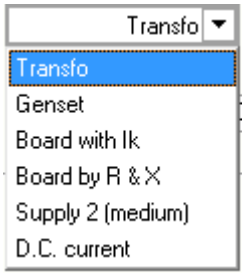
5.4.4 Max. active supplies in parallel

In **Caneco BT**, elementary sources are considered as identical. This data is used to determine Ikmax, which makes it possible to propose downstream protective device in case of coupling between several transformers

5.4.5 Min. active supplies in parallel

Ik mini are calculated taking into account the minimum number of sources in parallel.
Caneco BT proposes 1 by default which means that it is possible to have only one source in certain conditions for the installation.
Usually it is advisable to take the maximum number of sources in parallel minus one

5.4.6 Source type



Five possible choices:

- Transformer HV-LV
- Genset
- Board Source by Ik
- Board Source by R and X
- Power-monitored supply
- Battery set source (DC)

5.4.7 Source characteristics

They can be obtained:

- From a file: giving sources impedances and standard powers.
- From Ukr, short circuit voltage in % for transformers steady state and transient reactances, given in % to define generating sets.

Genset or transformer power can in this case be a not standardized power.

5.4.8 File

This is the name of the standard source characteristics file. These files can be completed by means of new files or from source values: choose *"Database"* from *"Options"* menu. This function is used to handle equipment database. The field is automatically filled and cannot be changed if you choose to define source characteristics from a file.
Caneco BT version 5.4 displays supply filenames in plain text

5.4.9 Ukr

This field can be filled only if you have chosen to define source characteristics from Ukr.

5.5 Network section

5.5.1 Standard

This field specifies recommended default electrical installation standard.
Only users having multi-standard version can get access to this field. They have the following choices C1510002 (2002), VDE 2010, CEI64-8, HD384, IEC364-09, BS7671-08, RGIE-AREI08, NIBT-NIN10, NP, NEN1010-96, NBR5410-04, AS3008, ...

5.5.2 Earthing system

Source earthing system: TN, TT, IT with or without Neutral.
It is possible within one project to change earthing system downstream LV-LV transformer. Apart from this specific case no other change is possible.
Distinction between TNC and TNS is done by selecting the conductors used in source or in a circuit (see section circuit. TNC is selected by a 3P + PEN link, TNS by a 3P+N+PE link).

5.5.3 Installation LV operation voltage

This is the source operating voltage *between phases,* on load (default 400V).

5.5.4 No load voltage

This value cannot be entered but can be calculated from standard operating voltage. Par convention, it is equal to 1,05 times the design voltage and can not be modified. This is the no-load voltage as reference used to calculate all maximum short-circuit currents.
It must not be confused with transformers dimensioning no-load voltage (410V for transformers 400V).

In IEC or CENELEC standard, this voltage equals C x operating voltage, C is specified by IEC 909 standard

5.5.5 Frequency

Frequency of the installation (50 Hz).
For 60 Hz, **Caneco BT** increases reactances for cables and equipments by a factor of 1,2.

5.5.6 Polarity

Type of Network: Three-phase or Single-phase

5.5.7 T Func. Prot HV

HV Protection functioning Time (ms).

5.5.8 Harmonics

According to standard, calculation does not take harmonics into account. It is user's responsibility to entry manually the factors to be taken into account, or to impose appropriate values for protection devices and cables,
This calculation is possible only with french standard NFC15-100-02 (2002) for which calculation rules have been defined.

- Harmonics Rate <= 15% (Neutral cross-section reduction possible)
- 15% < Harmonics Rate <= 33% (No Neutral cross-section reduction)
- Harmonics Rate > 33% (Increase of Phase and Neutral cross-section)

5.5.9 Short-circuit HV power

Updated short-circuit power values are proposed by default in Caneco BT version 5.4

Maximum power: SkQ Max

The default value of 433 MVA (the short-circuit power for the 20 kV grid) can be modified.
Choose lower values in order to allow for e.g. high-impedance overhead LV lines. This parameter has only a small effect on the Ik calculations.

Minimum power: SkQ Min

Enter a value different from the maximum value where your supply is a transformer supplied at HV and if the HV supply is backed up by alternators. In this case, enter the short-circuit power of these alternators.

Minimum and maximum values can be calculated through calculation and HV installation diagram software, **Caneco HT**. These two values are sufficient to assure calculation continuity between HV part and LV networks calculated with Caneco BT.

5.6 Link section

5.6.1 Mean length between sources and MSB

Enter mean length between sources terminals and MSB.

5.6.2 Installation method

When the wiring system is made of cables, cable installation method must be entered. Caneco BT proposes installation method “on perforated cable trays” as default with *Standard*.

5.6.3 Link type

Cables or bar sheath

5.6.4 Link nature

When the wiring system is made of cables, link nature can be copper or aluminium.

5.6.5 Cable type

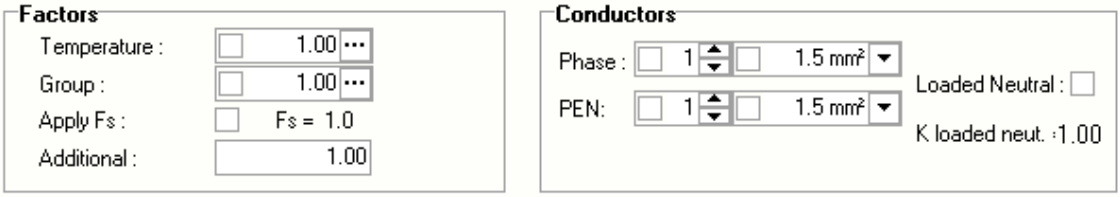
Choose the desired cable type.

5.6.6 Calculation

To Calculate source according to entered values

It is possible to calculate directly the source by a right click on the mouse.

5.7 Results forcing



Case of transformer-MSB cable links.
To fix a value tick corresponding box and enter required value.

5.7.1 Temperature factor K temp

Temperature factor limiting cable current carrying capacity. This default coefficient equals 1.0, which corresponds to a normal ambient temperature (30°C, non confined atmosphere with aerial installation method, 20 °C underground).

5.7.2 Group factor K prox

The corresponding value is calculated considering the cables on cable trays, issued from one single transformer with touching installation. Links with other transformers are assumed separated by a distance such as their thermal influence can be neglected (characterised by the group factor).
For installation methods other than *on cable trays*, you must modify eventually this group factor as proposed by **Caneco BT**. To do so, use button ... which displays installation methods tables according to standard used.

5.7.3 Symmetrical factor fs

Symmetrical factor fs (0,8) in the case of various cables in parallel.

5.7.4 Additional factor

Enter the additional permitted current derating factor in accordance with external influences. This factor is not laid down by standards, it is defined by the user.

5.7.5 Conductors

Number of conductors

- Calculated value taking into account a maximum cross-section of 300 mm², up to 3 cables.
- If current requires a cross-section bigger than 3X300 mm² per phase, the programme proposes different possible choices.

Forced value can go up to 10 conductors per phase.

Phases cross-section:

Maximum *calculated* value: 300 mm². (Commonly found size). Maximum *forced* value: 800 mm.

Neutral/PEN characteristic (Single-phase):

Calculated values taking into account Neutral reduction parameters, defined in dialog box opened by the option *section* of options menu.

Loaded neutral

When Neutral is loaded, a downgrading factor of 0.84 must be applied to current carrying capacities.

K loaded neut.:

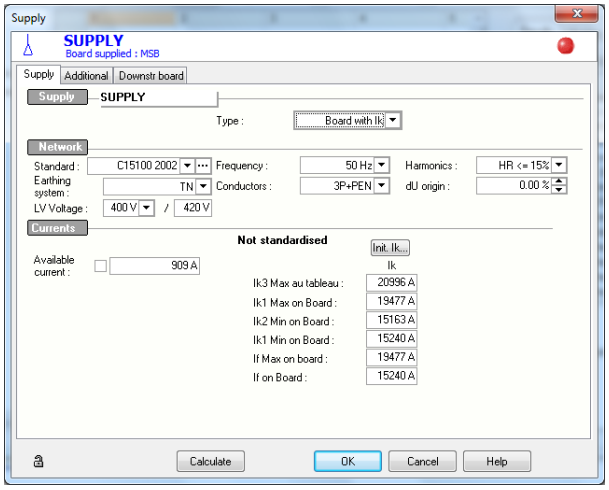
Corresponds to the loaded neutral factor, 0.84 or 1 depending on the harmonic level

5.8 Board Source by Ik

The LV supply by Ik applies in the following cases:
'Two-part tariff' supply: in this case, enter the Ikmax value at the delivery point.

5.8.1 Installation extension:

Copy all the short-circuit values at the existing switchboard.
Multiple-supply configuration:
The supplies are different and are not coupled: the design study will then be performed in several design calculations. The design calculations will be linked together by copying the Ik values at the intermediate switchboard
Coupling of supplies of the same type but with different powers: this sort of configuration can be modelled by a "Board supply by Ik", adding together the Ik values from each supply.



5.8.2 dU origin

Voltage drop at beginning of the installation, in %. Theoretically, 0% warranted by the provider.
For the *'two-part rate'*.

5.8.3 I available

The current contracted before the electricity provider.

5.8.4 Ik on board

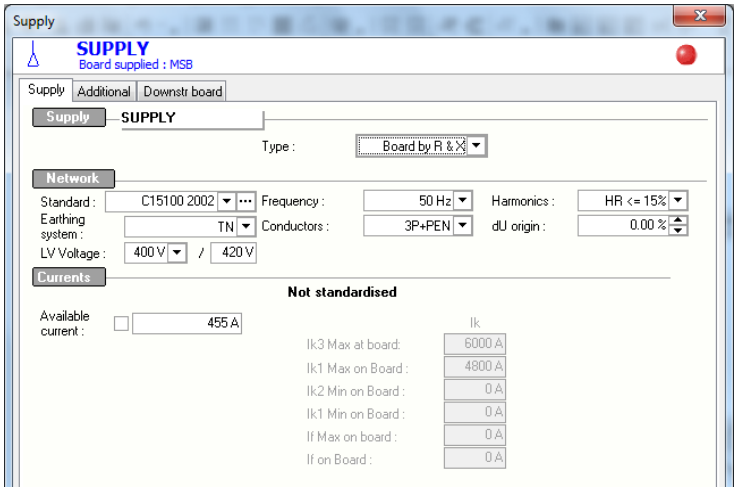
Max. and Min. short-circuit currents at the MSB making it possible to accurately recalculate the impedances at the switchboard.

5.9 Board source by R and X

The supply by LV Switchboard applies in the following cases:

- Installation extension:
- Multiple-supply configuration:

The design study will then be performed in several design calculations. The design calculations will be linked together by copying the impedances that will be injected at the Switchboard supply by R and X.



5.9.1 dU origin

Voltage drop at beginning of the installation, in %..

Choose values different from 0 only when low voltage supply has a noticeable voltage drop, for example:

- design study for an installation from a subsidiary switchboard remote from the supply source.
- design study for an installation from an LV/LV transformer
- installation including a Standby generator located a long way from the MSB

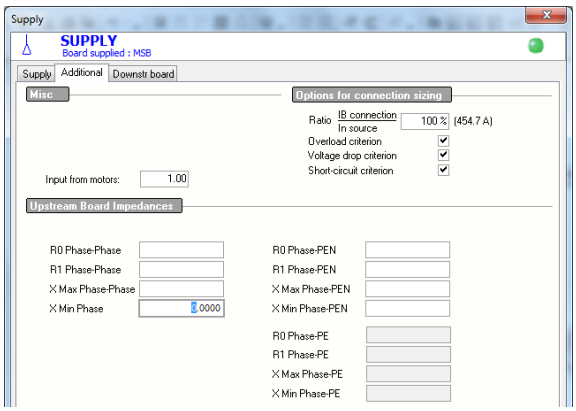
5.9.2 I available

Available current for distribution.

5.9.3 Ik Max on board

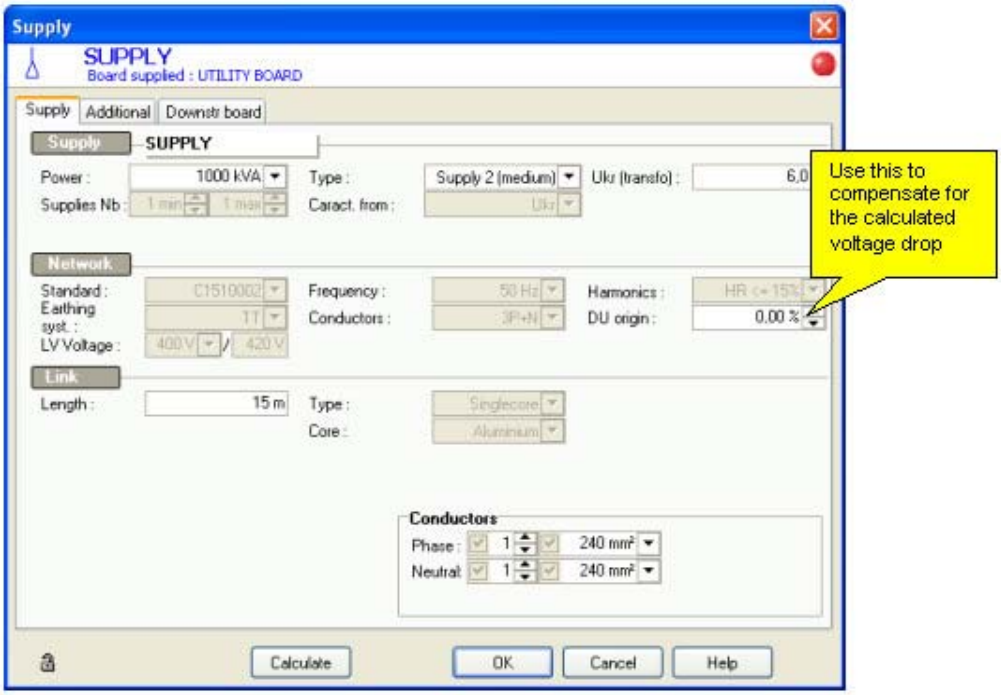
Max. short-circuit current at switchboard. Calculated from the impedances entered under the ‘Additional’ tab

If the existing installation was designed in a version of Caneco BT, the “Board supply by R and X” configuration can be achieved by copying the impedances for the distribution from which the extension begins under the ‘Impedances’ tab of the LV switchboard supply. This makes it possible to calculate the voltage drop and short-circuits more accurately



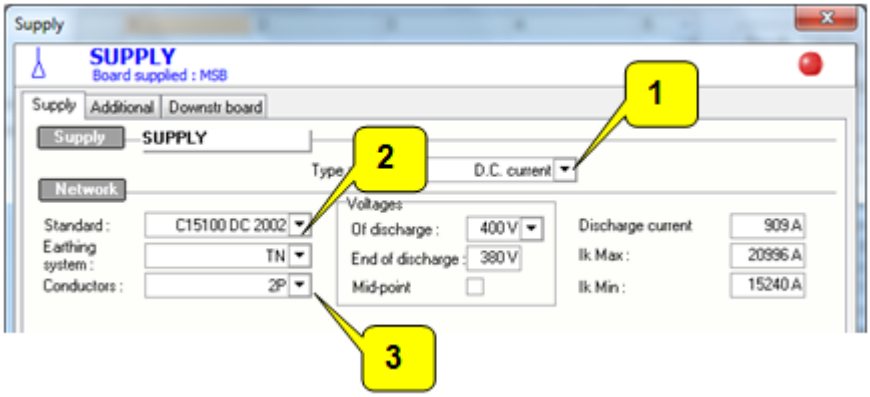
5.10 Power-monitored supply

Caneco BT 5.4 lets you configure a Power-Monitored supply as per the standard.



If the length of the connection leads to a voltage drop greater than 0 %, it is possible to decrement the 'DU origin' field (1) to bring the calculated value back to 0 %.
A template 'Tarif jaune.mdl' for a "Power-Monitored Supply" project can be found in:
C:\Documents and Settings\All Users\Application Data\ALPI\Caneco\5.4\FR\ ENG\Template

5.11 Battery set source (direct current)

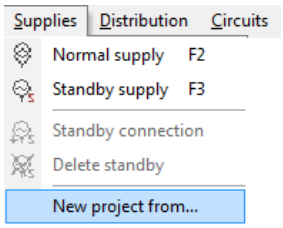


- Supply type (1)
- DC calculation standard (2)
- Supply characteristics (3)

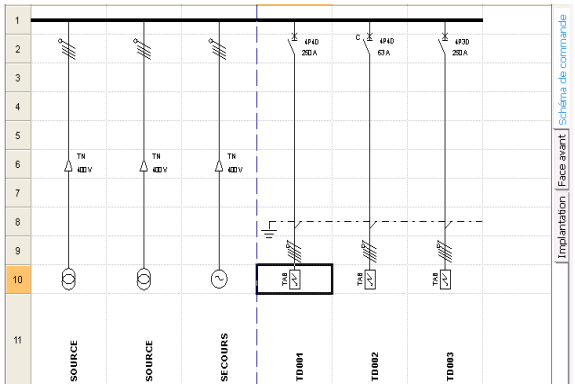
For further details concerning direct current calculations, please refer to the document entitled "NT_2009_Direct Current Module PDF", which can be found in:
C:\Program Files\Alpi\Caneco\5.4\ENG\Documents. Or, consult ALPI technical Support.

5.12 Creating a new project from an existing project

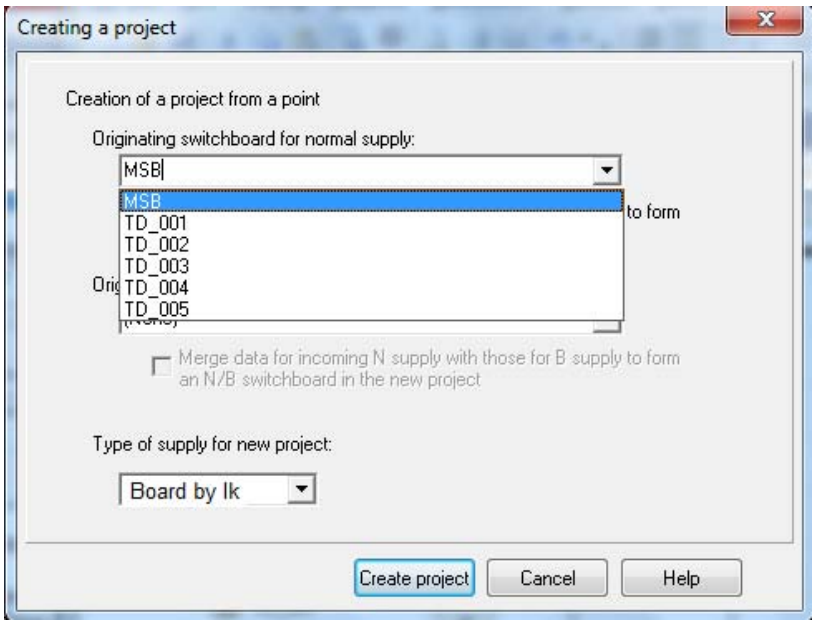
This technique is a new feature in version 5.4, it makes it possible to handle a complex project (multiple supplies) in the form of several .afr files.



Existing project

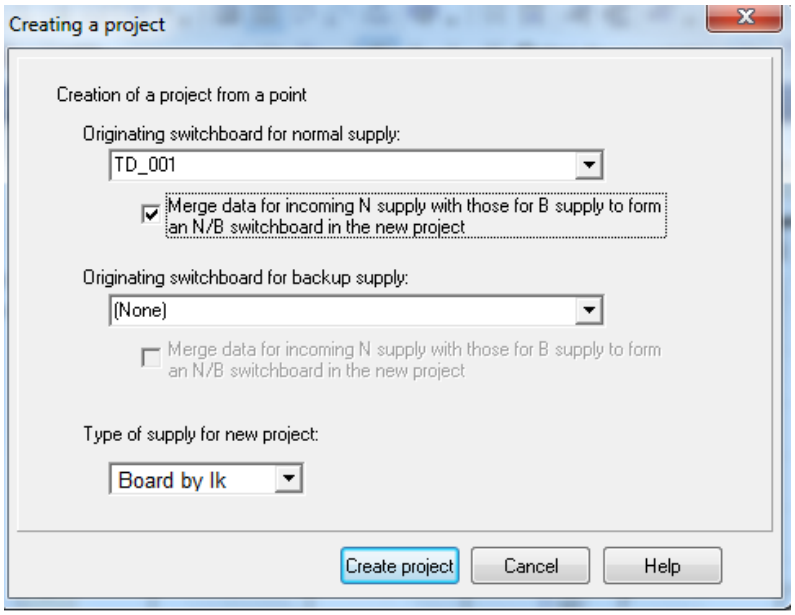


Creating a new project from circuit TD001

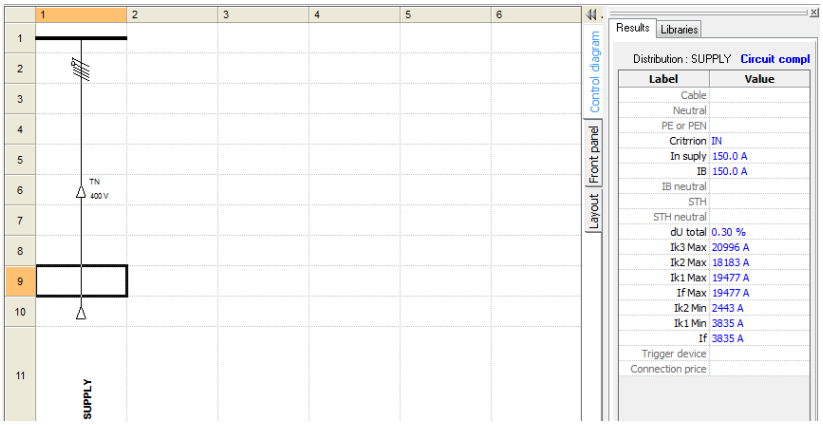


Select the switchboard from which you want to continue your installation

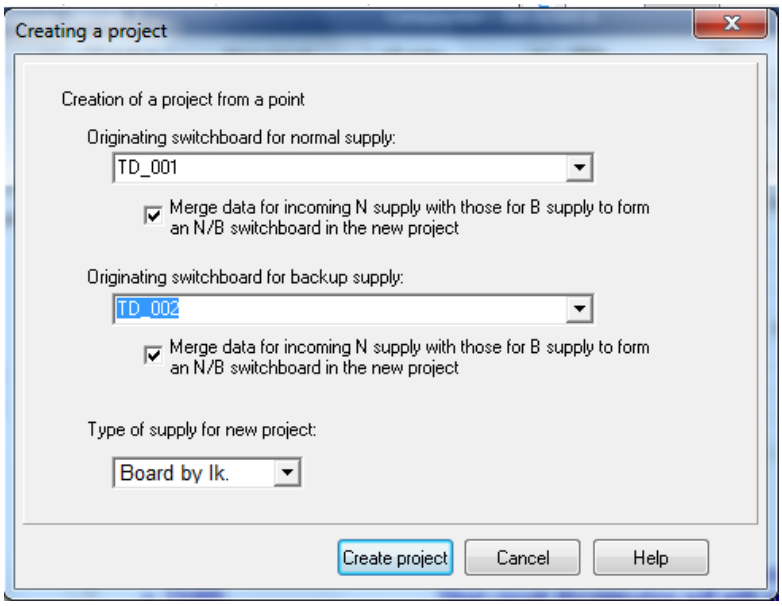
To take the switchboard's N&S characteristics into account, check "Merge data for incoming N supply with those for S supply to form an N/S switchboard in the new project"



Result of creating the project



You can still create a 2nd supply from the ‘Supply’ menu:
“Standby Supply”
“New project from”

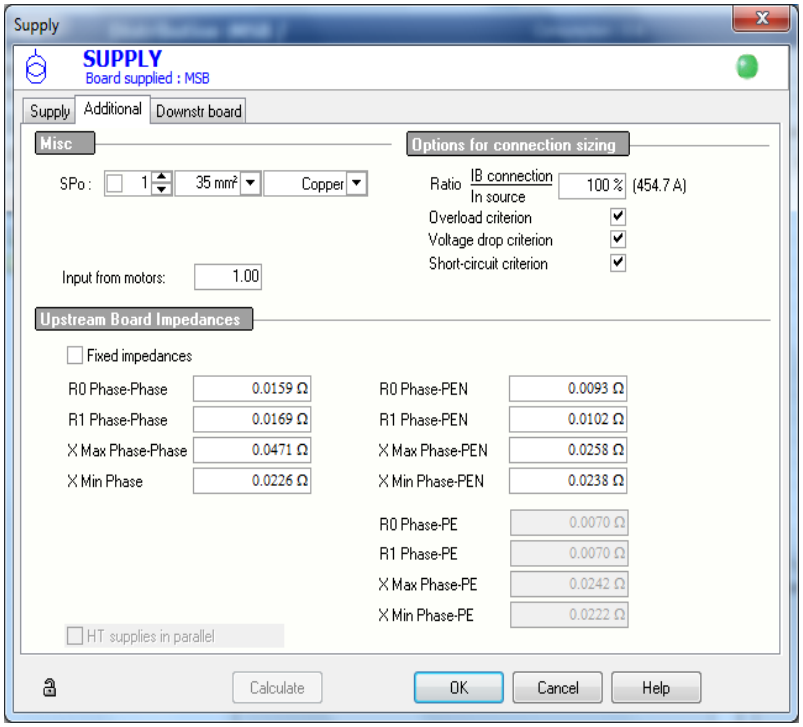


5.13 Additional tabs

5.13.1 Miscellaneous

Spo: Cross-section of the P0 conductor connecting the HV/LV transformer to the MSB.

Ra: Earth resistance value at the supply.
Ra is only displayed if the earthing system is TT.



5.13.2 Options for connection sizing

IB/In ratio:

Makes it possible to define the power actually provided by the supply (value expressed in % of the nominal power). This item of information will make it possible to calculate the cross-section for the connection and the thermal trip setting in the MSB.

5.13.3 "Overloads" check option:

If unchecked, the overload criterion will not be checked

5.13.4 "Short-circuit" check option:

If unchecked, the short-circuit criterion will not be checked
These two options are useful in those cases where the supply–MSB connection is imposed and does not have to be verified by Caneco BT.

5.13.5 HV supplies in parallel

Check option **(1)** if the HV circuit is common in parallel with the HV/LV transformer. In this case, the Ik values calculated will be higher.

5.13.6 Upstream Board Impedances

This relates to the loop impedances upstream of the MSB and relating to a single transformer. Hence these values are the sum of the upstream HV loop impedances (transposed to the secondary), the transformer's loop impedances, and the loop impedances of the transformer–MSB connection.

In the event that you have to override these values, make sure you enter loop impedances (and not line impedances)

R0 Phase-Phase

Resistance of the Phase-Phase loop (equals twice the resistance of one phase), calculated at ambient temperature. This value is used for determining maximum 3-phase short-circuit currents (Ik Max Tri).

R1 Phase-Phase

Resistance of the Phase-Phase loop (equals twice the resistance of one phase), calculated at operating temperature. This value is used for determining minimum short-circuit currents (Ik Min).

X Phase-Phase

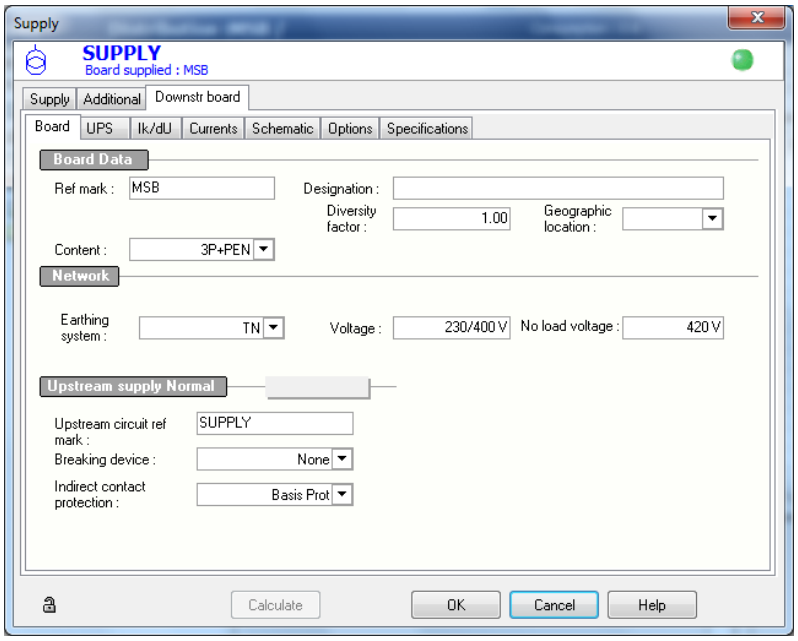
Reactance of the Phase-Phase loop (equals twice the reactance of one phase in the case of a cable connection). This value is used for determining maximum 3-phase short-circuit currents (Ik Max Tri).

Max. X Ph-Phase

Maximum reactance of Phase-Phase loop. This value is used for determining minimum 2- or 3-phase short-circuit currents. In the case of a cable connection, it is equal to X Ph-Phase.

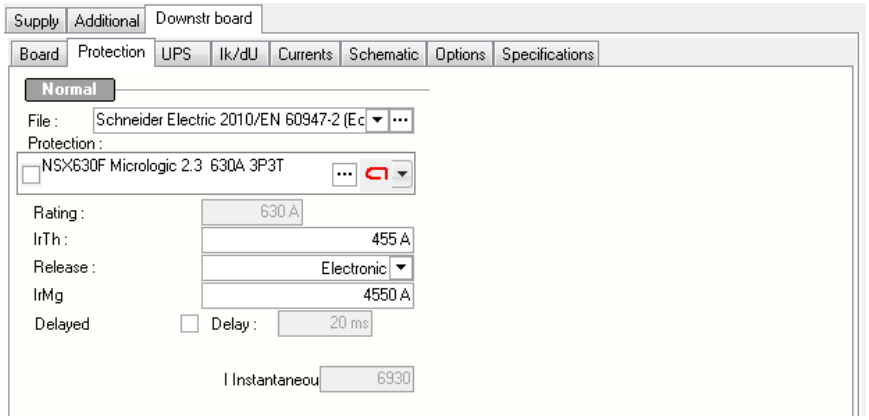
5.14 Downstream board

Clicking on the '*Downstr board*' tab opens the following window:



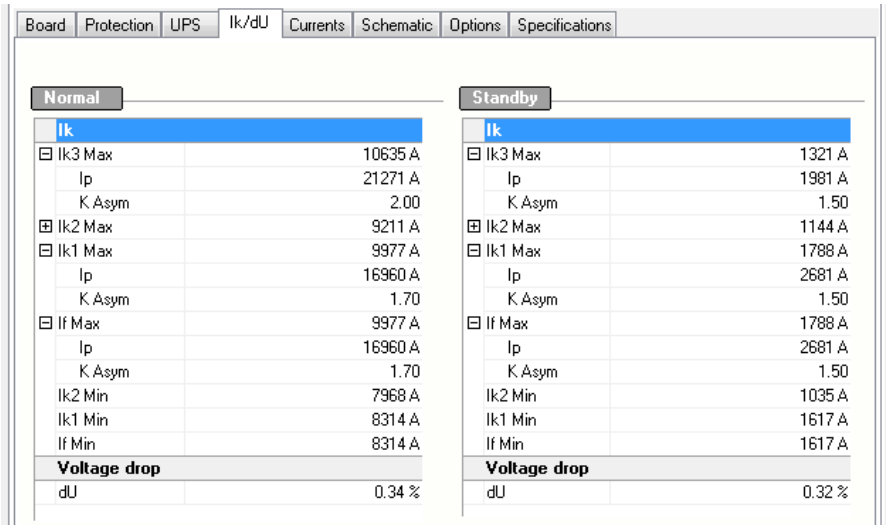
For a description of all these fields, see the '*Board window*' paragraph in the '*Distributions*' section

5.14.1 Protection



For a description of all these fields, see the '*Board window*' paragraph in the '*Distributions*' section

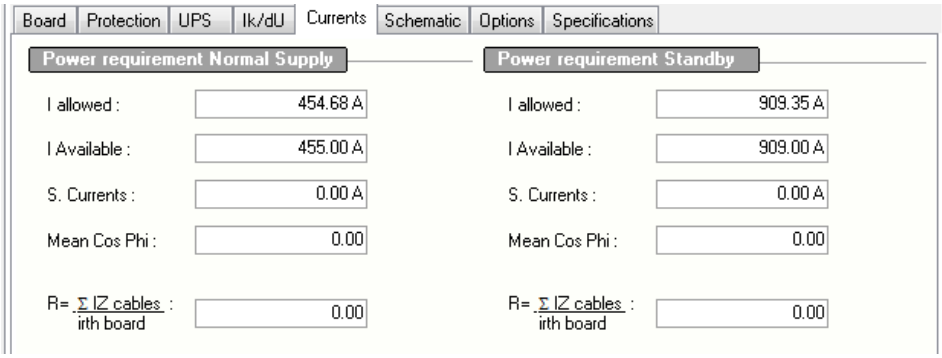
5.14.2 Ik/dU



Ik		Ik	
⊟ Ik3 Max	10635 A	⊟ Ik3 Max	1321 A
Ip	21271 A	Ip	1981 A
K Asym	2.00	K Asym	1.50
⊞ Ik2 Max	9211 A	⊞ Ik2 Max	1144 A
⊟ Ik1 Max	9977 A	⊟ Ik1 Max	1788 A
Ip	16960 A	Ip	2681 A
K Asym	1.70	K Asym	1.50
⊟ If Max	9977 A	⊟ If Max	1788 A
Ip	16960 A	Ip	2681 A
K Asym	1.70	K Asym	1.50
Ik2 Min	7968 A	Ik2 Min	1035 A
Ik1 Min	8314 A	Ik1 Min	1617 A
If Min	8314 A	If Min	1617 A
Voltage drop		**Voltage drop**	
dU	0.34 %	dU	0.32 %

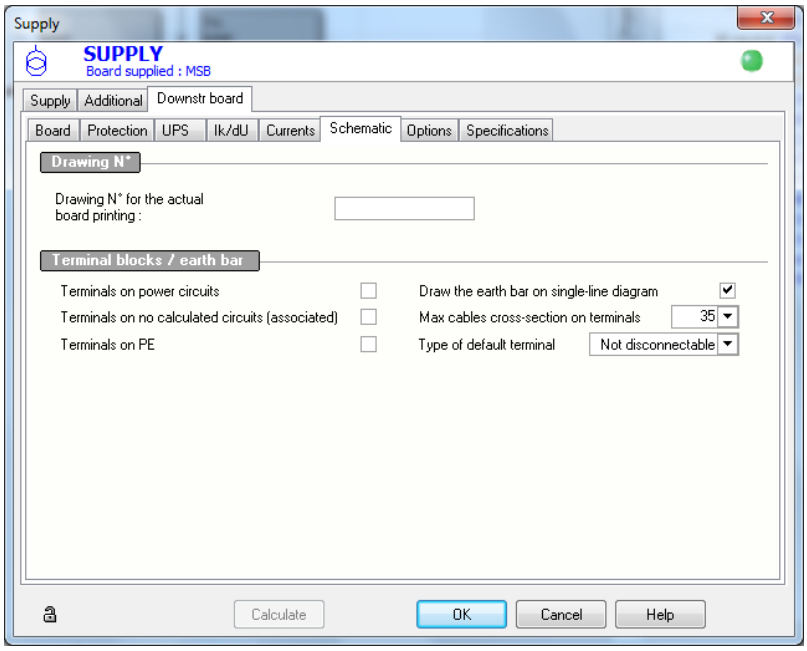
For a description of all these fields, see the '*Board window*' paragraph in the '*Distributions*' section

5.14.3 Currents



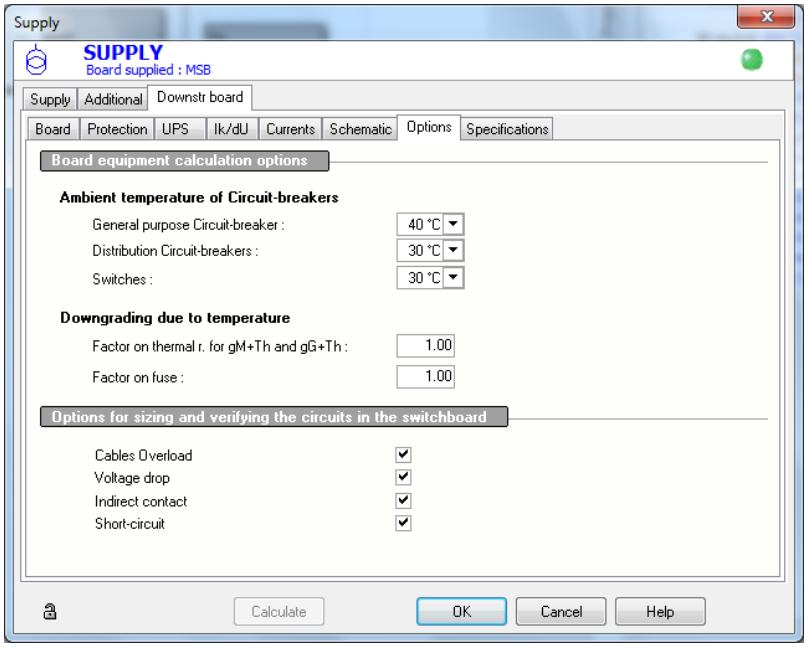
For a description of all these fields, see the '*Board window*' paragraph in the '*Distributions*' section

5.14.4 Schematic



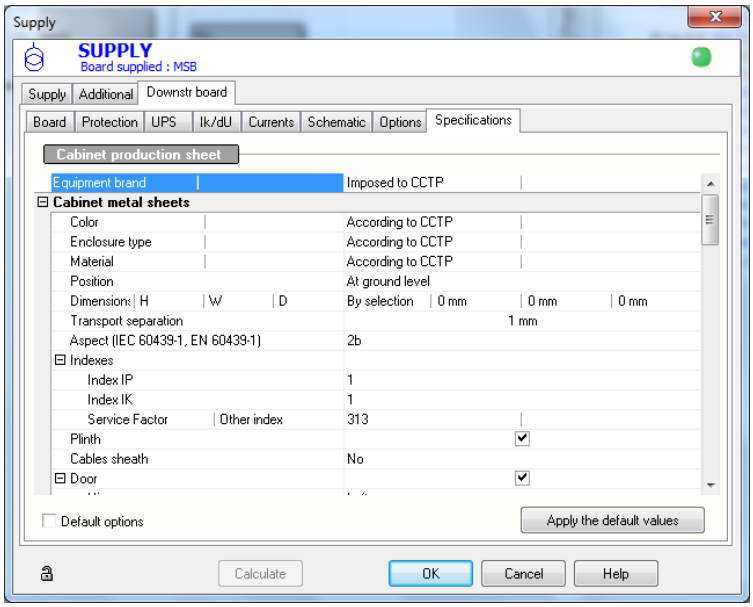
For a description of all these fields, see paragraph in '*Schematic*' section

5.14.5 Options



For a description of all these fields, see the 'Board window' paragraph in the 'Distributions' section

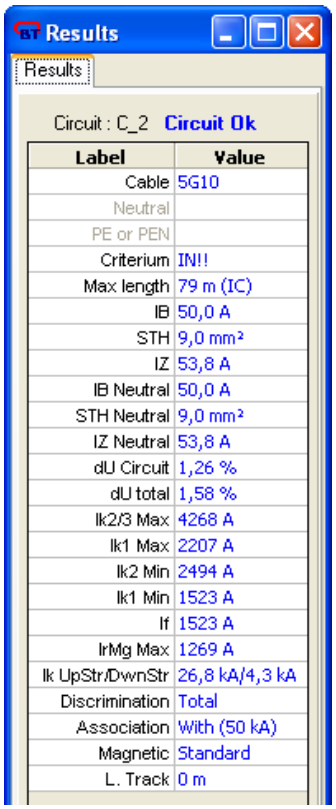
5.14.6 Specifications



For a description of all these fields, see paragraph in ‘Schematic’ section

5.15 Results

Display in Results window: Menu Display/Calculation results



5.15.1 Cable

Multi-core cable conventional writing, or phase conductors if the link is of single-core type.
Examples:
4G1.5 means 4 conductors out of which 1 is earth (yellow/green) (G = ground)
2x3x (1x185) means a single-pole connection made up of two conductors per phase.

5.15.2 Neutral

Conventional writing of neutral conductors if the connection is a single-pole one.
PE or PEN
Neutral conductors conventional writing if the link is of single-core type.

5.15.3 IB

Source on load nominal current in the phase conductors. Transfo-MSB link design current is considered equal to that value.

5.15.4 IB Neutral

Source on load nominal current in the neutral conductor. Transfo-MSB link design current is considered equal to that value.

5.15.5 STH

Theoretical cross-section of phase conductor in mm², according to overload condition.

5.15.6 STH Neutral

Theoretical cross-section of neutral conductor in mm², according to overload condition.

5.15.7 dU (%)

Voltage drop at the end of the sources cable (at MSB level).

5.15.8 Ik3 Max

This is the max. symmetrical 3-phase short-circuit current, at the MSB, used for determining the breaking capacity of the equipment and for calculating the thermal stresses for 3-phase circuits.
This value is calculated according to the maximum number of sources in parallel and to maximum power of HV network short-circuit.

5.15.9 Ik2 Max

This is the max. symmetrical 2-phase short-circuit current, at the MSB, used for determining the breaking capacity of the equipment and for calculating the thermal stresses for 2-phase circuits.

5.15.10 Ik1 Max

This is the max. symmetrical single-phase short-circuit current, at the MSB, used for determining the breaking capacity of the equipment and for calculating the thermal stresses for single-phase circuits.


This value is calculated according to the *Maximum number of sources in parallel and to the maximum power of HV network short-circuit.*

5.15.11 IK2 Min

This is min. 2-phase short-circuit current (Ik2: Ik phase-phase), at the MSB, when there is no neutral present.

5.15.12 IK1 Min

Single phase minimum short circuit current (IK1: IK phase-neutral), at MSB level, when neutral is present,


This value is calculated according to the min. number of supplies in // and the HV grid's minimum short-circuit power.

5.15.13 If

Default short circuit current (phase - PE), at MSB level, used to check human protection (indirect contacts).


This value is calculated according to the *Minimum number of sources in parallel and to the minimum power of HV network short-circuit.*

6 Distributions

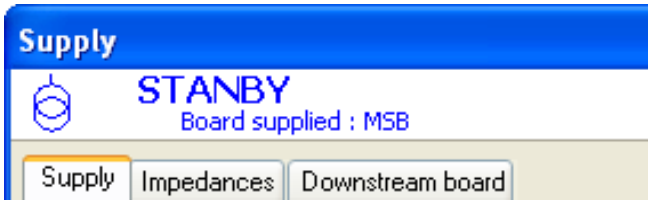
6.1 General

A distribution is a device used to supply other circuits:

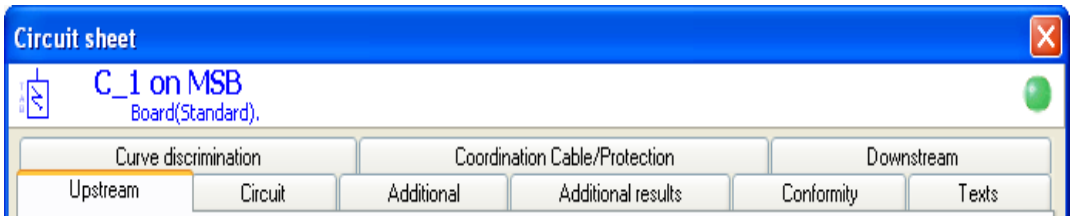
- a board
- a busbar trunking system
- a transformer LV-LV

6.2 Board windows

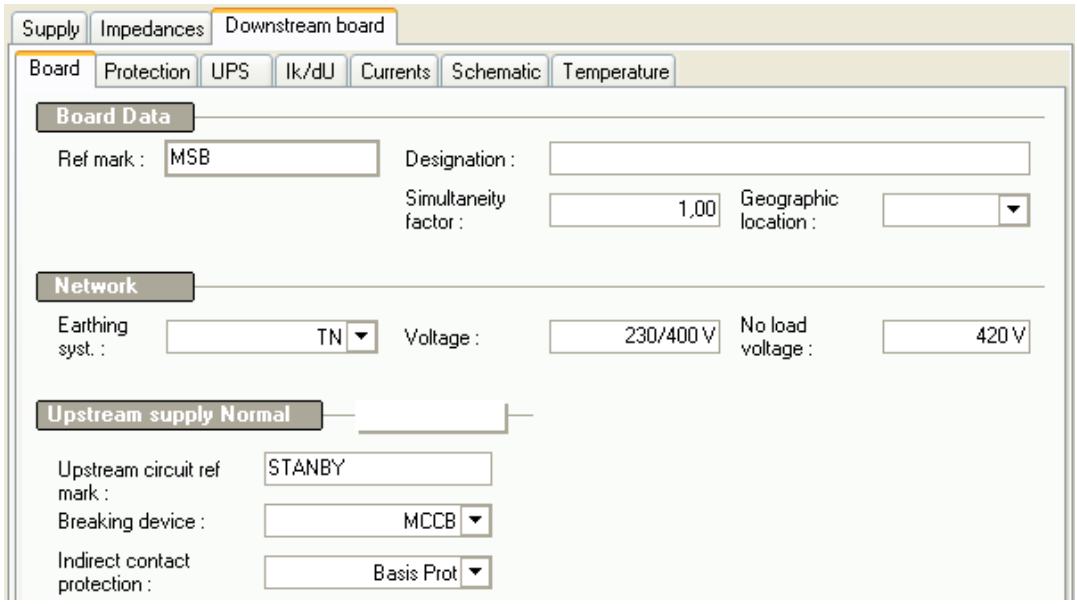
You can display the Board window:
In the Source Window by clicking on the Downstream Board Tab



In the Board style circuit window by clicking on the Downstream Upstream Tab



6.2.1 Downstream board tab



Ref mark
Board Downstream Ref mark.

Designation
Board name (data recommended for ease of identification).

Diversity factor
Diversity factor for circuits fed by the considered board (simultaneity between them).
Example: a distribution feeds 10 circuits of 10 Amps each. A Simultaneity factor of 0.8 means that the total real consumption is 10 x 10 x 0,8, to say 80 Amps.

Geographic location
Equipment geographical location. This data cannot be entered in this window. To modify it, you must change the geographical location of the circuit feeding the board.

Earthing system
Board Earthing system: TT, TN, IT

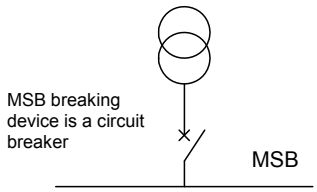
Voltage
Voltage in V:
- between board phase and neutral, in a single phase board (Phase-Neutral)
- between phases in other cases

No load voltage
No load voltage in V, used to calculate Ik3 Max.

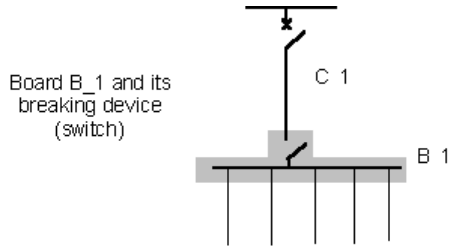
Upstream circuit ref mark
Circuit Upstream ref mark. In case of an installation with a standby, the board can be fed by two different circuits. An upstream circuit supplied from the normal supply and another one from the standby source supply.

Breaking device
Board breaking device (generally a switching device in distribution boards).

Case of a MSB in which the breaking device is a circuit breaker to get an efficient source protection:



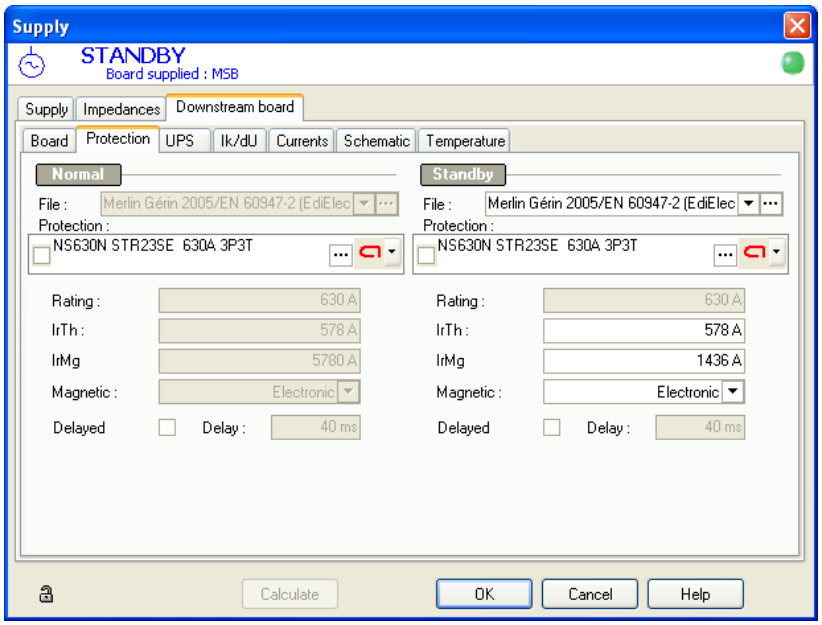
Case of a distribution board in which the breaking device is a switch:



IC Protection
Nature of the human protection against electrical shock realized by the breaking device (for example: differential residual current in TT earthing system).

6.2.2 Protection Tab

Protection characteristics at the supply point of the board (breaking device) calculated by **Caneco BT**.
This protection must not be confused with the protection of the circuit feeding the board. See previous examples of boards breaking devices.



File
Protection manufacturer file.

Protection
Protective device commercial name.

Rating
Circuit breakers rating.

Irth
Circuit breaker thermal relay setting or fuses rating value.

IrMg/In
Circuit breaker magnetic setting or fuses rating value.

Magnetic
Type of magnetic used
Standard or C curve for modular CrBrk
Low or B curve
Electronic or D/K curve

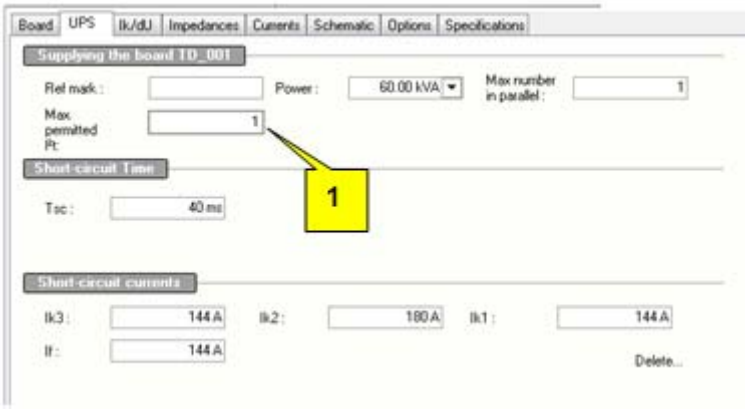
Delay
Circuit breakers short circuit delay.

RCD setting
Circuit breakers residual current (differential) delay setting.

RCD delay
Circuit breakers residual current differential) delay.

6.2.3 UPS tab

If necessary, default values must be replaced by manufacturers ones.

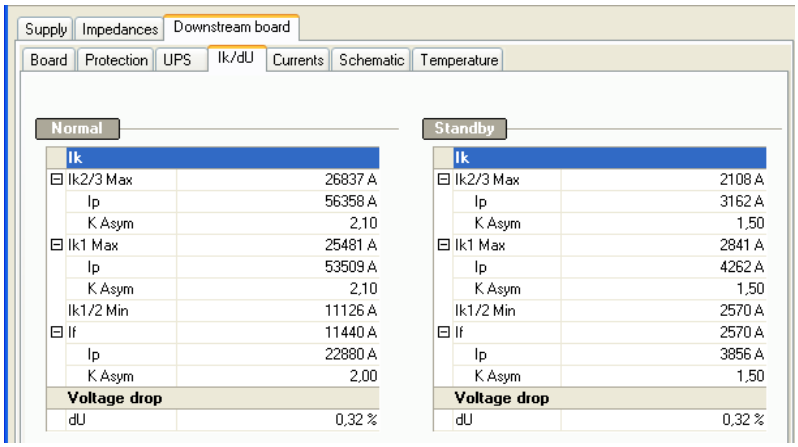


(1) Thermal stress permitted by inverter.

A UPS can be connected either on a *Normal* or *Standby* distribution. A comparison between Ik is done to keep the least favourable one (Ik max on the network, Ik min on the UPS). The process is inverted when Normal source Ik Min become less than UPS ones.
UPS are considered as current gensets. Due to that, Ik are unchanged along the network tree. The UPS is always considered as connected in *« By-Pass »* mode. Functioning Time of the circuits protection downstream the UPS are compared with the sustaining time of the UPS on Ik.

6.2.4 Ik/dU Tab

Normal and standby short circuit currents at board level



IK3 Max
Maximum three-phase short circuit current. Maximum value between Normal and standby if it exists.

Ik2 Max
Maximum 2-phase short-circuits current if there is no neutral. The higher of Normal and Standby values, if there is a Standby.

Ik1 Max
Maximum single-phase short-circuit current if there is a neutral. The higher of Normal and Standby values, if there is a Standby.

If Max
Maximum Phase/PE short-circuit current if there is a PE. The higher of Normal and Standby values, if there is a Standby.

Ik2Min

Minimum 2-phase (Phase-Phase) short-circuits current if there is no neutral.

Ik1Min

Minimum short-circuit current: single-phase if there is a neutral.

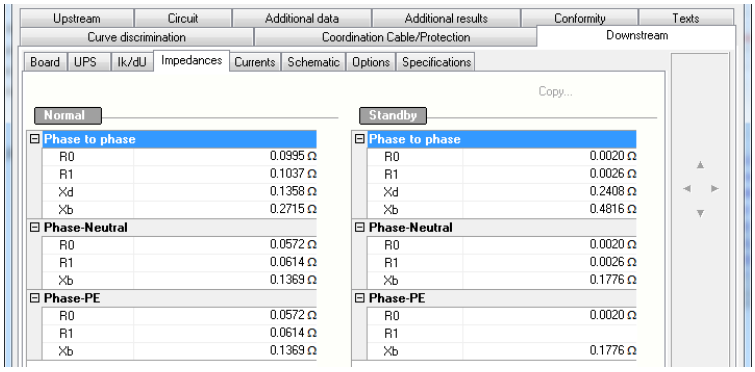
If

Phase–PE fault short-circuit current. Minimum of Normal and Standby values, if there is a Standby.

dU

Cumulated voltage drop (in %) at board level from source of installation.

6.2.5 Impedances Tab



Phase-Phase

R0 Phase-Phase

Loop resistance Phase to Phase (equals to 2 times one phase resistance), calculated at ambient temperature. This value is used to determine the tree-phase maximum short circuit currents (Ik Max Three).

R1 Phase-Phase

Loop resistance Phase to Phase (equals to 2 times one phase resistance), calculated at operating temperature. This value is used to determine the minimum short circuit currents (Ik Min)

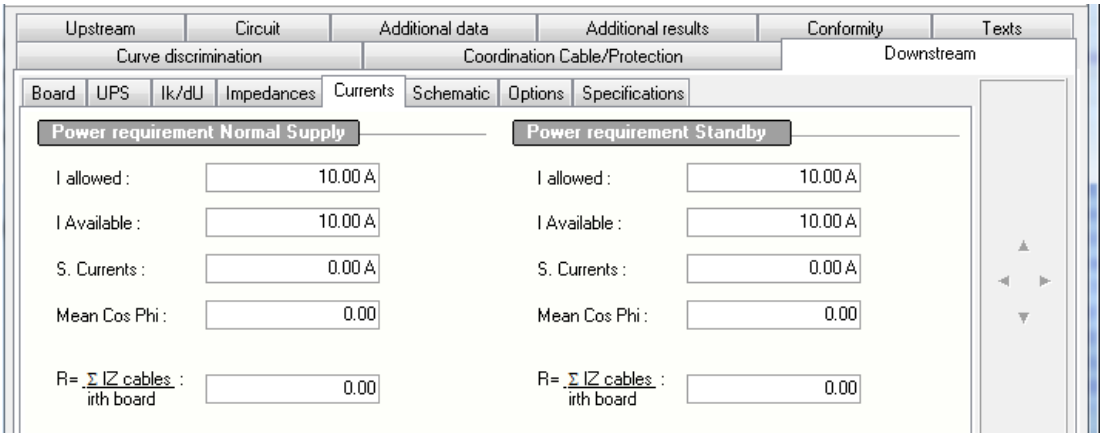
Xm

Mean loop reactance Phase to Phase.

Xd

Loop reactance Phase to Phase.

6.2.6 Currents tab



I Allowed

Allowed current downstream board. This value is equal to the current of the circuit feeding the board.

I available

Available current downstream board: available design current for new circuits which can still be fed from the board.

S currents

Design current IB sum of all circuits issued from the board multiplied by the board simultaneity factor.

Mean cos phi

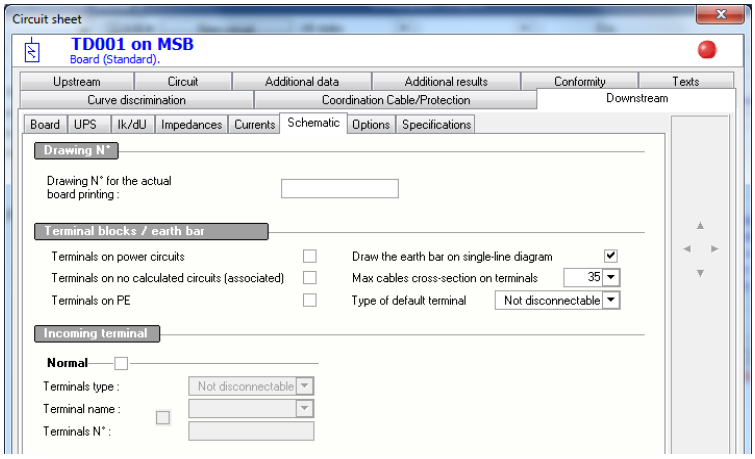
Mean cosinus phi at board level, taking into account downstream circuits and eventual capacitors.

R=S IZ cables / Irth board

Ratio between sum of *IZ* of downstream circuits (IZ calculated without taking into account group factor) and the upstream thermal relay setting.

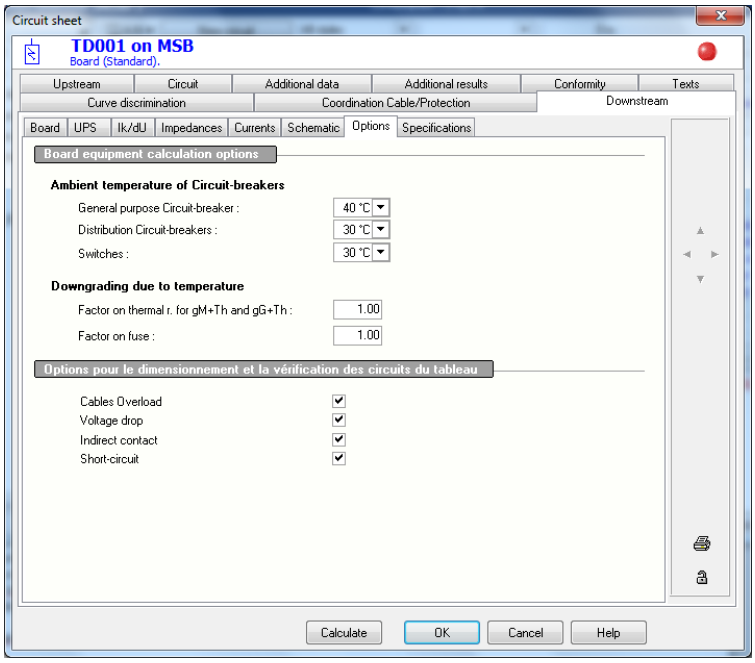
The use of this information figures in the standard. It makes it possible to modify the proximity factors of the circuits located downstream, provided that all these circuits are juxtaposed, in the absence of any other circuits.

6.2.7 Schematic tab



For a description of all these fields, see paragraph in ‘Schematic’ section

6.2.8 Options tab



Board equipment calculation options

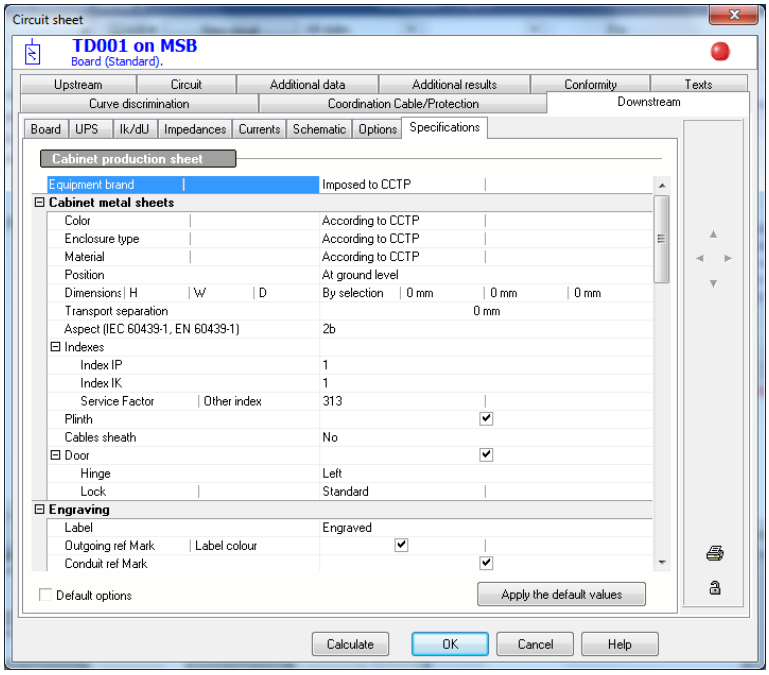
These options make it possible to de-rate equipment ratings according to temperature.

Options for sizing and verification of board circuits

If they are unchecked, these options make it possible to not calculate and not verify the circuits downstream of the switchboard.

This is useful, for example, in cases where the circuits are calculated under another standard but one wishes to represent them within a Caneco BT project.

6.2.9 Specifications tab



For a description of all these fields, see paragraph in ‘Schematic’ section

6.3 Busbar Trunking System Window

6.3.1 Definition

When you create a circuit with a *busbar trunking system* style, Caneco creates:

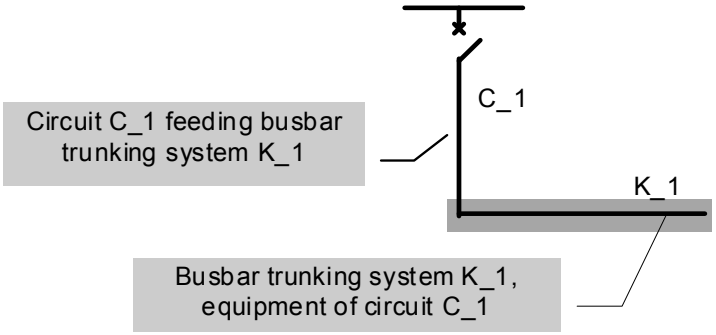
- the *circuit* made up of a protection device, a link and an equipment
- the *busbar trunking system* which makes up a particular equipment because it has its characteristics (length, equipment type, etc.). This busbar trunking system is a distribution because it can supply itself others circuits.

If busbar trunking system *circuit* does not include a supply cable, you must specify that this *circuit* has a null length link.
On the contrary, the *busbar trunking system* length is necessarily longer than 0 meters.

When Caneco calculates a *busbar trunking system* circuit, it calculates simultaneously:

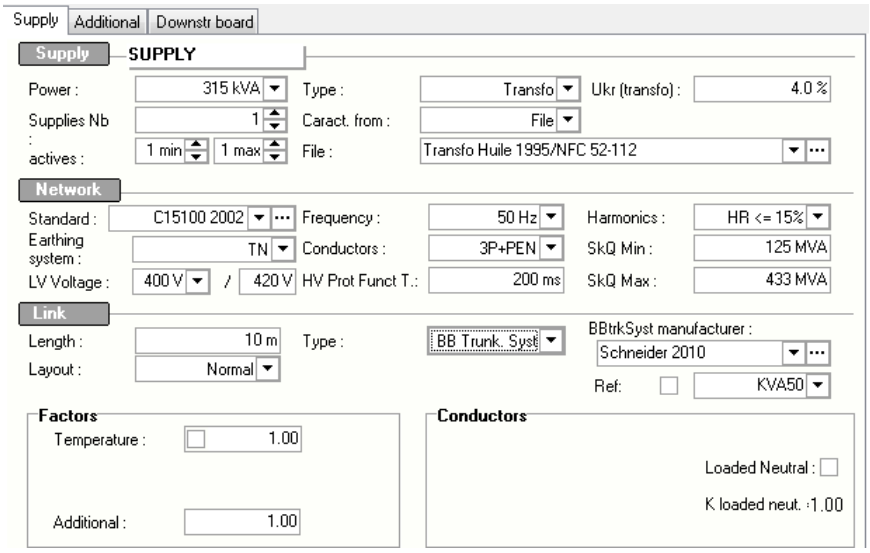
- the protection taking into account the busbar trunking system
- the circuit cable connection
- the busbar trunking system.

A circuit of busbar trunking system style includes:

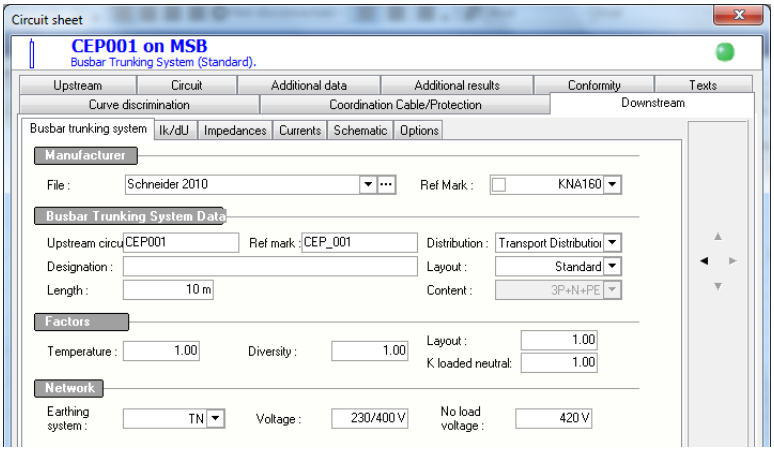


6.3.2 Information on the busbar trunking system

It is possible to display the window of a busbar trunking system:
In the Source Window, if this source supplies MSB, by clicking on the Downstream Board Tab.



In the Busbar trunking system style circuit window, by clicking on the Downstream Upstream Tab:



(This same window is displayed by clicking on Upstream board tab, in a window of any circuit supplied by a busbar trunking system).

6.3.3 Manufacturer Section

File
Name of the busbar trunking system manufacturer file.

Reference
Name of the busbar trunking system model.

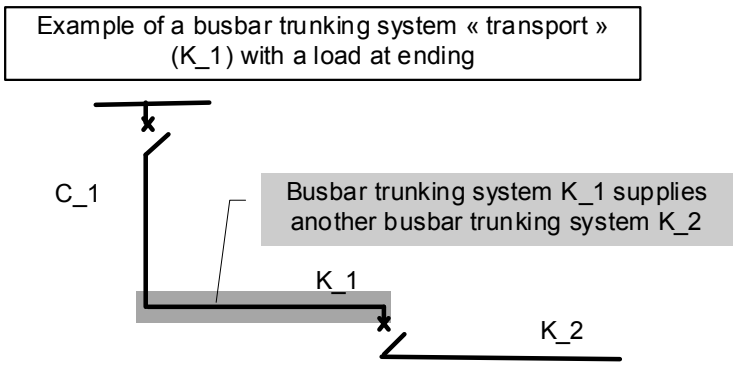
6.3.4 Busbar Trunking System Data Section

Upstream circuit
Ref. mark of the circuit supplying the busbar trunking system

Ref mark
Busbar trunking system ref mark.

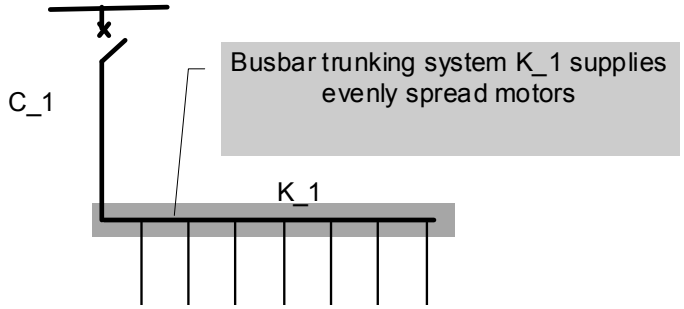
Designation
Name of the busbar trunking system

Distribution
Kind of distribution made up by busbar trunking system. This data has an effect on voltage drop calculation in this busbar trunking system:
Transport distribution: the busbar trunking system carries electricity: This busbar trunking system allows to supply only an equipment at the end: a board or a busbar trunking system, or any other circuit. The mean current carried by the BB trunking system on its length is IB.



- ***Comb Distribution***: the busbar trunking system feeds circuits distributed along its length. The mean current carried by the BB trunking system on its length is IB/2

Example of a busbar trunking system « comb » (K_1) with an evenly spread load

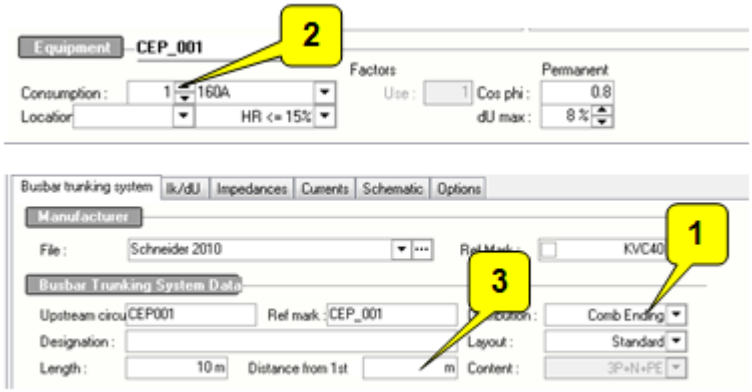


- ***Transport terminal:*** the busbar trunking system is a terminal circuit, which feeds a terminal circuit fitted at the end of it.
- ***Comb terminal:*** the busbar trunking system is regarded as a terminal circuit, which feeds a number of regularly distributed terminal equipments (e.g. luminaires).
- *New:* A busbar trunking system configured as a comb terminal (1) may be regarded as feeding a number of identical, evenly distributed terminal equipments (e.g. lighting) without intermediate connections.

In this case:

- - define the number of items of equipment in the corresponding field on the circuit sheet (2)

- fill in the distance to the first equipment (3) under the 'Downstream' > 'Busbar trunking system' tab



Layout

Arrangement of the busbar trunking system made in the site. According to the above layout, the busbar trunking system is more or less efficiently cooled by ambient air. This layout defines the layout factor default value which reduces the admissible current of the busbar trunking system.

- **Standard:** standard layout recommended by the manufacturer which determines nominal current carrying capacity (K layout equals 1 in this case).
- **Perpendicular:** horizontal layout perpendicular to the one recommended by the manufacturer. In this case K layout is given by the manufacturer. When this value is unknown, Caneco BT proposes 0.8 for K layout.
- **Vertical:** In this case K layout is given by the manufacturer. When this value is unknown, Caneco BT proposes 0.8

Content

Presence of N, PE or PEN in the busbar trunking system. This value must be compatible with the feeding circuit content but can be different.

For ex., circuit can be TNC (3P+PEN), when busbar trunking system is TNS (3P+N+PE).

6.3.5 Factors Section

Temperature
Temperature factor: this factor, given by the manufacturer, reduces the admissible current of the busbar trunking system. Its value is 1 for 30°C.

Simultaneity
Simultaneity factor for circuits fed by the considered board (simultaneity between them).

Layout
Layout factor, it reduces the admissible current of the busbar trunking system.
It depends on chosen layout (see above). You must modify the values proposed by Caneco BT according to the special conditions (e.g., confined air) the manufacturer's information or the standard.

K Loaded Neutral
Just as for cable, a derating factor may be applied in the event of harmonics.

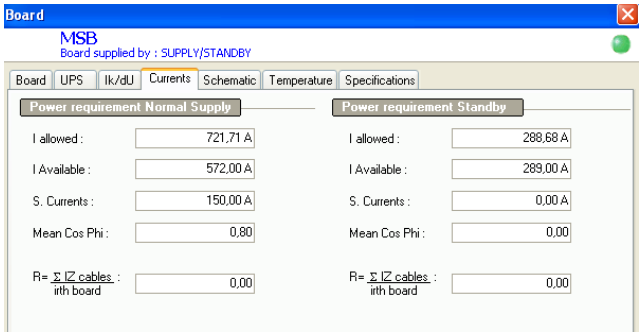
6.3.6 Network Section

Diagram
Busbar trunking system Earthing system: TT, TN, IT

Voltage
Voltage in V:
- between board phase and neutral, with single-phase busbar trunking system (Phase-Neutral)
- between phases in other cases

No load voltage
No load voltage in V, used to calculate Ik Max..

6.3.7 Currents tab



I Allowed
Allowed current downstream busbar trunking system. This value is equal to the current of the circuit feeding the busbar trunking system.

I Available
Available current downstream busbar trunking system: sum of the circuit design currents for new circuits which can still be fed from the busbar trunking system.

S Currents
Sum of design current IB of all circuits issued from the busbar trunking system, multiplied by its simultaneity factor.

Mean Cos phi
Mean cosinus phi at busbar trunking system level, taking into account downstream circuits and eventual capacitors.

6.3.8 Ik / DU Tab

Information concerning short-circuit currents a voltage drops in the busbar trunking system:

For a description of the fields, see the *Board window* paragraph in the *Distributions* chapter

6.3.9 Schematic Tab

For a description of the fields, see the *Board window* paragraph in the *Distributions* chapter

6.3.10 Temperature Tab

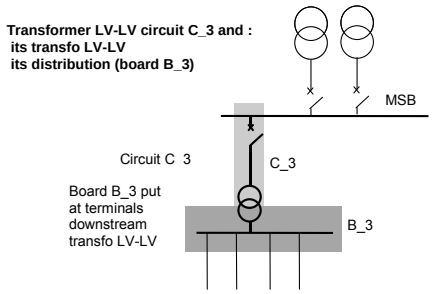
For a description of the fields, see the *Board window* paragraph in the *Distributions* chapter

6.4 LV-LV transformer window

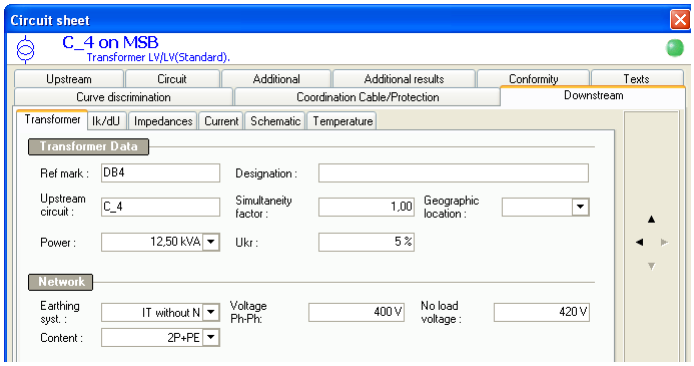
6.4.1 Definition

When a circuit of LV-LV transformer style has been created, it creates automatically:

- LV-LV transformer downstream circuit cable.
- Virtual board on LV-LV transformer secondary terminals, which makes it possible to feed other circuits.



6.4.2 Transformer Tab



Ref Mark

Board ref mark on transformer secondary.

Upstream Circuit

Upstream circuit ref mark.

Power

Transformer output power in kVA

Designation

Board designation on transformer secondary taps.

Downstream coincidence factor K

Coincidence factor K (simultaneity) downstream transformer.

Ukr

Short circuit current on the transformer secondary, in %.

Geographic location

Geographical location of the LV/LV transformer.

Earthing system

Earthing system on the transformer secondary. It is possible to change earthing system between primary and secondary.

Secondary voltage

Transformer secondary on load voltage:

- voltage between phases for three-phase or two-phased circuits.
- voltage between phase and neutral for single-phase circuits

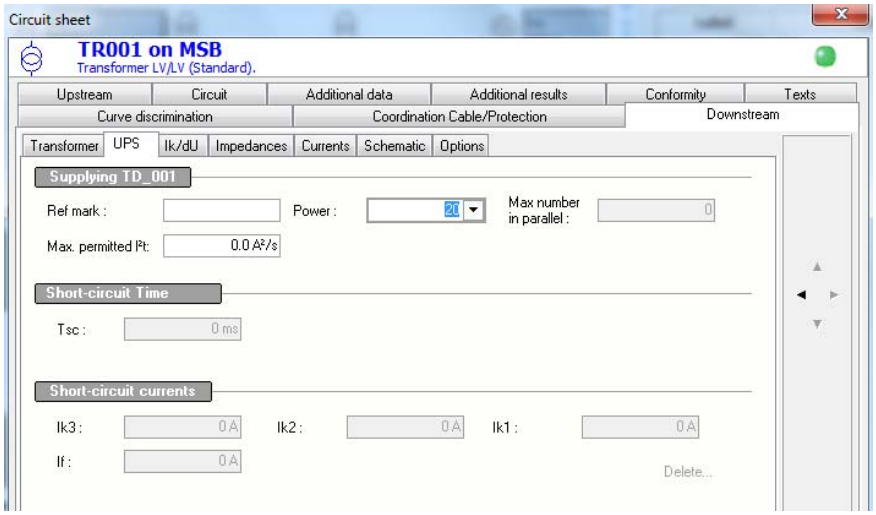
This on load voltage is followed by the reference no load voltage which is used to calculate short-circuit and which is calculated by **Caneco BT** and cannot be entered.

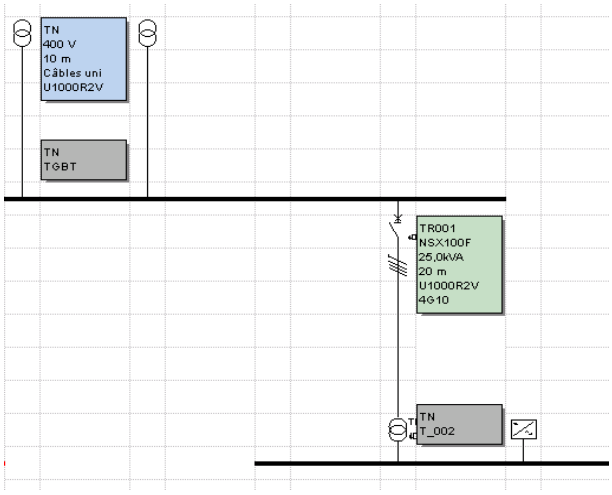
Content

Earthing system on the transformer secondary.

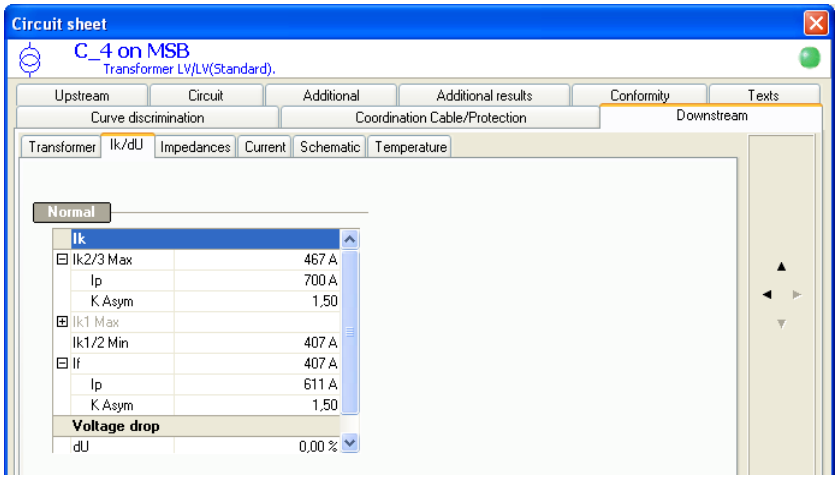
6.4.3 UPS Tab

From version 5.4, possibility of connecting an inverter.



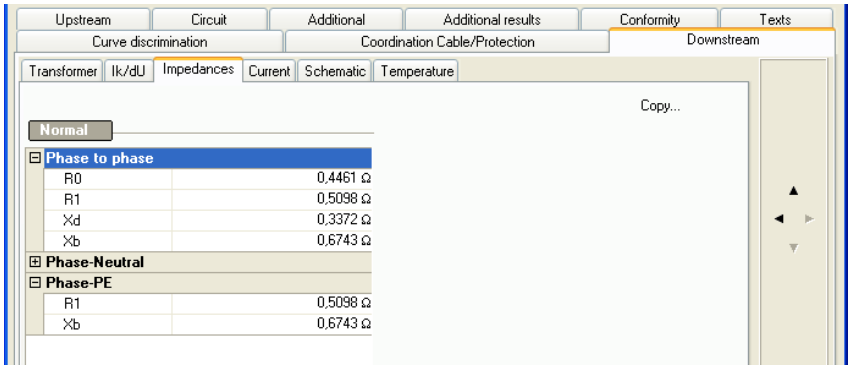


6.4.4 Ik/dU Tab



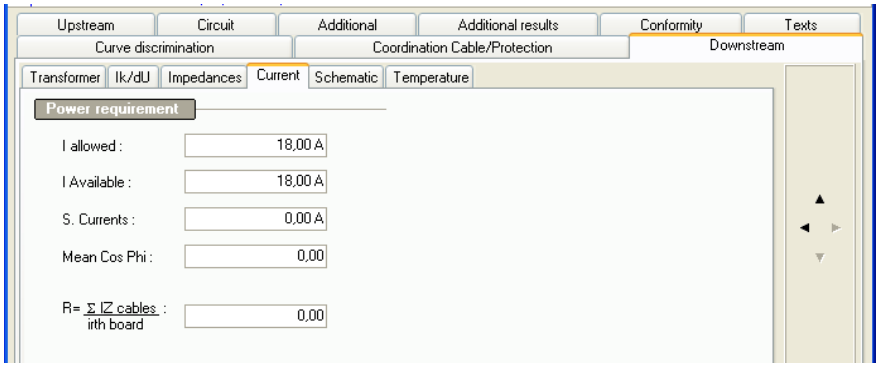
For the description of all these fields, see paragraph *Board window* from *Distributions* chapter

6.4.5 Impedances Tab



For the description of all these fields, see paragraph *Board window* from *Distributions* chapter

6.4.6 Currents Tab

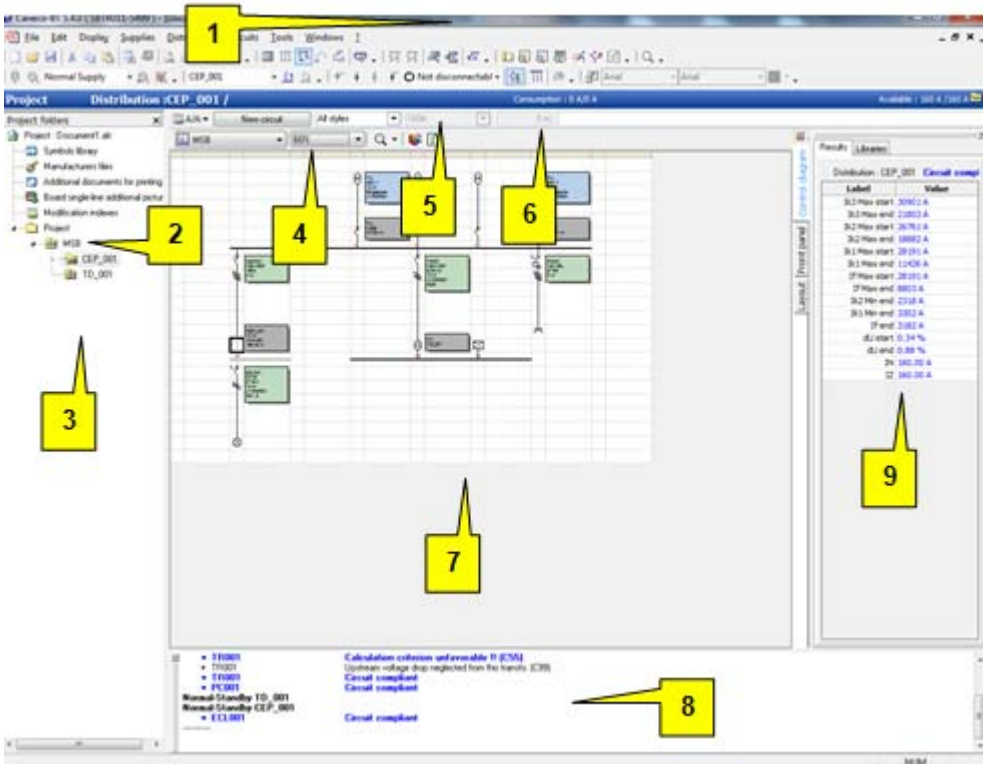


For the description of all these fields, see paragraph *Board window* from *Distributions* chapter

7 Network single-line

7.1 Description of the network single-line

The *Network single-line* is a graphical editor which represents each circuit by a vertical column made up of maximum 10 symbols



Circuits displayed in the window are those issued from the whole project or one distribution (board).

- 1: Active supply
- 2: Active distribution
- 3: Project tree structure
- 4: Zoom
- 5: Consumption of active circuit
- 6: Length of active circuit
- 7: Network single-line
- 8: Calculation report
- 9: Results for the active circuit

7.1.1 Active Source

In Caneco BT, network single-line represents only the circuits supplied by active source. This may be either the Standby Source. The diagram is differenced according to the active Source.

See §7.3

7.1.2 Active Distribution

Choose board downstream from which you want to display the network diagram (MSB in this example). This command allows you to restrict the diagram range, when you describe a large installation.

7.1.3 Zoom

Choose zooming in (values above 100 %) or zooming out (values below 100 %) to increase or decrease diagram view.
Choose *screen size* to get the whole diagram fit in the project window.

With the Window zoom you can zoom on the zone selected by the cursor.
With the centre zoom centre you can make a zoom In or Out centred on the cursor position. Press Shift key to zoom out.

7.1.4 I available

I available on the selected Board (MSB in the example).
This value is determined by a local power requirement calculation, taking into account the currents of circuits which are fed, coincidence factor and design current of feeding circuit.

7.1.5 Consumption

Consumption of circuits supplied by the distribution taking into account coincidence (simultaneity) and use factors.

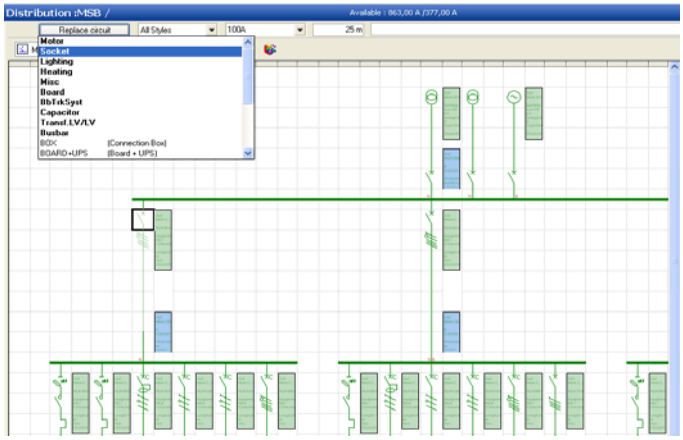
7.2 Create one or more circuits

Create a circuit

To create one or more circuits, use the command New from Circuit menu. You can create also these circuits without leave the network single-line diagram.
First, select board supplying this circuit. For this, you can:

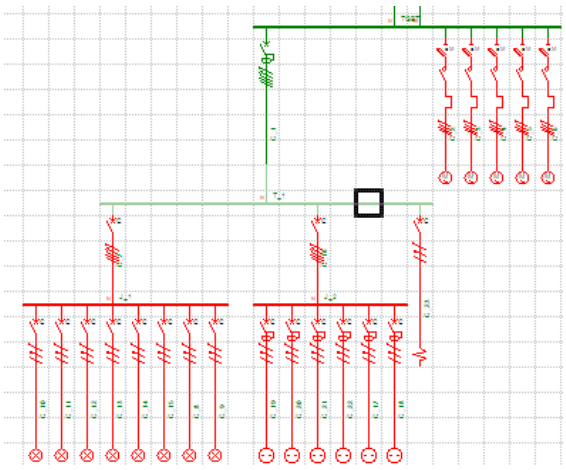
- either click on the project tree or on the distribution icon
- either click on the network single-line diagram from the board horizontal bar or, at right side from this bar, if you want to insert a circuit at right of this bar.

Then, click on button «New circuit» at left top from the network single-line diagram. A menu appears displaying the different circuit styles.



- Step 1: Click on the ‘New circuit’ button (**A**) and select the style of circuit you want to create.
- Step 2: Click to the right of the board ‘bar’ (**B**) to create a circuit to the right of the last one created.

The new circuit is represented automatically on the diagram (**1**)



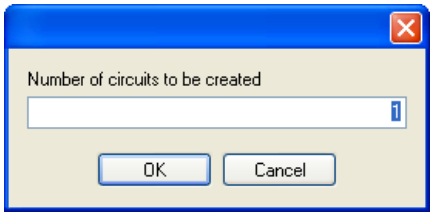
To entry its characteristics, double-click on the circuit, the «Circuit sheet» window appears …

See the following chapter: Circuit data entry and results.

The button «New circuit» becomes «Replace circuit» when the cursor is on a circuit. In this case, it is possible to modify the active circuit style.

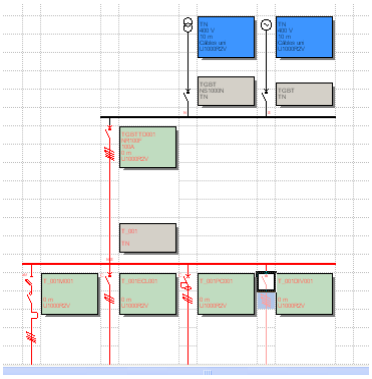
Create several circuits

To create simultaneously several circuits, proceed as above but before you choose the circuit style, press and hold the Shift key. After you has chosen the circuit style, Caneco BT ask you for the number of identical circuits you want to create:

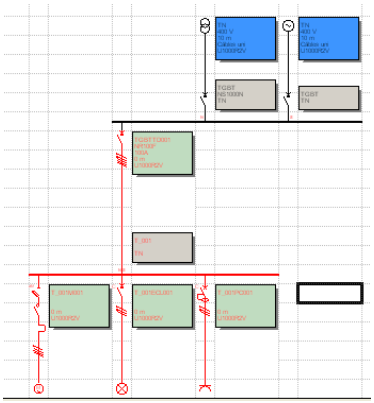


Deleting circuits

1- Select the circuit(s) to be deleted; the selection must include at least two squares (**1**).



2- Press the 'Del' key on your keyboard or use the Windows methods (Ctrl X, etc.)



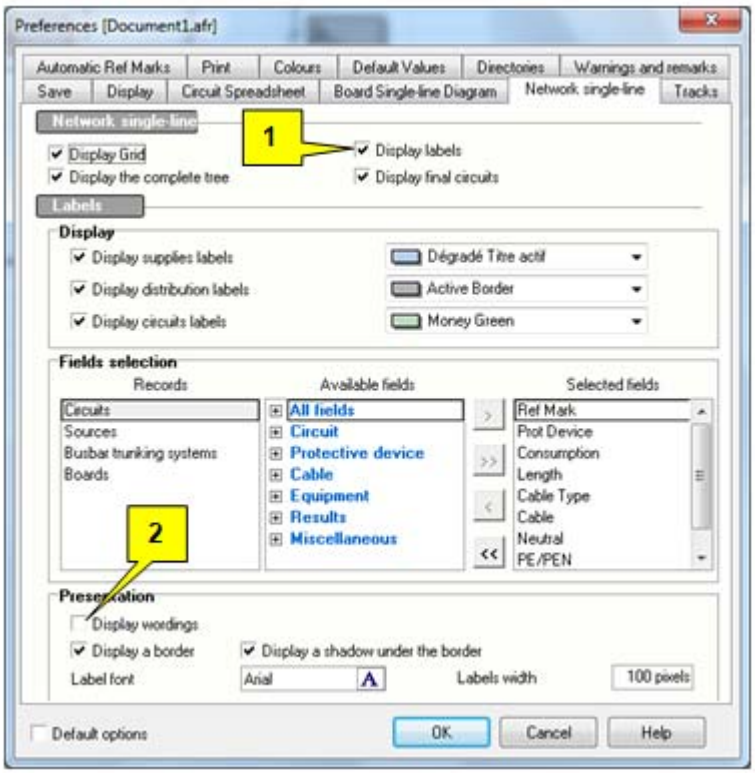
7.3 Representation of the network single-line diagram

We has seen in Description of the network single-line diagram paragraph, how this diagram can be represented from a board and differenced from the active source.
Other commands can be used to customize the network single-line diagram:

- add labels
- delete terminal circuits on the diagram

7.3.1 Labels

A label is a wording made up of data or results and attached to the source, a distribution, or a circuit.
To create and define labels, select the menu *Tools/Preferences* and then *Network single-line* tab.



Records

Choice of information kind to be displayed: Circuits, Sources, Boards

Available fields

List of fields which can be displayed among all record fields, or from fields categories.

Selected fields

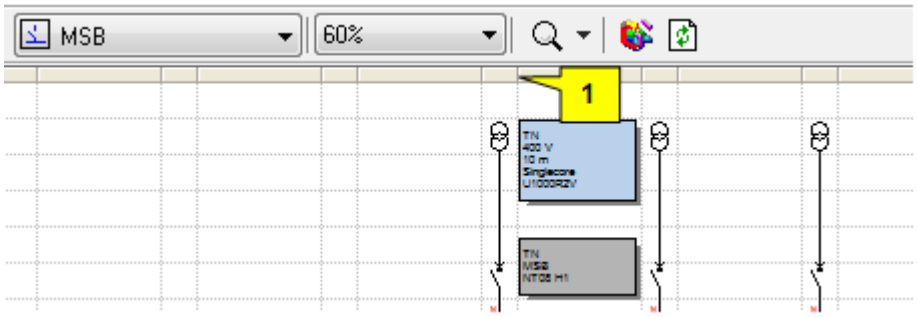
Includes all selected fields for display.
Select the fields with the appropriate arrows

Labels displaying

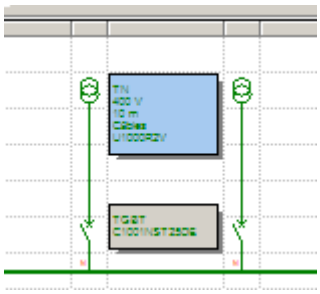
Check the “Display labels” option (1).
The label legends can be displayed by checking the “Display legends” option (2).

Labels size

You may modify the label width modifying the column width reserved to them (1):



You can get this display reducing column width:



Modification is applied to all labels of the network single-line diagram.

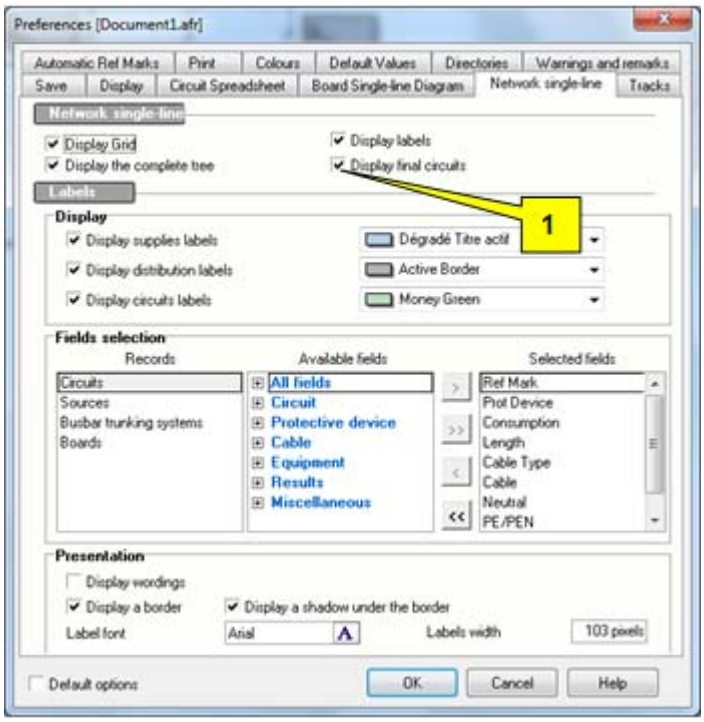
Delete final circuit display

In large projects with a large number of distributions, network single-line diagram may be used difficulty.
You can then:

- do not represent whole tree but the active board only.
- represent circuits supplying distributions only (boards, busbar trunking systems or LV-LV transformers)

All these commands are in Tools/Preferences menu, Editors tools tab:

Example: By unchecking the “Display terminal circuits” option (1), you limit the diagram to the circuits feeding distributions



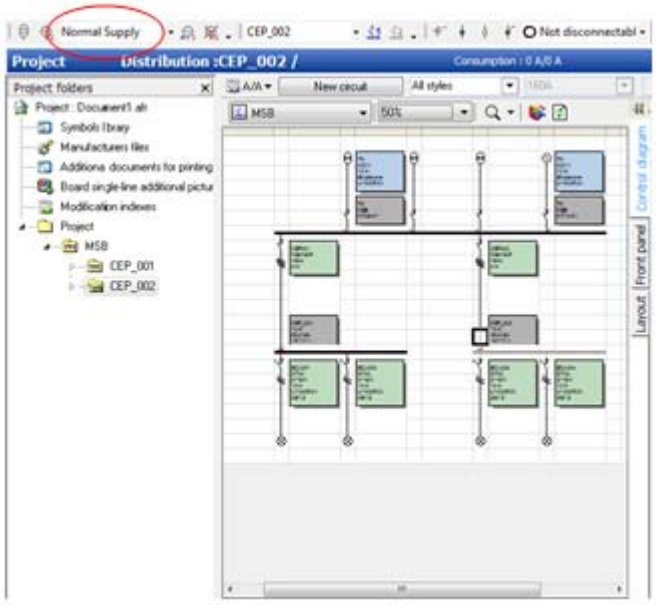
7.4 Representation of a project with a Standby source

If there is no standby source, diagram has only one possible representation.
Otherwise, when there is a standby source, diagram may be different according to supply source.
If you choose normal source (default reference mark *SOURCE*) you represent the diagram of circuits which may be supplied from this source. Represented circuits are all circuits supplied by normal source, i.e. the circuits with a N (Normal, i.e. not backed up circuits) or N+S (Normal and Standby).
If you choose standby source (default reference mark *STANDBY*) you represent the diagram of circuits which may be supplied from this source. Represented circuits are all *backed up* circuits, i.e. the circuits with S (Standby) supply or N+S (Normal and Standby). See the example below.
Diagram is differenced according to active source (Normal or Standby). On the contrary of version 4, version 5 represents all sources supplying each board.
Example of diagram in configuration on circuits normal source supplied from normal source (Normal or Normal-Standby circuits).

7.4.1 Board with N & S supplies

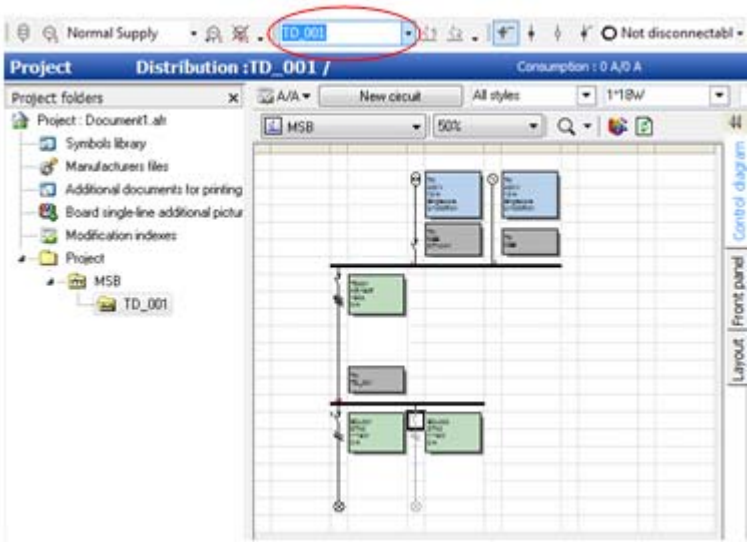
The short-circuit currents are automatically calculated on the N and on the S branches. This makes it possible to determine the Ik values for the downstream circuits in an appropriate manner according to their powering mode (N, S, or N+S).

Example of the same diagram in configuration normal Source
Circuits supplied from the normal source (Standby or Normal-Standby circuits)



To improve legibility, all supplies are shown (even ones that are not active)

Example of the same diagram in configuration Standby Source
Circuits supplied from the Standby source (Standby or Normal-Standby circuits)



Conventionally, in Caneco, diagram of circuits represented with Standby source, corresponds to this source at left. Normal sources (in this case, 1 transformer) are shifted to right.

At printing, diagram may be represented either as Normal or as Standby, according to parameters chosen. For a project with a standby source is possible (and recommended) to include in Caneco BT folder the two diagrams: Normal AND Standby.

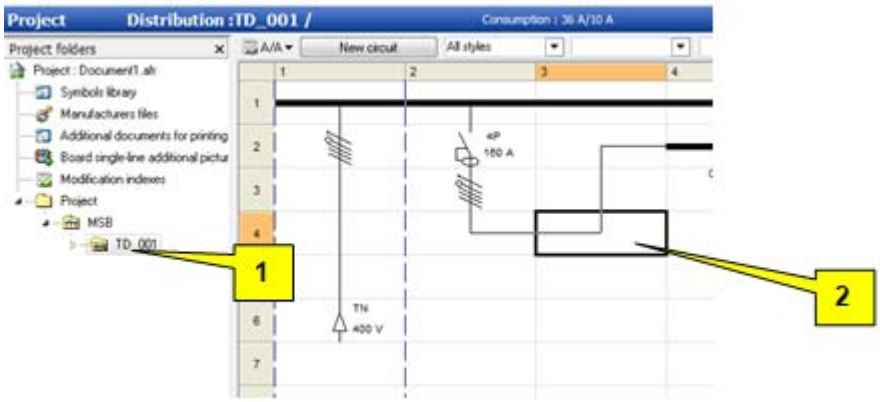
8 Board Single-line Tool

8.1 Board Single-line Tool

This entry tool is especially suitable for circuit schematic data entering. Circuits displayed are those with an active distribution only.

To enable the board single-line diagram, you must:
to enable the Board Single-Line Tool

Select the distribution you want to display. You can do it by clicking on this distribution, in the project tree situated at left side of the screen:

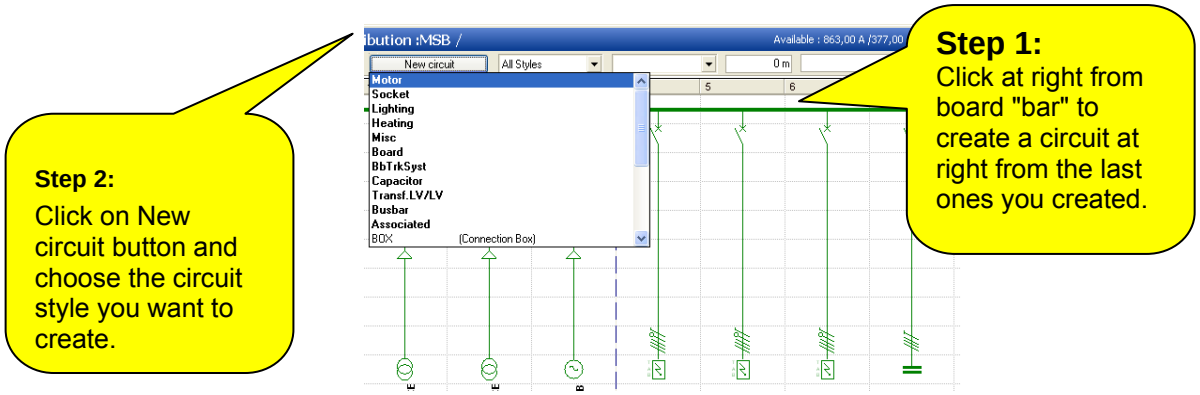


- Step 1: Click on the board you want to edit (1)
- Step 2: Caneco BT displays the diagram (2)

Create a circuit

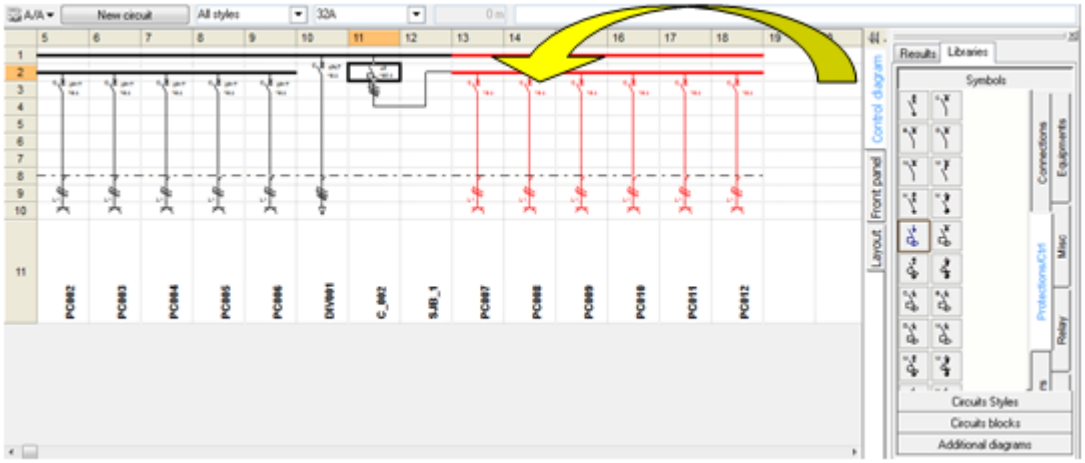
To create one or more circuits, use the command New from Circuit menu. You can create also these circuits without leave the network single-line diagram.

First, select the point from which you want to insert the circuit. Caneco BT inserts any new circuit at left side from the active circuit. You must click on the point situated at right from the last created circuit to put a new circuit at left from this one. Then, click on «New circuit» button at top left from the network single-line diagram.



To create simultaneously several circuits, proceed as above but before you choose the circuit style, press and hold the Shift key. After you has chosen the circuit style, Caneco BT ask you for the number of identical circuits you want to create.

8.2 Modifying the diagram of a circuit

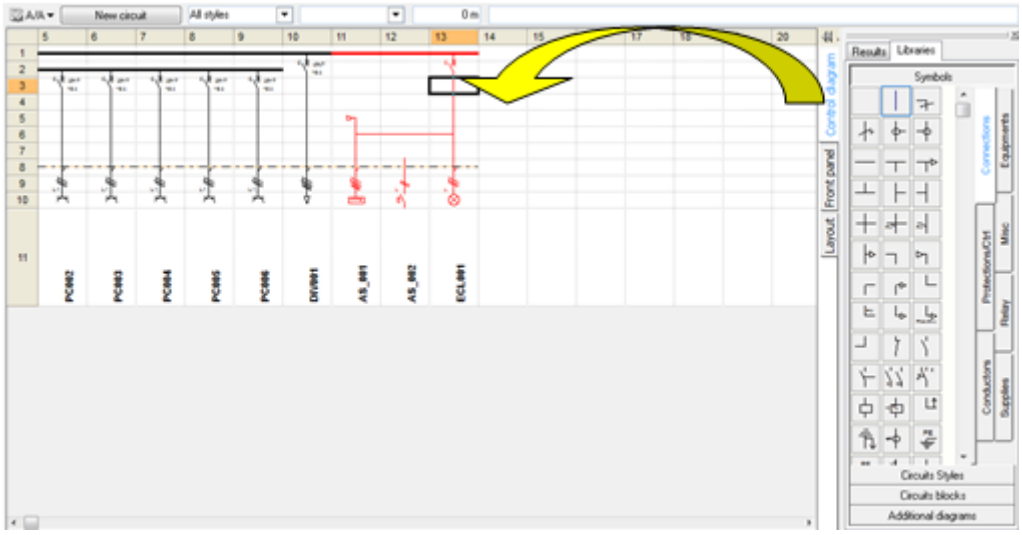


You want to modify the diagram of a circuit through the symbol library. Enable it by clicking on Library tab, in the screen zone reserved to results. Choose the «Protections» tab of this library. To add a symbol, choose it from the library and put it using drag-release control:

Caneco BT does not allow you to modify a circuit diagram if this modification is contrary to data used to its calculation. In this case, Caneco BT opens the circuit sheet and you must modify the data so that they will be in accordance with diagram meaning.

8.2.1 Delete a symbol

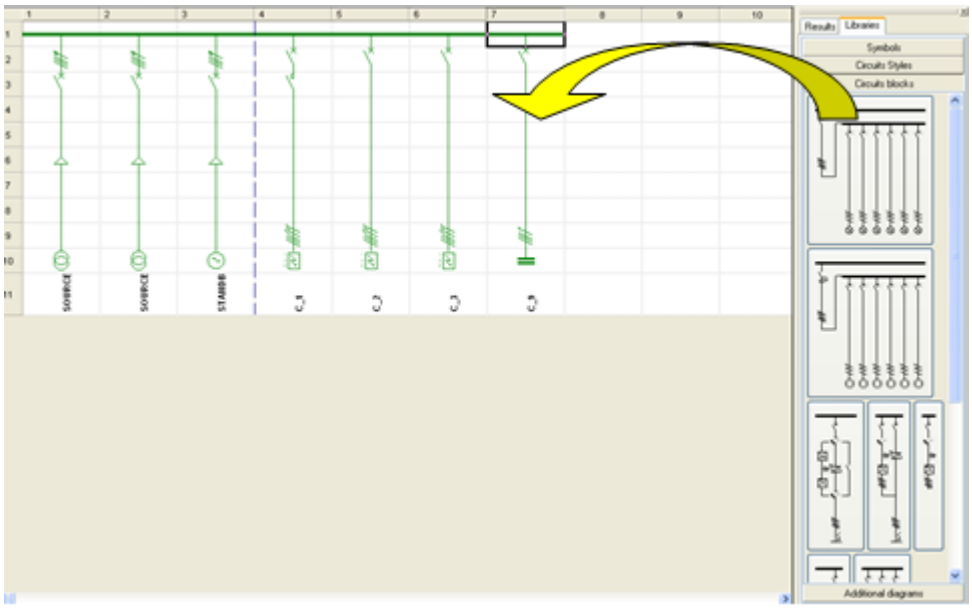
To delete a symbol, replace it with the first continuity symbol from « connections » zone of the library:



8.2.2 Creating circuits using style libraries and circuit blocks

To create one or more circuits, it is possible to use also the circuit style and circuit block libraries. Each of these libraries has different proprieties;
Circuit style library allows to create a single circuit, completed with one or more associated circuits (not calculated circuits). Values of created circuit are initialised depending on rules set for this style.
The library of circuit blocks allows you to create several circuits as you use the copy-paste control. Values of created circuits are identical to those of the block circuits.
.
To active circuit style and circuit block libraries, click on buttons situated at the bottom of the library

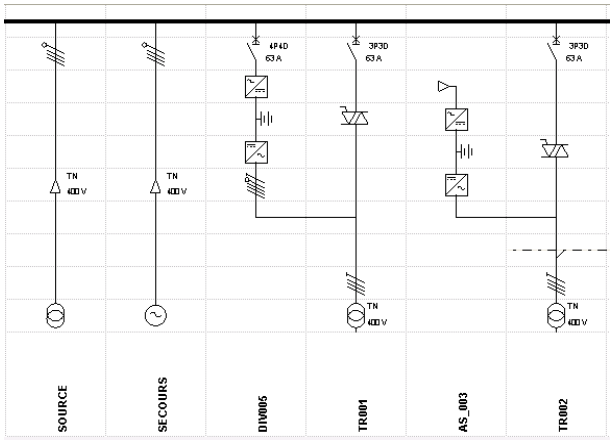
From the circuit style library, create a lighting circuit with standby block:



In the same way, you can create several circuits from the circuit block library.

The circuit style and circuit block libraries are also used in network and board single-line editors.

8.2.3 Creating new blocks of inverter circuits with built-in LV/LV transformers



8.3 Edition Commands

8.3.1 Selection of one or more circuits

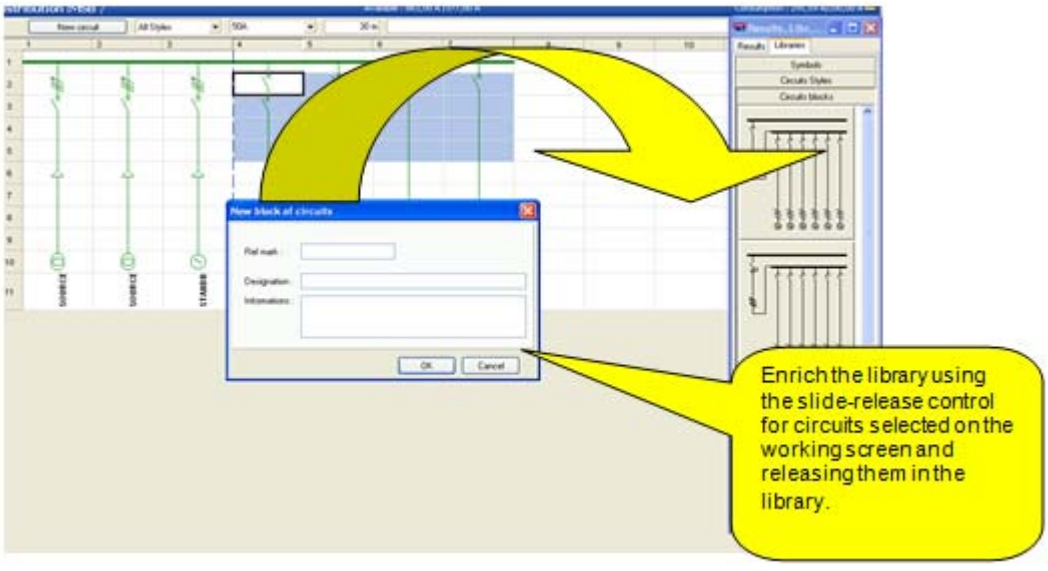
Selection is made as for columns on a spreadsheet software, clicking on a first column, pressing and holding Shift key, then clicking on last column you want to choose.

8.3.2 Cut, Copy, Paste

When several circuits are selected, the Cut, Copy, Paste commands become active. These commands run as in a spreadsheet.

8.3.3 Enriching the circuit style and circuit bloc libraries

To enrich the circuit style and circuit bloc libraries, select the circuits you want include in the library and use the slide-release control to slide them into the library. Caneco BT opens a window allowing you to set, in the library, the identification of the created circuit block:



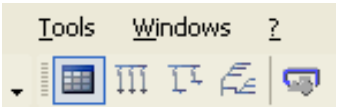
The circuit style and circuit block libraries are also enriched from the network and board single-line editors.

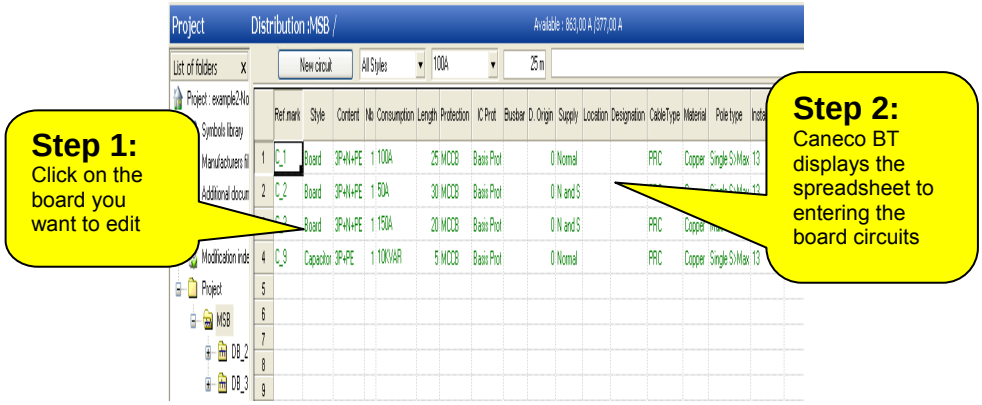
8.3.4 Inserting additional diagrams

See DIAGRAMS section

9 Spreadsheet Tool

This entry tool is especially suitable to entering numerous circuit data. It is specially useful to entering information on designation, length, consumption and number of circuit devices.
To enable the spreadsheet, you must:
Select the spreadsheet tool

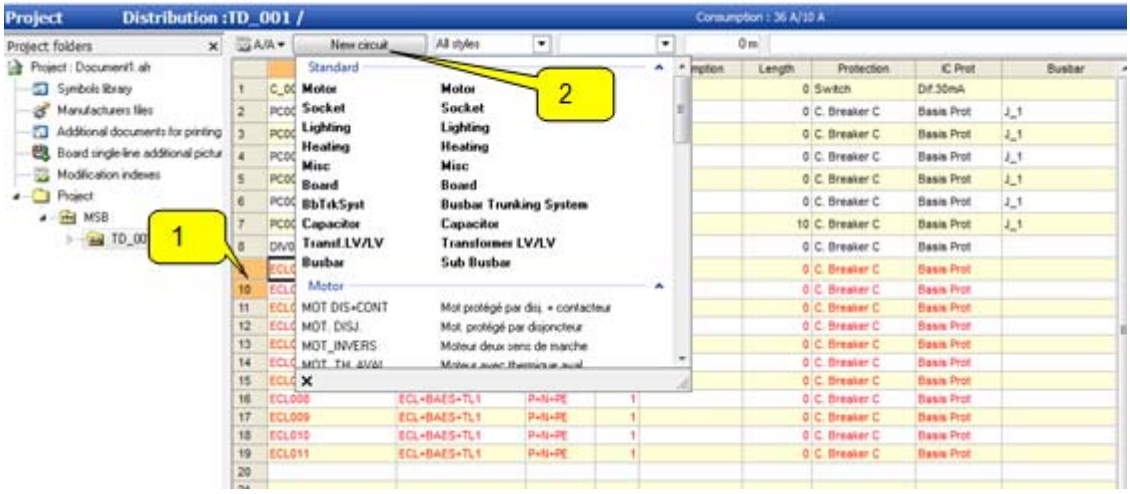




Select the distribution you want to display. You can do it by clicking on this distribution, in the project tree situated at left side of the screen

9.1 Creation of a new circuit

To create one or more circuits in the spreadsheet, select first the point from which you want to insert the circuit. Caneco BT inserts any new circuit above the active circuit. You must click on the point situated below the last created circuit (2) to put this new circuit below. Then, click on «New circuit (2)» button at top left from the network single-line diagram



To create simultaneously several circuits, proceed as above but before you choose the circuit style, press and hold the Shift key. After you has chosen the circuit style, Caneco BT ask you for the number of identical circuits you want to create.

9.2 Edition Commands

9.2.1 Selection of one or more circuits

Selection is made as for rows on a spreadsheet software, clicking on a first row, pressing and holding Shift key, then clicking on last row you want to choose. So, you can copy and paste one or more circuits.

9.2.2 Selection of one or more cells

Selection is made as for cells on a spreadsheet software, clicking on a first cell, pressing and holding Shift key, then clicking on last cell you want to choose.

9.2.3 Cut, Copy, Paste

When you select one or more circuits, or one or more cells, the *Cut/Copy/Paste* commands become active. These commands run as in a spreadsheet.

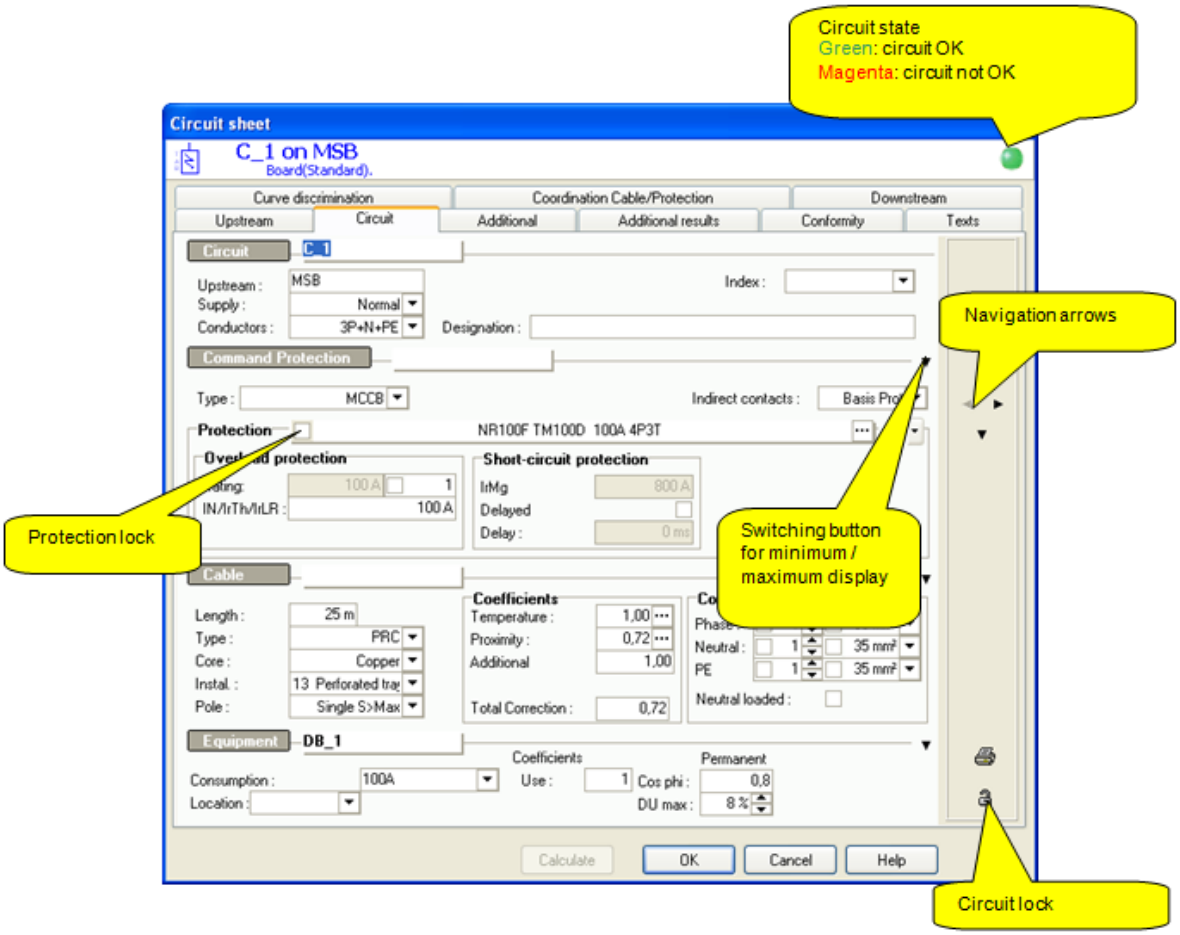
10 Detailed circuit calculation window

To display the circuit window you can double-click on a circuit or pass through the Circuit/Edit menu.
User can then choose between two display modes:

- Minimum display
- Detailed display

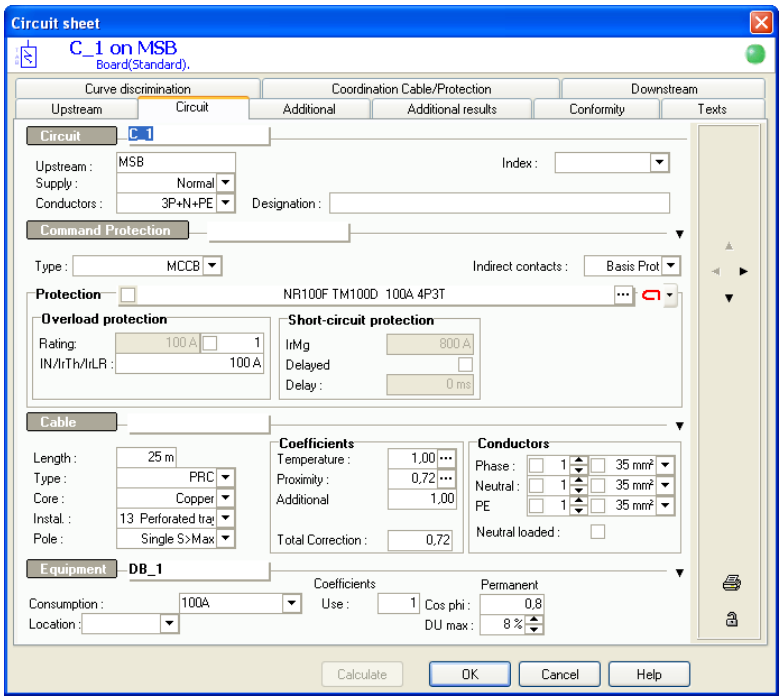
10.1 Minimum display

Minimum display shows the minimum data needed to calculate a circuit.

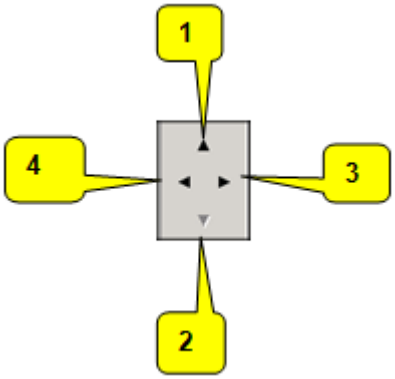


10.2 Detailed display

With detailed display you can see and modify circuit data at expert level.



10.3 Navigation arrows



10.3.1 Upstream distribution arrow

Opens upstream distribution window (feeding circuit)

10.3.2 Downstream distribution arrow

Opens downstream distribution window (fed by the circuit)

10.3.3 Next circuit arrow

Validates active circuit, and display following circuit

10.3.4 Previous circuit arrow

Validates active circuit, and display previous circuit

10.4 Circuit Tab

10.4.1 Circuit topic

Circuit

Specify the circuit identification on maximum 15 characters.

Upstream

Board ref mark from which the circuit is issued. This ref mark is automatically completed by **Caneco BT**, when you have created a circuit.
You can modify it, so as to shift one circuit from one board to another one.

Supply

There are three possibilities:

- Normal: the circuit issued from board is supplied only by Normal source (not essential circuit)
- Standby: the circuit issued from board is supplied only by Standby source (essential circuit)
- Normal/Standby: the circuit issued from board is supplied by Normal and Standby source (essential circuit)

Indicating that a circuit is supplied in Normal/Standby implies that it is calculated taking into account the two possible sources, which sometimes may be very unfavourable, in case of the standby supply is provided by small low power gensets.

Content

Indicates the content of the circuit: for example 3 phases, N and PE.

- PE means equipotential bonding conductor.

In TN diagram, the 3P+PEN content allows to make TNC, 3P+N+PE from TNS.

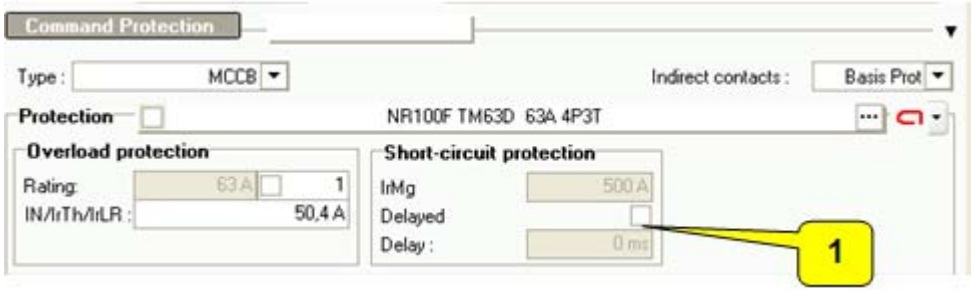
Content	*Meaning*
3P+PE	Three-phased circuit with PE
3P+N+PE	Three-phased circuit with Neutral and PE
3P	Three-phased circuit without PE
3P+N	Three-phased circuit with N and without PE
3P+PEN	Three-phased circuit with PEN (TNC system)
P+N+PE	Single-phase circuit with Neutral and PE
P+N	Single-phase circuit with Neutral and without PE
2P	Two-phased circuit (phase to phase) without PE
2P+PE	Two-phased circuit (phase to phase) with PE

Do not confuse 2P with P+N. In 230/400V installation, P+N means single phase (230V), while 2P means two-phase (400V)

Designation

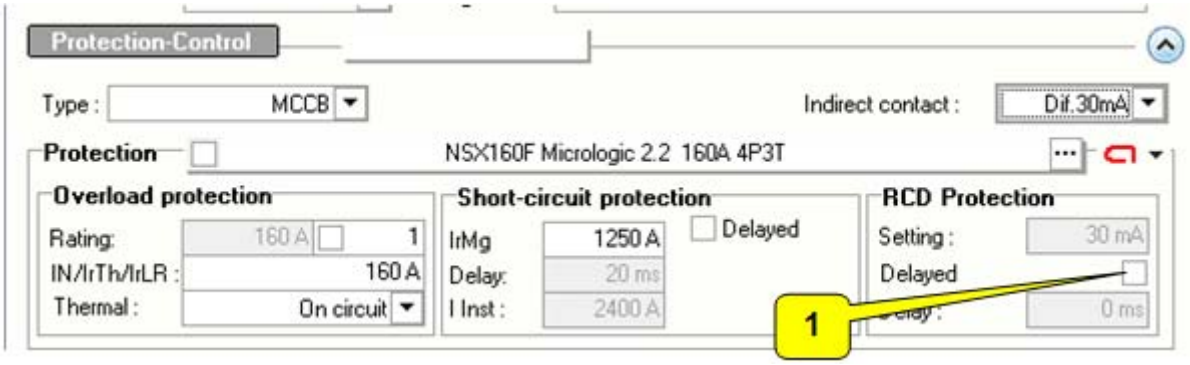
Circuit designation (maximum 36 characters).

10.4.2 Protection topics



if manufacturer file has an EDIELEC format, click on «delayed» to get a delayed protection on short-circuit.

If human protection against indirect contacts is made by a Differential, the window is completed with other information:



if manufacturer file has an EDIELEC format, click on «delayed» to get a delayed differential protection.

Type

Enter circuit protection.

Type	***Meaning***
CrBrk. moulded case	general purpose circuit-breaker, moulded case according to EN 60947-2 and IEC 947 standards.
Open circuit-breaker	general purpose circuit-breaker, Open according to EN 60947-2 and IEC 947 standards.
CrBrk C	modular circuit-breaker, C and U curves according to standard EN 60947-2 or EN 60898
CrBrk B	modular circuit-breaker, B and L curves according to standard EN 60947-2 or EN 60898
CrBrk D	modular circuit-breaker, D or K curves according to standard EN 60947-2 or EN 60898
CrBrk Mot	motor circuit-breaker according to standard EN 60947-2 and IEC 947 ensuring motor protection.
CrBrk + Th	motor start protection realized by a coordination contactor + circuit-breaker + thermal relay type 1 or type 2.
gG	fuse g1 or gG type
aR	Ultra-fast fuse
gR	Ultra-fast fuse
gS	Ultra-fast fuse
gG + Th	association fused switch contactor + thermal relay with fuse of g1/gG type. This type of protection is suitable for distribution circuits. Contactor is determined in category AC1
aM	fuse g1 or aM type
aM + Th	association fused switch contactor + thermal relay with fuse of aM/gM type. This type of protection is suitable for motors. Contactor is determined in category AC3-AC4
CrBrk without thermal r.	circuit without overload protection, which is allowed by the standard for some circuits (not supposed to produce overload). **Caneco BT** will ask you for the type of protection against short-circuits. The overload condition is checked taking into account the design current (IB).
Without protection	Protection is in fact a protection against Short-circuits of the circuit feeding the upstream board. This is the case with feeding lines with decreasing cross-section. No protection against overload is accepted only with the following standard conditions: equipment not capable of producing an overload or protected at circuit ending.

Indirect contacts

This is the mean to ensure human protection against indirect contacts.

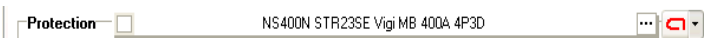
Indirect Contacts	*Meaning*
Basic Prot	Protection against electrical shocks is ensured by the protection defined in field *Type* (protection against short-circuits).
Dif. 300mA	residual differential protection of 300 mA rating
Dif. 30mA	residual differential protection of 30 mA rating
Dif. 10mA	residual differential protection of 300 mA rating
Autres DDR	Adjustable residual current protection
AEB	Additional Equipotential Bonding (AEB).
Equipot	Earth general equipotential bonding. This is the case of installations in which chassis are connected to an earth general equipotential bonding network, realised by bared underground earth cables or by bared earth cables laid on cable ways. This device allows to not distribute the PE in each circuit cable (cable content can be then a 3P without PE). Equipment chassis for this circuit must be directly connected to this equipotential bonding network.

Protection

Name of the protection model (Breaking device, Release, RCD References), Rating and number of poles.

Protection Lock

Unlocking/Locking of the protection is reported by the ticked or not ticked state of the box planned with this end in view.

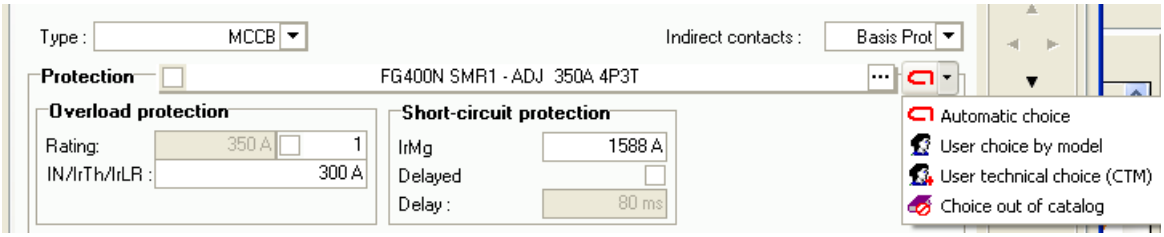


During a calculation, a locked protection is not modified. The user can modify the values in the catalogue' value limits.

Rating

Rating of the smallest protection which can satisfy standard conditions, if your *protection choice* is *automatic*; **or** the rating you have selected if your *protection choice* is *manual*.

If you want to impose this value, the button  or the user's choice by model situated at right from this field allows you to choose the protection amongst all ones included in the manufacturer file you has chosen, and according to standards

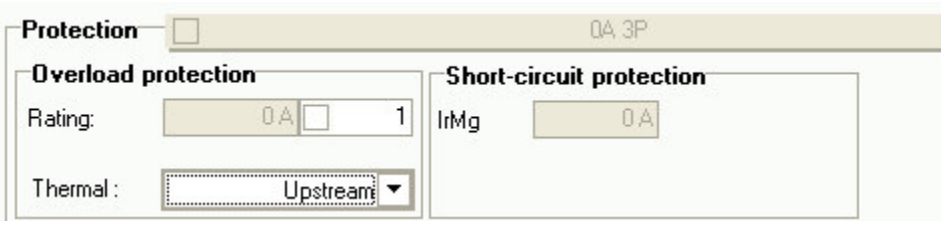


IN/Irth/IrLR

Réglage du thermique du disjoncteur ou calibre du fusible assurant la protection contre les surcharges.
Pour un disjoncteur, le réglage du thermique est paramétrable (commande *protection* du menu *Option*). Il peut être réglé au minimum (IB: courant d'emploi), au maximum (calibre de la protection) ou au maximum supporté par la liaison (IZ du câble pour les *récepteurs* ne nécessitant pas d'être protégé contre les surcharges).
If you want to force this value, enter the value which characterizes the protection against overloads:

- thermal relay setting when protection is a circuit-breaker,gM+th or g1+th fuse.
- fuse rating when protection is a fuse g1.

Thermal



Impact of choice of position of thermal circuit breaker:

- Upstream of the busbar trunking: Cross-section calculated according to the protection of the upstream circuit
- Downstream of the busbar trunking: The cable cross-section will be calculated according to In or thermal adjustment for a circuit breaker or I2 for a gG fuse (value to be entered by the user if the protection is not defined in Caneco BT)

Irmg or IN (protection against SC)

Circuit-breaker magnetic setting or fuse rating insuring protection against short-circuits.

- For a circuit-breaker, magnetic setting is set to the maximum value compatible with circuit-breaker, and insuring opening with the smallest of the minimum short-circuits (If or Ik1 or Ik2).
- If you want to force this value, enter the value which characterises the protection against short-circuits: magnetic setting when protection is a general purpose circuit-breaker (Gen CBrk) or a motor circuit-breaker (CBrk. Mot.) or a circuit-breaker in coordination with a contactor (CBrk. + Th).
- Maximum release value warranted on short-circuit, when protection is a modular circuit-breaker (CBrk C, B, D/K)
- Fuse rating when protection is a fuse gG, or aM+th

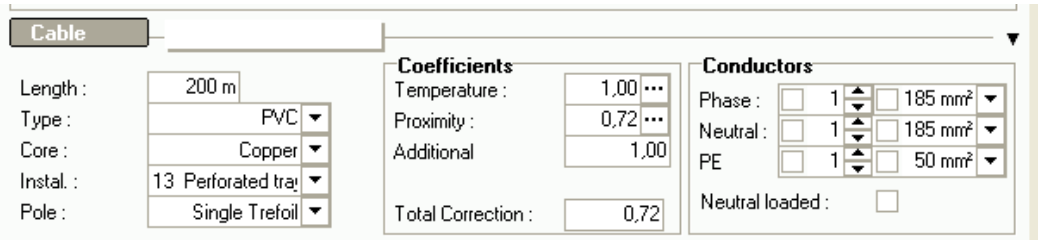
Delayed

With the tab, you can select protections with a delayed release

Delay

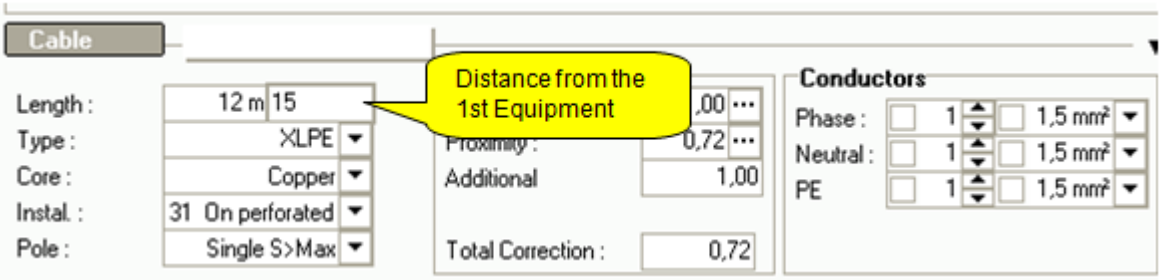
Magnetic delay in ms.

10.4.3 Cable topics



Length

In case of several equipments, it is the distance of the far device.
In this case, it appears an additional distance to the 1st equipment:



1er Equipment (m)

Enter (with circuits having several devices) the distance between protection and nearest device. This data is used in versions after 4.1B, for voltage drop and discrimination calculation.

Cable type

Enter the cable type used for the link between protection and device. This type is chosen in the list of cable type. This list is saved in a file with extension **.cbl*. The file can be selected for the project and modified by means of *Manufacturer files / Cable* topic from Options menu. The default file is *Caneco.cbl*.

Cable conductor core

Core	*Meaning*
Copper	copper conductor
Alu	aluminium conductor
Cu or Alu	copper conductor for small cross-sections, in aluminium for big cross-sections. The threshold between copper and Alu is defined in the Dialog box called by *Cables* command in Options menu.
Alu + PE Alu	copper conductor for phases and Neutral, and PE in Alu. This choice is possible only when link is of type *Single-core* or *Multi + PE* (multi-core)

Installation method

Enter the cable installation method according to chosen the calculation standard.
Clicking the button on the right to get the list of the different methods of installation.

Pole

Choose single-core or multi-core cables.
Uni / Multi: Automatic switching between single-core or multi-core cables from specified cross-section.

Temperature factor (K. temp)

This coefficient is named in standard as *Temperature correction factor*. It downgrades the current carrying capacity depending on the temperature. Default value is 1, this factor is defined by the standard, depending on the cable insulation and cable operating reference temperature. It can be determined by **Caneco BT**, depending on given temperature, and the choice of cable type, if you used the button ... located immediately on the right.

To calculate the coefficient with **Caneco BT**, depending on the given temperature it is assumed that you have correctly chosen your cable type before. If you change the cable type and if your cable insulation has changed, it is necessary to recalculate this factor depending on the desired temperature.

Group factor (K. prox)

This factor is known in standards as *cables or circuits group correction factor*. It downgrades the current carrying capacity depending of the proximity of other cables.
The value proposed by **Caneco BT** depends on the style. It is usually 0,72, which corresponds to perforated cable track installation method, on one layer, touching, unlimited number of cables.
This factor has a significant impact on the cable calculated cross-section, you must study carefully among all parameters the most important one:

- Proximity of cables between themselves. According to standard, installation methods, and according to their spacing, cables distant from each other do not mutually heat each other.
- Cables load compared to their current carrying capacity. a circuit with IB < 0.7 Iz is supposed not to heat neighbouring cables.
- Global load of cables laid on same cable track. This global load can be reduced by the thermal setting of the circuit feeding the distribution.

See section *Distributions* / Board window / information on boards / cables S IZ / Board IrTh
.

To facilitate estimation of this coefficient, in the window you can press button ... on the right to get help on this matter.

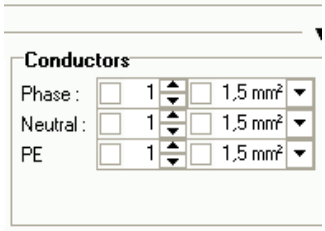
Additional factor (K. Addit)

Enter additional downgrading factor for current carrying capacity depending on external conditions. This factor is not standardised, it can be fixed by the user.

Symmetrical factor fs

Apply a symmetrical factor (fs=0.8), if need and if the number of conductors per phase >1 (according to NFC 15-100 standard only).

10.4.4 Results fixing topic



Results which may be fixed are values calculated by **Caneco BT**, which you can eventually adapt to existing data. It concerns cables and protection.
To force one data, you must tick the box on the left of this data. You can cancel fixing by clicking again on the check box.
When a value is fixed, it is checked by **Caneco BT**.

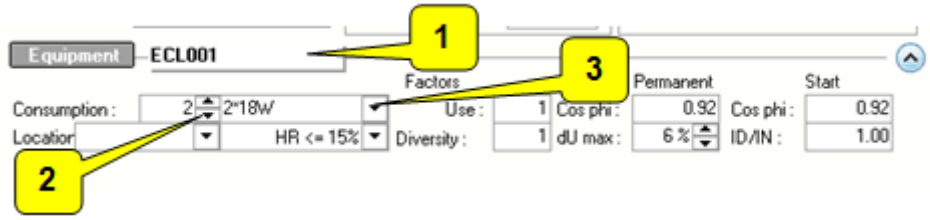
Conductors - Phase
The smallest calculated phase cross-section of the link, taking into account all standard criteria.
If you want to force this value, enter the number of conductors per phase for the link, then the cross-section for each phase.

Conductors - Neutral
The smallest calculated neutral cross-section of the link, taking into account all standard criteria.
If you want to force this value, enter the neutral number of conductors for the link, then the cross-section for neutral.

Conductors – PE (or PEN)
The smallest calculated PE/PEN cross-section of the link, taking into account all standard criteria.
If you want to force this value, enter the PE/PEN number of conductors for the link, then the cross-section in mm2.

Loaded Neutral
To apply an additional factor to current carrying capacity if Neutral is loaded.

10.4.5 Equipment topics



Ref Mark of the equipment (1). (V5).
For the distribution circuits (board, LV/LV transformer, busbar trunking system), you can modify directly the distribution ref. mark fed.

Equipment number
Enter the equipment number (2).
You can also design circuits feeding several pieces of equipment.
Example: 12 lighting devices of 2*36 W
Total circuit consumption equals to:
Total circuit power = number of equipments * consumption, where *consumption* is defined as follows.

Consumption
Enter the consumption for each equipment: current or consumed electrical power or *standard power*.
Power can be entered in A, W, kW, kVA, consistency of the chosen unit is checked according to selected equipment type.
- Ex: KVA are forbidden for motors.

The arrow at right from this field makes allows to open the standard power list, which related to the circuit style.
- If the circuit style is based on *Caneco BT motor* style, the standard powers are motor mechanical powers.
- If the circuit style is based on *Caneco BT Lighting* style, standard powers are conventional designations (1*58 W, 2*36 W, etc.) of fluorescent lights. 2*36W means a light having 2 fluo lights of 36W.
- if the circuit style is based on *Socket* style, standard powers are conventional designations (2*16 A, 3*32 A, etc) for sockets: 3*32A means three-phase socket 32 Amps.

Standard power list can be extended. It is saved in a file with extension *.*std*. The file can be selected for the project and modified by means of *Manufacturer files* command from Options menu. The default file is *Caneco.std.*

Do not put blanks in consumption.
Correct examples: 120, 50KVA, 30KW.

Consumption given in KW has a meaning depending on the equipment type: for a motor, it is the available mechanical power on the axle and not the electrical power.
Default unit is the one indicated (and which can be modified) in Calculation action from Option menu.
In all cases, consumption is transformed in design current (IB in the results window).

Geographic location
Enter this data with the equipment nearest geographical location.

Rate of harmonics (4)
The level of 3rd order harmonics and multiple of 3 is applicable to circuit. Calculation takes into account the standard rules for neutral cross-section calculation.

Attention: Neutral is considered as loaded at a rate of harmonics between 15 % and 33%, so that a reduction factor is applied on the withstand currents. Calculated cross-sections are increased about 25%.

See paragraph affected by standard

Attention: When a rate of harmonics is >33%, the neutral is calculated to get a withstand current at least equal to 1,45 times the design current on the phase. The protection device must have, in neutral, an assigned current al least equal to this value.

See paragraph affected by standard

Use factor
Circuit use factor which can be specified.
Default proposed value is:
- that of chosen standard power, if consumption is got from standard power table
- or that of the circuit style.

This value has no incidence on cable and protection dimensioning. It affects only the power requirement.

Diversity factor
When a circuit has several equipments (sockets, lighting, etc.), it is possible to apply a Diversity/simultaneity factor *kSimult* for equipments amongst themselves. Circuit total power = number_of_equiment*consumptio*KSimult

Permanent Cosinus Phi
Circuit Power Factor which can be specified.
Default proposed value is:
- that of chosen standard power, if consumption is got from standard power table
- or that of the circuit style

dU max
Indicates maximum admissible voltage drop in %, from the beginning of the installation to the cable end. Default proposed values by **Caneco BT** depends on the style and takes into account source supply (private supply or LV distribution) and of equipment kind.

Cos Phi Start
Cosinus phi at start, to calculate voltage drop during motor start for example.
Default proposed value is:

- that of chosen standard power, if consumption is got from standard power table
- or that of the circuit style.

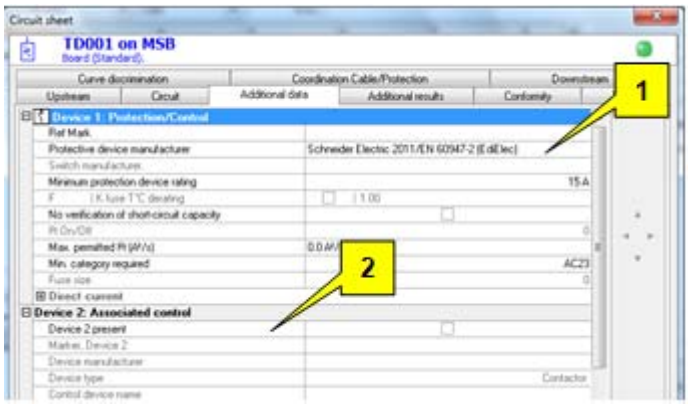
You can modify this default value.

ID/IN
ID/IN factor. The same remarks as above.

10.5 Upstream tab

For the description of all these fields, see paragraph *Board window* from *Distributions* chapter.

10.6 Additional Tab



10.6.1 Topic Device 1: Protection/Command (1)

Ref mark

Enter here the reference mark for the protective device: this reference will be displayed to the right of the protective device in the Board Single-line tool.

Protection manufacturer

Allows you to choose a protection/breaking device from a circuit specific catalogue file.

Protection minimum rating

Minimum rating is defined in circuit style.

- Light Style: 10A
- Socket Style: 16A

User may modify this value. For example minimum rating for sockets can be reduced to 10A instead of 16A. It is incumbent on user must to enforce standard rules.

K, fuse T°C derating

The line fuse derating factor. This factor may depend on the type of fuse holder. It is mandatory to always enter this, as the nominal rating of UR fuses is given at a T_{amb} of 20°C, and hence this factor is rarely 1.

No check on short-circuits thermal stress for conductors

When this option is ticked, ***protection against short-circuit may be provided by protection against overload***, according to conditions specified in the standard

The following table shows the protective devices for which the **"No check on conductor short-circuit capacity"** option can be used.

Max. permitted I^2t (A^2s)

The max. permitted I^2t for the electronic equipment to be protected on the line. This value should be given by the manufacturer of the equipment to be protected.

Fuse size

It is necessary to add this parameter necessary in order to limit the number of UR fuse files to one per family.
There are several sizes in each family, and the same rating is found in several sizes, but with different T/C, I²t lim, and Ip lim characteristics.

Type of protective device	YES	NO
Instantaneous thermal-magnetic circuit-breaker	x	
Electronic circuit-breaker with long delay incorporated and short instantaneous delay	x	
Modular circuit-breakers	x	
gG fuses	x	
Non-thermal circuit-breakers		x
Magnetic + Thermal circuit-breakers		x
aM fuse with or without thermal trip		x
All delayed protective devices		x

10.6.2 Topic Device 2: Associated control (2)

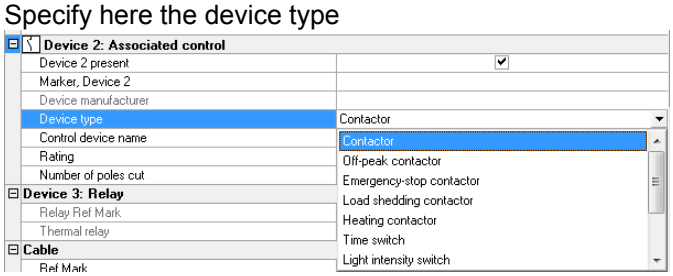
This item allows you to enter the type of associated control device on a circuit.

Topic Device 2:

Enter here the reference mark for the device: this reference will be displayed to the right of the device symbol in the Board Single-Line tool.

Device type

Specify here the device type



Control device name

Allows enter reference mark of control device

Rating

Allows enter device rating.
These data will be displayed at right of device symbol, in Board network single-line tool.

Number of tripped poles

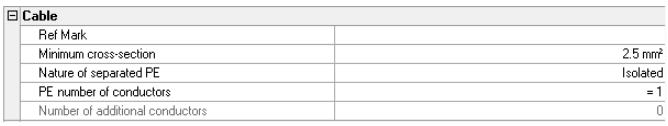
Allows enter number of tripped poles. These data will be displayed at right of device symbol, in Board network single-line tool.

10.6.3 Topic Device 3: Thermal relay

Thermal relay:

Thermal relay associated with a power contactor as per stipulations in manufacturers' catalogues.

10.6.4 Cable topics



Minimum cross-section:

User may modify this value. For example minimum cross-section for sockets can be reduced to 1.5mm2 instead of 2.5 mm2. It is incumbent on user must to enforce standard rules.

Nature of separated PE:
User may set here the nature of separated PE conductor (Isolated, Bare)

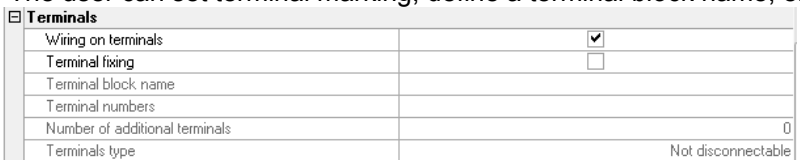
Number of PE conductors:
User may set here the number of PE conductors.
(allows reduce phase cross-section)
The default value for “Number of PE conductors” is set as 1.
In situations where this option would lead to over-sizing of the cross-sections for the phase conductors, or even prevent calculation (indirect contact criterion), a message will be displayed to suggest checking the “Number of PE conductors = no. of phases” option in the ‘Calculation options’ window, under the ‘Cables’ tab.

Handling PE thermal stress –
This is handled by automatically taking into account the “Breaking Time Rule” or BTR. This may affect:
BBTS sizing
PE cross-section reduction
Magnetic trip settings
The calculation criterion and compliance

Number of additional conductors:
User may set here the number of additional conductors (for example: pilot wire on a heating circuit).

10.6.5 ‘Terminals’ section

The user can set terminal marking, define a terminal block name, enter the number and type of terminals.



10.6.6 ‘Circuit characteristics’ section

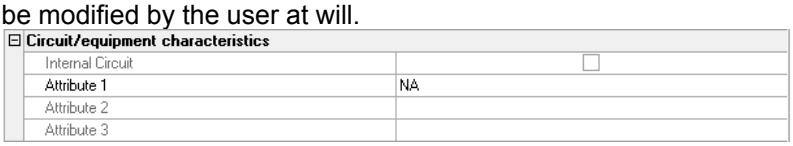
Creating circuit attributes (attributes 1, 2, and 3) makes it possible to describe the nature and diagram of a circuit. These attributes can make it possible to automatically generate multi-line block diagrams in electrical wiring diagram applications.
These attributes are usually correlated with the attributes of the symbols used in the Caneco single-line diagram of the circuit, including any associated circuits there may be. They may give a form of synthesis of it.
Example of a star-delta motor feed:

- attribute 1: star-delta
- attribute 2: Local control, remote manual disconnect

Example of an instrumentation circuit (associated circuit alone):

- attribute 1: instrumentation
- attribute 2: datalogger

These attributes may be initialized by Caneco BT in accordance with information defined by their style. They may be modified by the user at will.



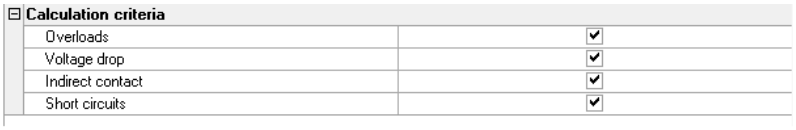
10.6.7 ‘Calculation criterion’ section

The user can choose not to verify one calculation criterion for a very specific reason.
If the ‘Overload’ criterion is deselected, the following message will appear:

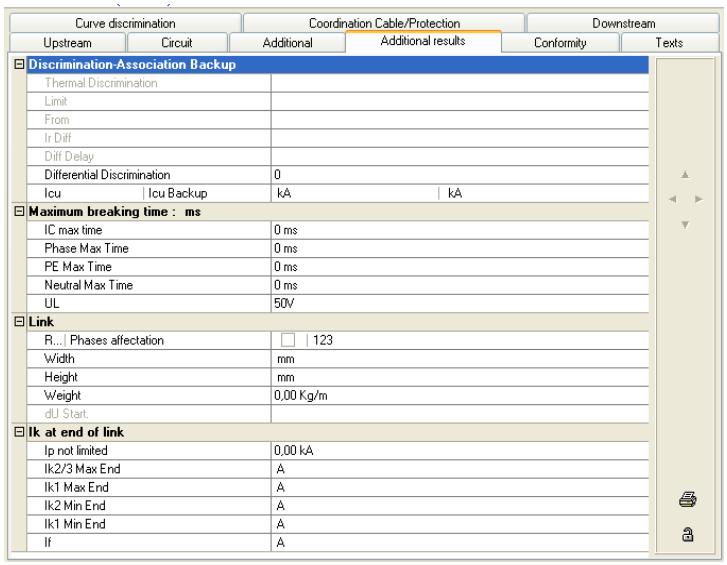
A virtually identical message will appear, depending on which criterion is deselected.

- Attention! This section is intended for experienced users only.

In the event of a reservation expressed by a technical inspection service, the Caneco BT user will be obliged to provide justification.



10.7 Additional results Tab



10.7.1 Discrimination-Association Backup Topic

Thermal discrimination with upstream

- ***Without*** means that in certain cases of overload faults, discrimination with upstream may not be provided. The upstream protective device is liable to trip before the downstream protective device.
- ***With*** means that in all cases of overload faults, discrimination with upstream is provided.

Discrimination Limit.

Current discrimination limit on short-circuit in Amps

Discrimination from

Distance from which there is total discrimination on short-circuit. The considered distance is the one separating protection from short-circuit point.
With this distance one can appreciate functional discrimination conditions for circuits made up of several equipments (lighting circuits, sockets). If the given distance is more than the first equipment distance (most unfavourable place for short-circuits risks), discrimination becomes functional.

Ir Diff

Differential Residual Current Device adjustable in mA.
You cannot get access to this value if you choose Diff Ad. (Differential adjustable) for human protection against indirect contacts.

Diff Time delay

Residual Current time delay in ms.

Diff Discr.

Differential discrimination with upstream. This is the differential discrimination in case of earth fault current (If) on the calculated circuit.
It can be:

Discrimination	*Meaning*
Nil	the upstream protection trips at the same time as that of the circuit
Uncertain	the upstream protection is liable to trip at the same time as that of the circuit
Total	the circuit protection trips and the upstream protection does not
Not calculated	the differential discrimination is not calculated

Icu

Protection breaking capacity (eventually with backup, coordination) in kA.

10.7.2 Max Breaking Time Topic

Tmax IC
Max functioning time in ms for a circuit-breaker protection not to exceed human protection against electrical shocks condition. This time is fixed by the standard (from 100 to 800ms according to voltage and earthing system). For distributions, the time is increased to 5s, (see standard).

Tmax Ph
Max functioning time in ms for a circuit-breaker protection not to exceed cable phase thermal stress.
This time is calculated considering a max three-phase short-circuit at the beginning of the link (Ik3 max: see I3Max later).
For fused protections, this time is by convention 5000 ms, but it is not significant.

Tmax Ne
Max. operating time in ms for a circuit-breaker protective device so as not to exceed the thermal stress of the cable neutral.
This time is calculated taking into account a max. single-phase short-circuit at the start of the circuit (Ik1 Max upstream).
For fused protections, this time is by convention 5000 ms, but it is not significant

Tmax PE
Max functioning time in ms for a circuit-breaker protection not to exceed cable PE thermal stress.
This time is calculated taking into account a min. phase–PE short-circuit at the far end of the circuit (If min).
For fused protections, this time is by convention 5000 ms, but it is not significant

10.7.3 Link topic

F/Poles distribution
Phase distribution for single-phase circuits, fixed or not.

Link width
This is the width of the link on cable track. If cables are single-core, they are supposed to be in trefoil configuration if there are several cables (separated N or PE for example) they are touching. This value is used to calculate useful height on cable track sections.

Link height
This is the link height. If cables are single-core, they are supposed to be in trefoil configuration if there are several cables (separated N or PE for example) height is the height of the bigger cable. This value is used to calculate useful height on cable track sections.

Weight
Link weight for one metre in kg (cable, neutral and PE eventually separated). This value is used to calculate useful load of cable tracks sections.

10.7.4 Ik Topic

Ip not limited
This is the peak value of three-phase short-circuit for three-phase circuits
(Used to verify electrodynamic stress)

Ik3 Max
This is the max three-phase Ik for three-phase circuits

Ik1 Max
This is the max short-circuit current, single-phase if neutral is present

If Max
This is the maximum fault short-circuit current if there is a PE.

Ik2Min
This is the min short-circuit current, single-phase if neutral is present, two-phase (Phase to phase) if neutral is absent

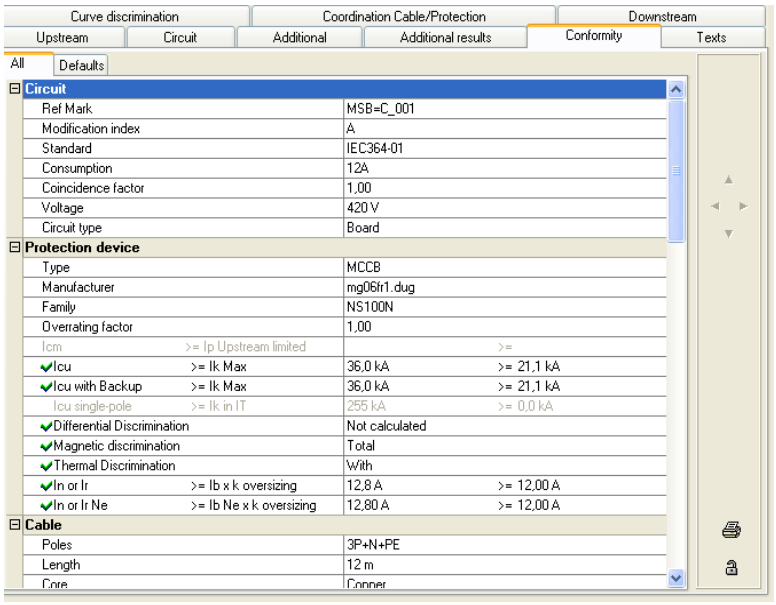
Ik1Min

This is the min short-circuit current, single-phase if neutral is present, two-phase (Phase to phase) if neutral is absent

If

This is the default short-circuit current If phase-PE at the end of the link.

10.8 Conformity Tab



10.8.1 Standard conditions

The Conformity sheet is used to indicate all standard conditions which must be satisfied by a circuit, to determine corresponding values and indicate if they are satisfied or not.

These conditions are:

- Protection
- determination of thermal relay rating or setting depending on IB:
- Thermal relay Ir or IN >= IB
- breaking capacity
- Icu with or without association with upstream >= IkMax

Cables

- Voltage drop
- Overload
- Protection against indirect contacts
- Thermal stress for phases, neutral and PE (PEN)

All of the conditions indicated are:

- those directly expressed in the standard e.g.:
  $k^2S^2 >= I^2t$, for the thermal stress condition.
- or the corollary conditions.

For example the condition:
Ik Mini > IrMagn x 1,2 (magnetic release on IkMini) which is one of the conditions to get the standard condition above.

These conditions translated by formulae can be completed by graphical representations

Compliant/non-compliant conditions
With the conformity sheet one can see immediately if conditions are not correct. In such case, with **Caneco BT** one can see in «Fault» tab of the conformity sheet, all standard conditions which are not correct.

- The conditions not met are identifiable by a red cross.
- Conditions met are identifiable by the green OK symbol.

10.9 Text Tab

This window allows free entry of additional information concerning the circuits.

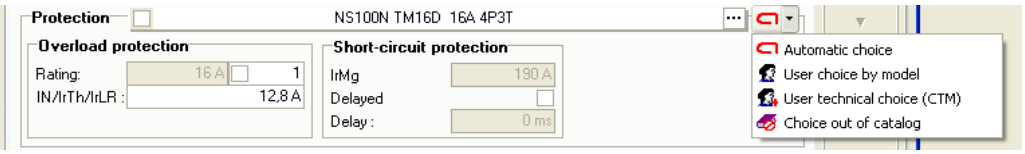
- Example: text 8 is reserved for indicating in which sheet of the control diagram you can find the wiring details for additional diagrams associated with the protection devices (See Schematics chapter).

10.10 Downstream Board Tab

For the description of all these fields, see paragraph *Board window* from *Distributions* chapter

10.10.1 Protection choice

The protection choice window is displayed for each circuit calculation.
The user can choose between three ways to get a protection



- **Economical automatic choice**

Caneco BT automatically selects in the list of protection the first one which satisfies all conditions according to circuit data. The automatic choice made by **Caneco BT** is indicated by the icon  ..

- **User's choice by model**

The user can choose another protection in the list, the User's choice by model is indicated by the icon  .

- **Choice out of catalogue**

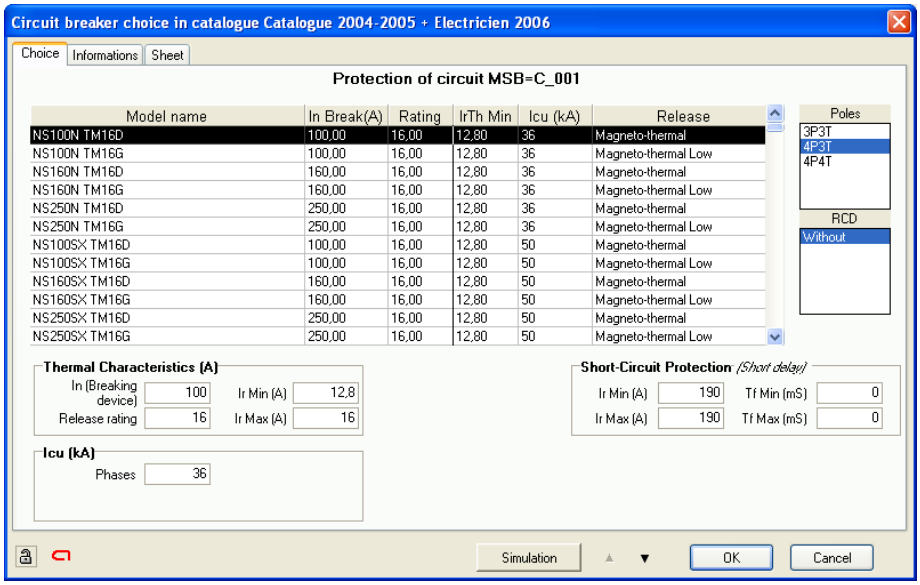
The user can choose a protection out of catalogue. The choice out of catalogue is indicated by the icon  .
Caneco BT uses the protection data entry given by the user to calculate. Rating, IrTh, IrMag.

- **User's technical choice**

The user can choose in the «Equipment technical choice» window another protection and its accessories, the user's technical choice is then indicated by the icon  .

.

Economical automatic choice



Model name

According to catalogue, the model name may include the name of the breaking device, release relay, and Residual current Device.

In Break

Nominal current of the breaking device

Rating

Rating of the release relay

Icu(A)

Breaking capacity of the protection (eventually with association -coordination) in kA.
Déclencheur

Release

Release type:
Thermal with Magnetic (5 to 10 In)
Thermal with Low Magnetic (3 to 5 In)
Electronic

Th. Discr.

Displays the Thermal discrimination with the upstream circuit-breaker when selecting the circuit protective device

Ik Discr.

Displays the short-circuit discrimination with the upstream circuit-breaker when selecting the circuit protective device

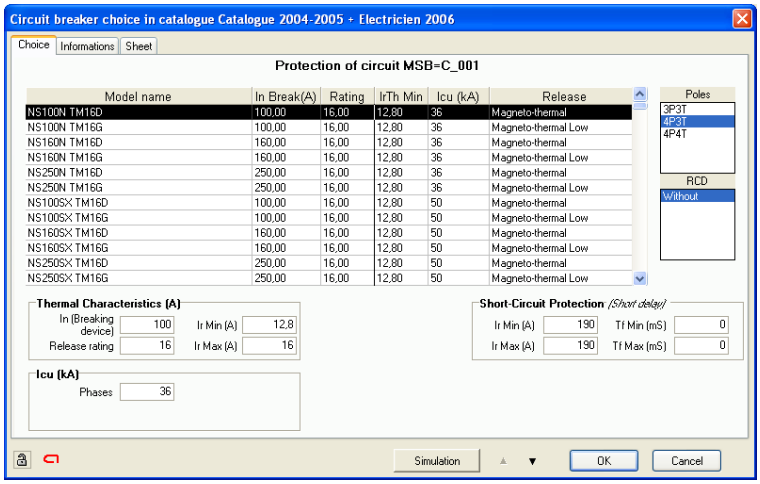
Poles

Configuration at the protective circuit breaker:
number of poles of the protection
number of protected poles

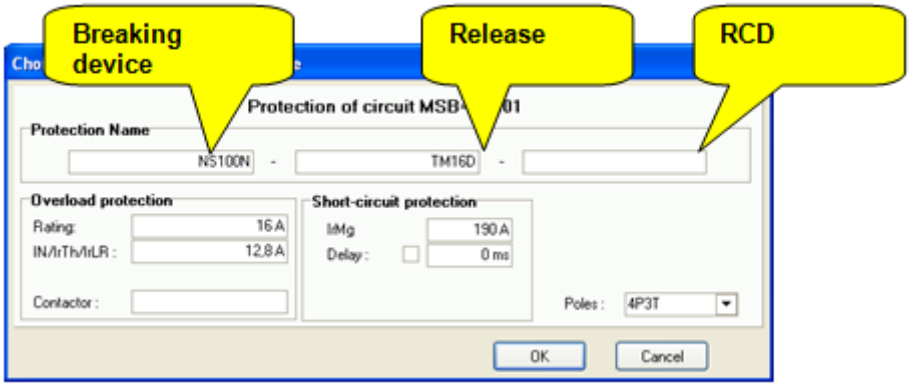
RCD

Residual current Device: without, separated, Ir Min/Ir Max

User's choice by model



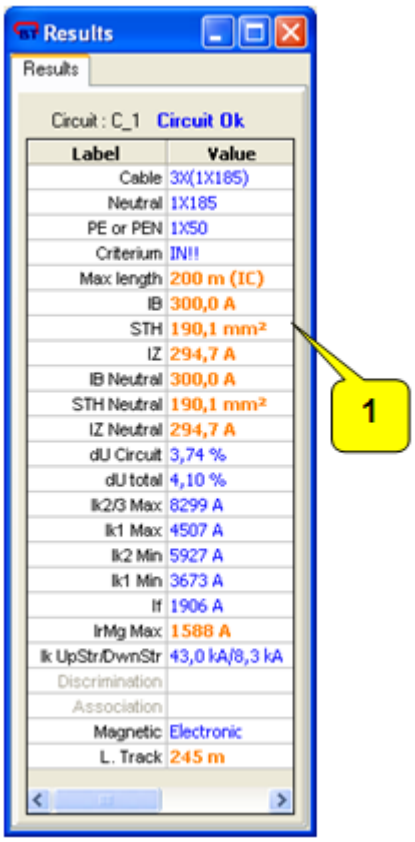
Choice out of catalogue



The user enters the name of the breaking device, release and RCD, as well as the protection data: Rating, thermal setting, magnetic setting, magnetic delay for short-circuit protection (short magnetic or protection delay of the electronic circuit-breakers), differential setting, differential delay. Breaking capacity is not taken into account.
Caneco BT does not check if the data are consistent.
Calculation is done taking into account entered data, not taking into account breaking capacity.

10.11 Results Window

To display this window choose Display/Results in the Display menu:



Limit results are shown in a different colour (orange: limit value, red: incorrect value)

10.11.1 Circuit

Circuit ref mark

State

State	***Description***
Circuit OK	means that the circuit complies with standard
To recalculate	means that the circuit must be calculated again. Due to some changes results may be wrong.
Cable not correct	means a circuit with fixed cable and whose cross-section is not sufficient to satisfy standard conditions
Protection not correct	means a circuit which protection type or characteristics have been forced, and which doesn't satisfy standard conditions.

10.11.2 Cable

Multi-core cable conventional writing, or phase conductors if the link is of single-core type.

- Examples: 4G1,5 means 4 conductors out of which 1 vert-jaune (G = ground) 3X50+N35 signifie 3 means 3 phase conductors + 1 N conductor of 35 mm^2

10.11.3 Neutral

Neutral conductors conventional writing if the link is of single-core type.

10.11.4 PE or PEN

PE conductors conventional writing if the link is of single-core type.

10.11.5 Criterion

This is the criterion for the phase cross-section calculation:

Criterion	*Meaning*
MINI	Minimum section
IN	overload condition
DU	Voltage drop
IC	Indirect contacts, Human protection against electrical shocks
CC	Thermal stress after Short-Circuit
Overridden	Values have been imposed

One or two exclamation marks can be added after these criteria:

- If gap corresponds to a cross-section, a «!» is added (i.e: *CI !* means *Human protection* criterion, with a cross-section gap according to the more unfavourable of other criteria.
- If gap is two cross-sections or more, a «! ! » is added.

When the cross-section is determined simultaneously by two or more criteria, the last two criteria kept are displayed: ex.: *IN-DU* means *Overload condition* and *Voltage drop* criterion.

10.11.6 Max protected L.

Cable maximal length to keep protection and circuit design conditions.
This length is preceded by a 2 letter prefix:

Criterion	Meaning
DU	It means that with the maximum indicated length, the maximum voltage drop entered in cable data is reached
IC	It means that over the maximum indicated length, the human protection condition is no more fulfilled
CC	It means that over the maximum indicated length, the cable short-circuit protection condition is no more fulfilled.

10.11.7 Circuit dU

Circuit voltage drop in % on the *cable length*. This value does not include upstream voltage drop.

10.11.8 dU (%) start

Voltage drop at start (motors) or when switching on (lights), calculated by **Caneco BT**. This value is calculated only when ID/IN ratio is >1.

10.11.9 dU Total

Total Voltage drop in % from source.

10.11.10 Ik3 Max

Maximum 3-phase short-circuit current at far end of the circuit.

10.11.11 Ik2 Max

Maximum 2-phase short-circuit current at far end of the circuit.

10.11.12 Ik1 Max

This is the max short-circuit current, single-phase at circuit ending if neutral is present

10.11.13 If Max

Maximum fault short-circuit current at far end of the circuit if there is a PE.

10.11.14 Ik2 Min

Min. 2-phase short-circuit current at far end of the circuit if there is no neutral.

10.11.15 Ik1 Min

Min. single-phase short-circuit current at far end of the circuit if there is a neutral.

10.11.16 If

This is the default short-circuit current phase-PE at the end of the circuit.

10.11.17 IrMg max

Maximum setting for protection magnetic (general purpose circuit-breaker). This value is calculated from IkMini (Ik1 or Ik2) or If.

10.11.18 Ik Am/Av

IK Max Upstream / Downstream the link in kA.

10.11.19 Discrimination on IK

Short-circuit discrimination with upstream. It can be:

Discrimination	*Description*
Nil	No discrimination
Total	There is a selectivity for all short-circuits situated on the circuit, even on protection terminals
Functional	there is discrimination for all downstream short-circuits (most common situation), but not for a short-circuit at protection terminals (very low probability of SC)
Discrimination enhanced by cascading	Caneco BT uses M-G's "Discrimination enhanced by cascading" table. This makes it possible to combine (at least partial) discrimination and cascading. In this event, Caneco BT puts a + sign after the displayed discrimination value. And the association value in square brackets. (e.g. Total+, association [30 kA]).
Partial	Caneco BT gives you the discrimination limit. Caneco displays: I < values (ex. I < 10kA)
I< (I limit) + ?	the discrimination limit is (I limit) at the end of the curve before the Reflex zone. (see 'Discrimination' section)

No value means:
no value in the discrimination tables between circuit protection and upstream protection.
or **Caneco BT** doesn't know how to calculate the protection discrimination with upstream protection.
This result is completed by differential discrimination (see below)

 See also Additional Tab from Circuit window

10.11.20 Thermal discrimination

This relates to discrimination on an overload fault. The results are "With" or "Without"
(see 'Discrimination' section).

10.11.21 Discrimination differential. See « discrimination » chapter.

10.11.22 Backup (Association)

It can be With or Without Backup (coordination, or association) with the upstream protection. There is backup when breaking capacity of the circuit protection (alone) is not sufficient (hence lower than board Ik Max) and manufacturers backup tables show a backup possibility. In this case, it is necessary that its breaking capacity in coordination with the upstream protective device is higher than Ik max.

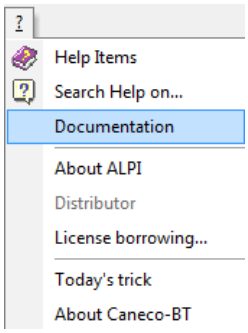
10.11.23 Magnetic

Standard, low or electronic according to chosen device.

11 Entering and calculating complex circuits

11.1 Uninterruptible power supplies – UPS –

UPS operating principles and the calculation method adopted in Caneco BT are described in an on-line document accessible via the 'Documentation' command from the Help menu.



This paragraph sets out the procedure for entering data for the various configurations of UPSs in Caneco BT and how to use the results obtained where these are present.

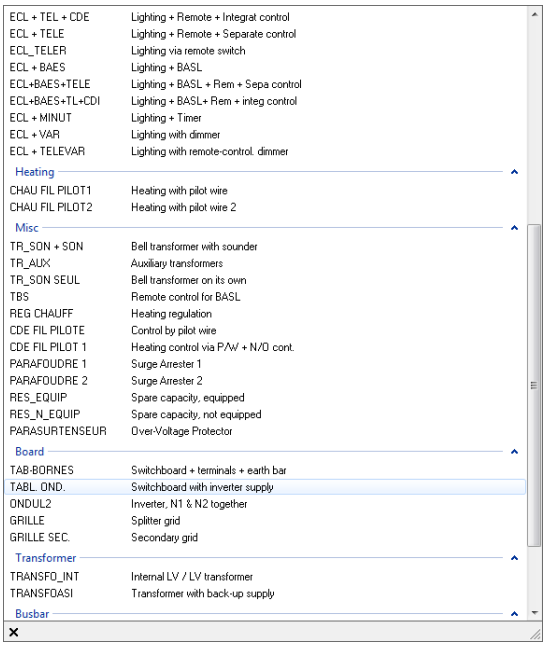
11.1.1 Single-supply UPS

This is a UPS supplied via a single feed. The protective device and cross-section of the latter will be calculated according to the inverter power.

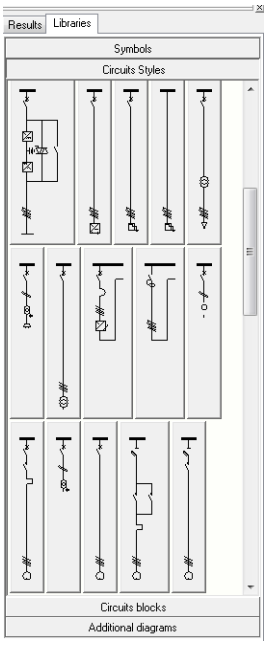
In order to allow for the battery charging and optimizing the inverter efficiency, it is recommended to over-rate the protective device by 25 %.

Data for the UPS circuit can be entered by:

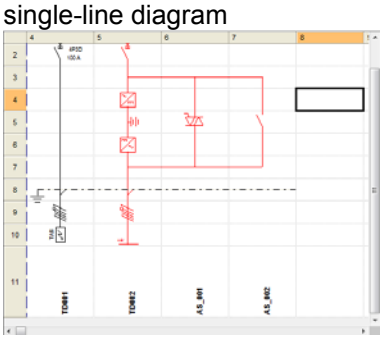
Selecting "UPS BOARD" in the style list



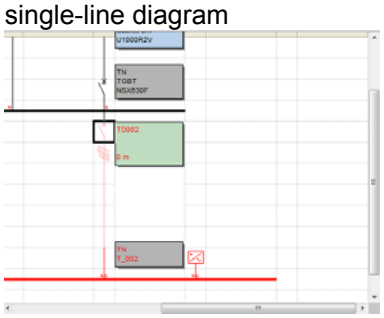
Dragging-and-dropping the block available in the circuit block library



Representation of the UPS in the Board single-line diagram

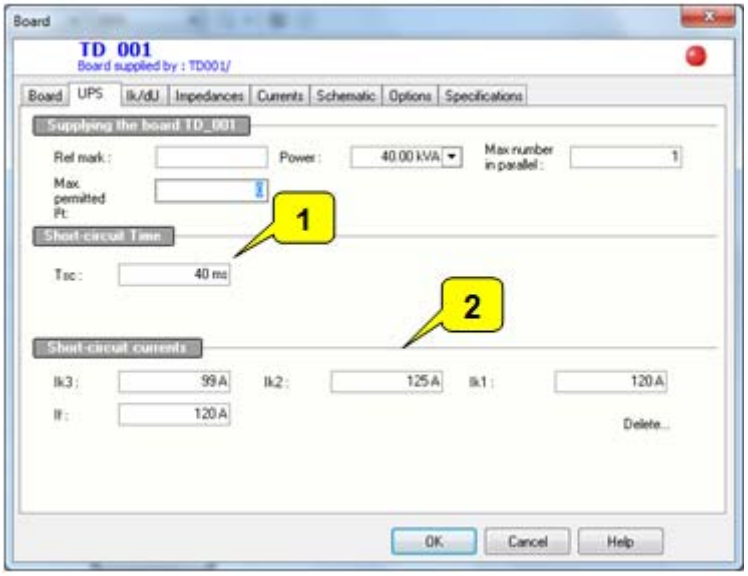


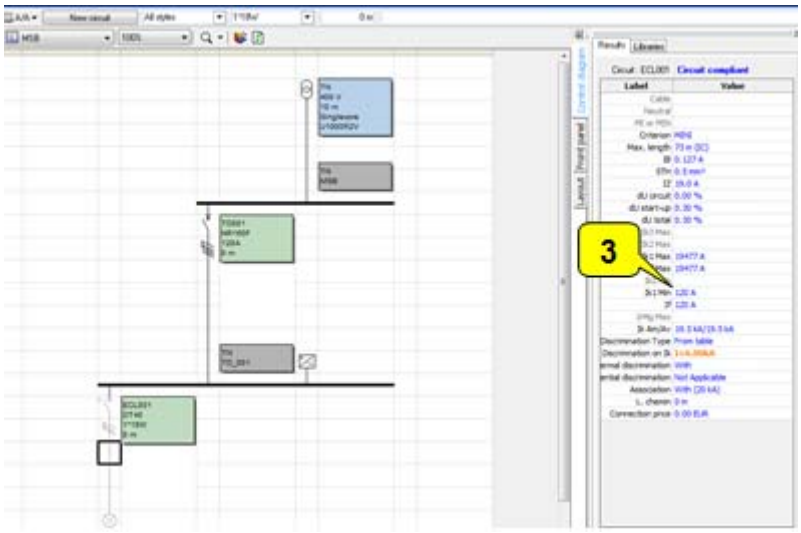
Representation of the UPS in the network single-line diagram



- **Attention:** don't forget to fill in the inverter data under the 'UPS' tab in the 'BOARD' window.

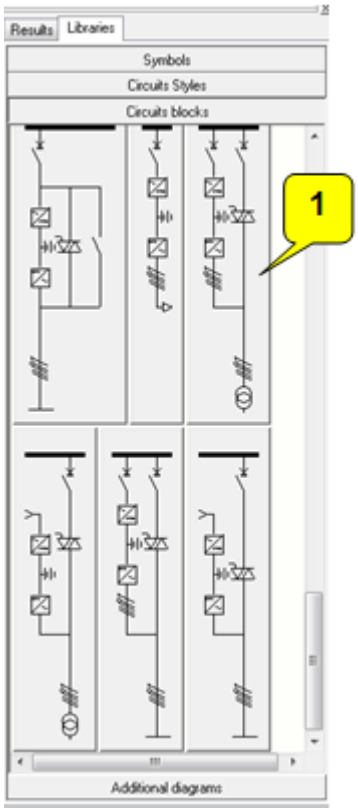
The short-circuit values (2) and the short-circuit withstand time (1) must be updated in accordance with the information provided by the equipment manufacturer.
This will make it possible to calculate the circuits downstream of the UPS, taking the latter's short-circuit ratings into account. (3)



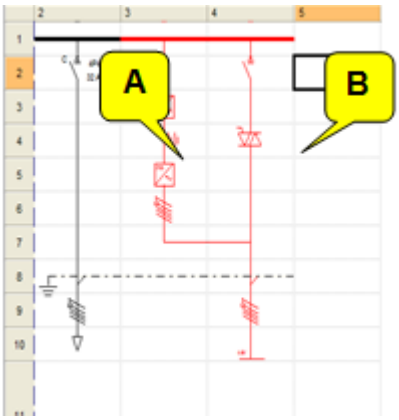


11.1.2 Dual-supply UPS

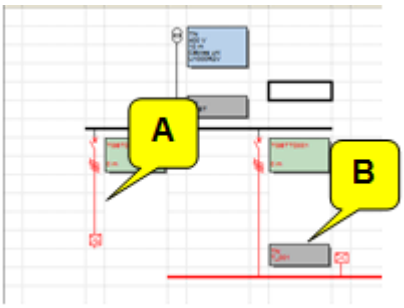
The circuit is available in the graphics library under the 'Circuit blocks' tab (1)
It is based on a miscellaneous circuit for calculating the network 1 (A) and a board circuit for calculating the network 2 or By-Pass (B) and filling in the inverter data ('UPS' tab under 'Board').
The downstream circuits are obviously entered downstream of the board



Representation of the UPS network 1 (A) and network 2 or By-Pass (B) in the Board single-line diagram



Representation of the UPS network 1 (A) and network 2 or By-Pass (B) in the network single-line diagram

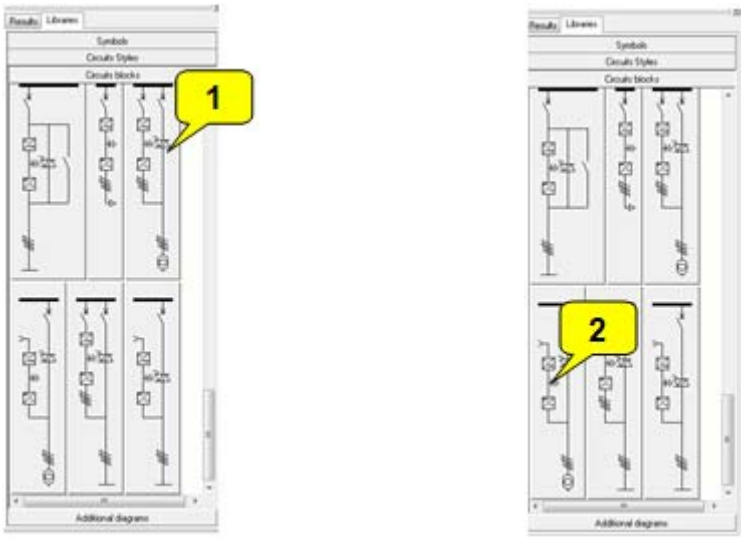


- **Attention:** don't forget to fill in the inverter data under the 'UPS' tab in the 'BOARD' window.

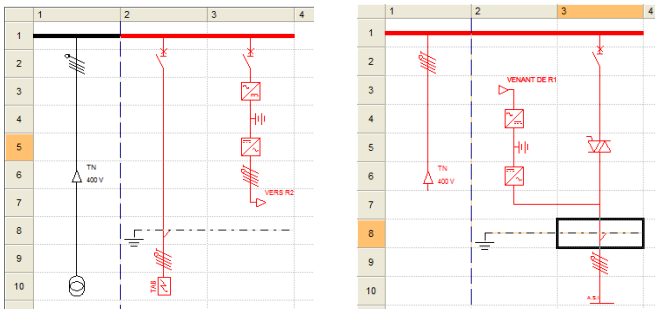
The Network 1 circuit is based on a 'Miscellaneous' circuit and makes it possible to calculate the Network 1 cross-section and protective device. The protective device is over-rated by 25 % by default.

The Network 2 (or By-Pass) circuit is based on a 'Board' circuit and makes it possible to calculate the Network 2 (or By-Pass) cross-section and protective device, and to enter the UPS data.
Date for the downstream circuits will be entered downstream of the board (Network 2) and will be calculated as for the single-supply UPS (see above).

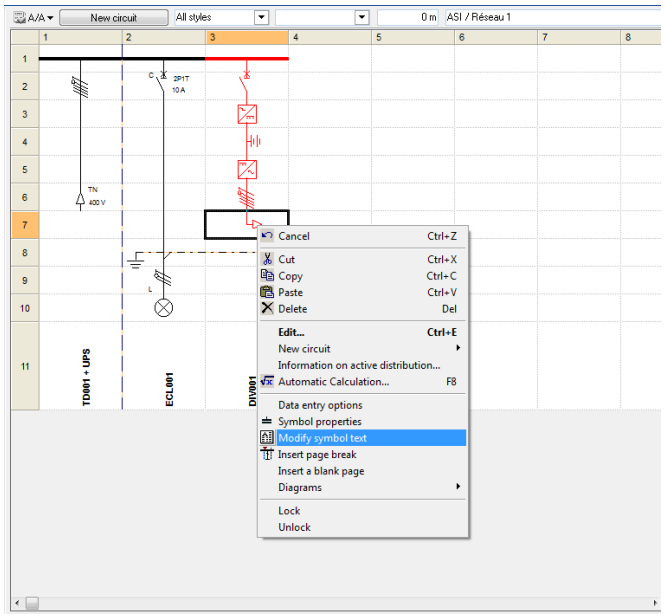
- Note: In cases where the Normal and By-pass supplies are not connected to the same busbars, the representation in Caneco BT can be produced using two blocks, Network 1 (1) and Network 2 (2) available in the graphics library.



Graphical representation in Caneco BT:



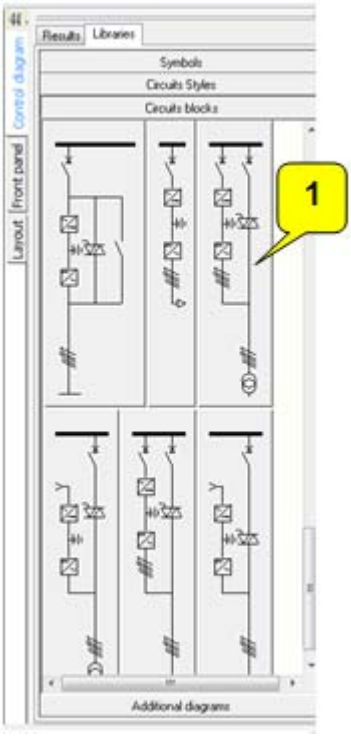
The cross-reference texts between one circuit and the other will be entered using the “Modify symbol text” command in the contextual menu.



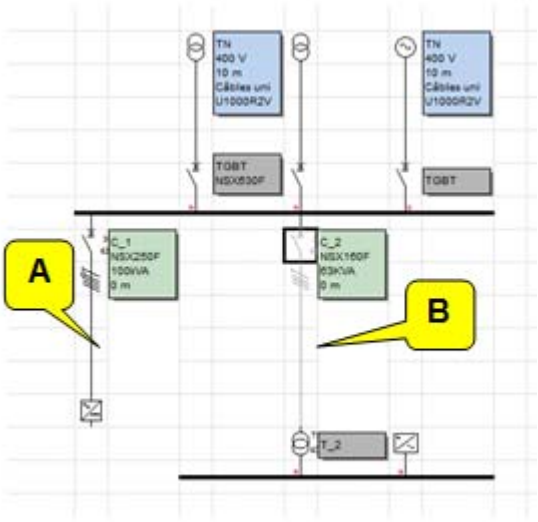
11.1.3 Dual-supply UPS with isolating transformer

The circuit is available in the graphics library under the ‘Circuit blocks’ tab (1)
It is based on a miscellaneous circuit for calculating the network 1 (A) cross-section and protective device and an LV/LV transformer circuit for calculating the network 2 or By-Pass (B) cross-section and protective device and filling in the inverter data (‘UPS’ tab of the LV/LV transformer).

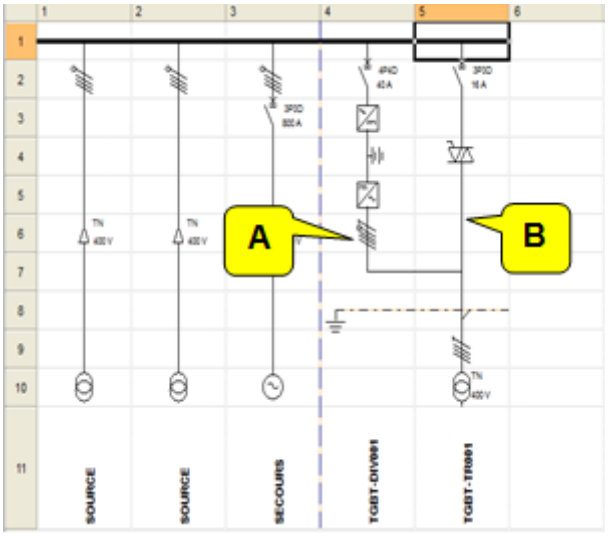
The data for the downstream circuits will obviously be entered downstream of the LV/LV transformer and the calculation rules are the same as for the previous cases.



Representation in the network single-line diagram



Representation in the Board single-line diagram



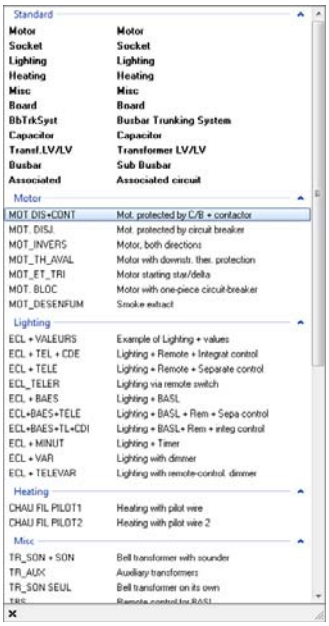
11.2 Regulator + motor output

The regulator + motor output calculation method adopted in Caneco BT is described in an on-line document accessible via the 'Documentation' command from the Help menu.

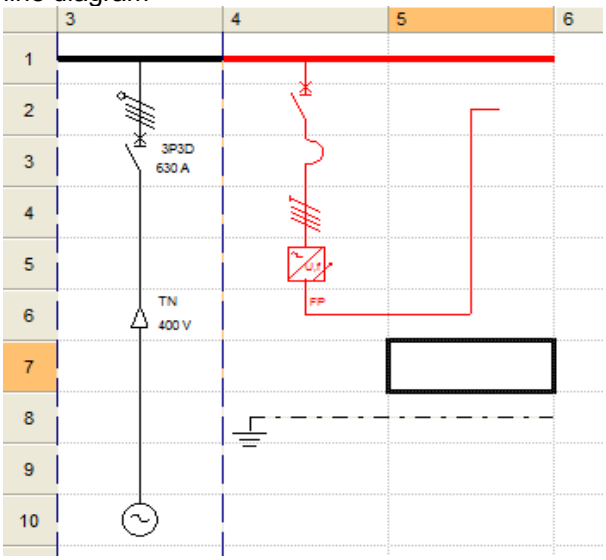
The motor output will be regarded as being protected against over-current and indirect contact by the regulator.
The cross-section of the motor supply connection will be calculated in accordance with the permitted current (Iz). The latter depends directly on the motor operating current.

The voltage drop at the regulator terminals shall be taken as 0 V.

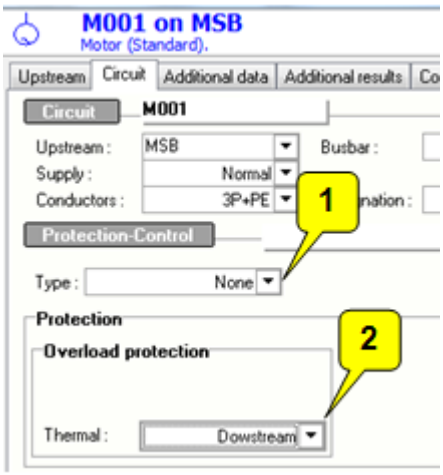
Entering the regulator from the style list



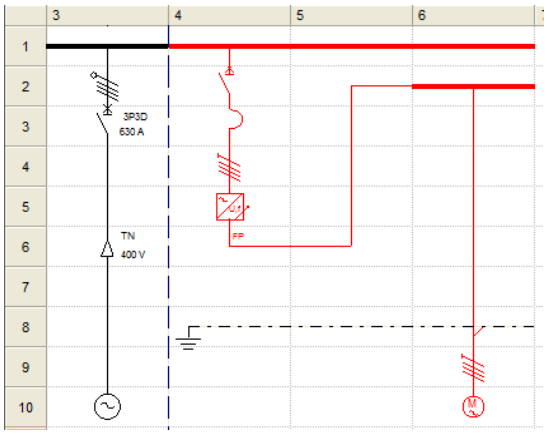
Representation of the regulator in the Board single-line diagram



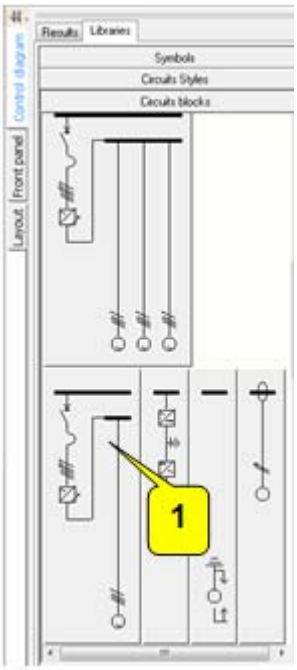
Enter the motor downstream of the regulator and don't forget to select "Without Prot." for the protective device type (1) and to select the overload protective device as "Upstream" (2)



Representation of the regulator + motor combination in the Board single-line diagram



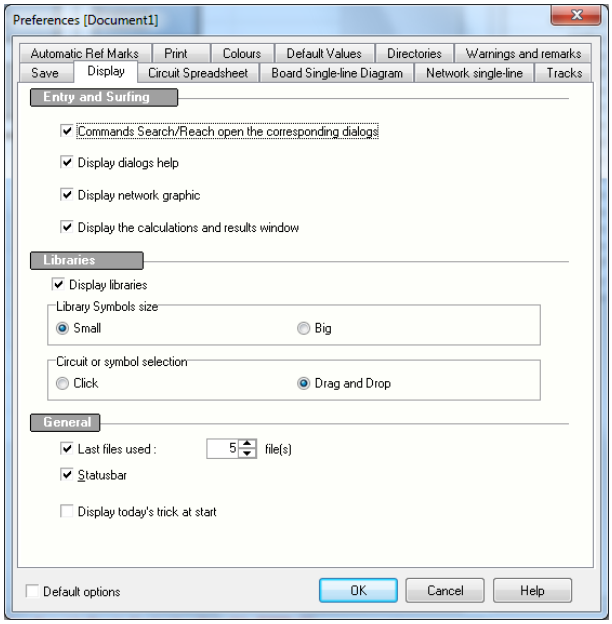
- Note: The regulator + motor output is available as a block **(1)** in the graphics library, under the 'Circuit blocks' tab.


Results
Libraries
Symbols
Circuits Styles
Circuits blocks
Control diagram
Front panel
Layout
1

12 Preferences

12.1 Generalities on Preferences

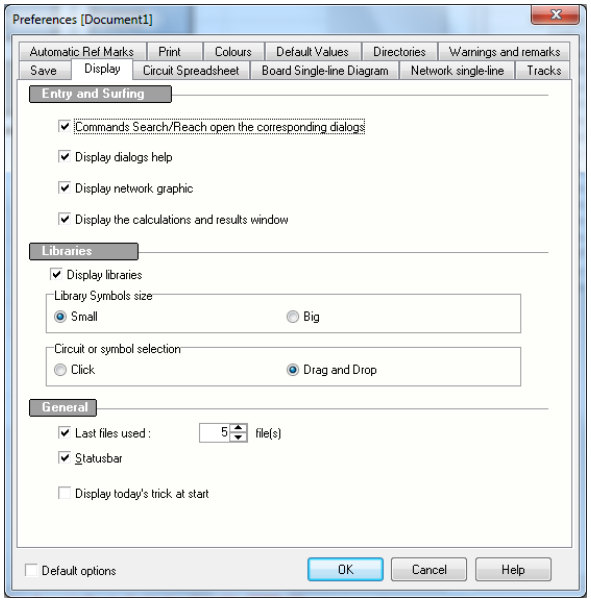
The «Preferences» tool enables to set the default preferences parameters, classified by items.
To each item corresponds a tab containing options to set up.



12.2 Display tab

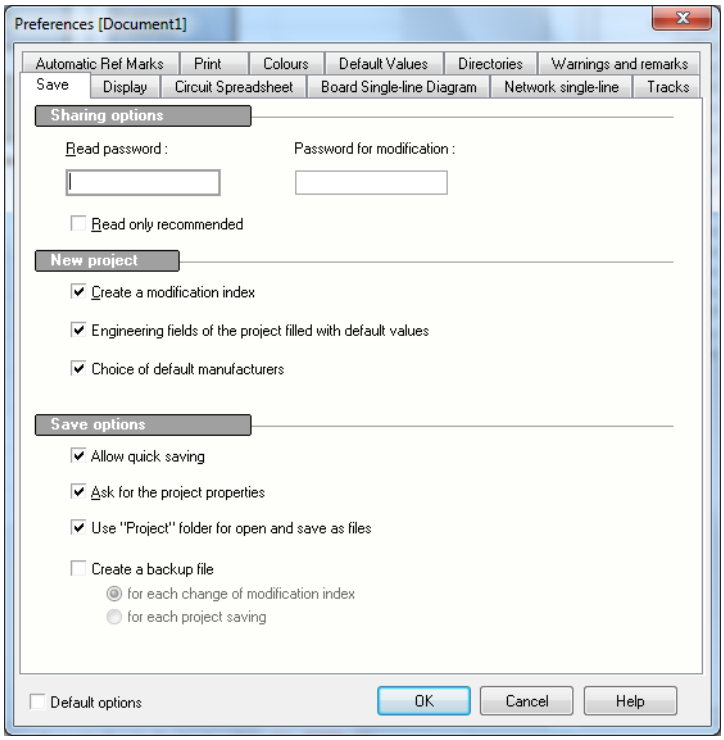
This window enables you:

- To set acquisition and navigation context
- To set use mode for symbol library
- To display status bar
- To set the number of files used which will be displayed in File window
- To enable the Today's trick at start window



12.3 Save tab

This item allows you to set saving options



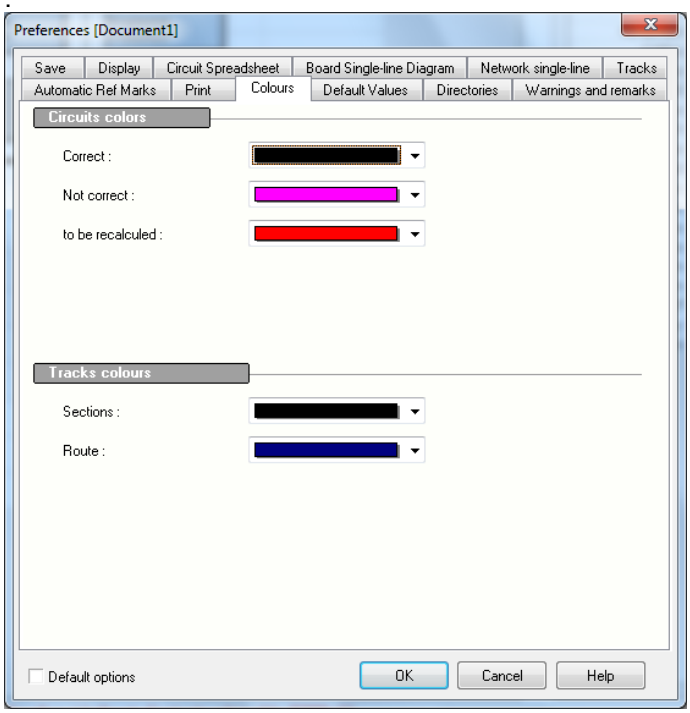
12.4 Colours tab

This item allows you to choose colour for each circuit state:

- **Correct circuit**
- **Circuit to be recalculated**
- **Circuit not OK**

Section and route colours of a cable tray may be also set in this window

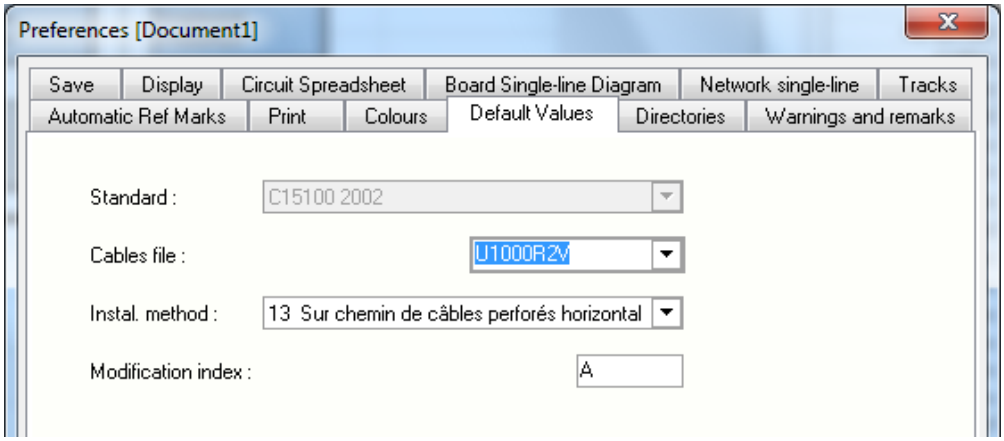
.



12.5 Default Values Tab

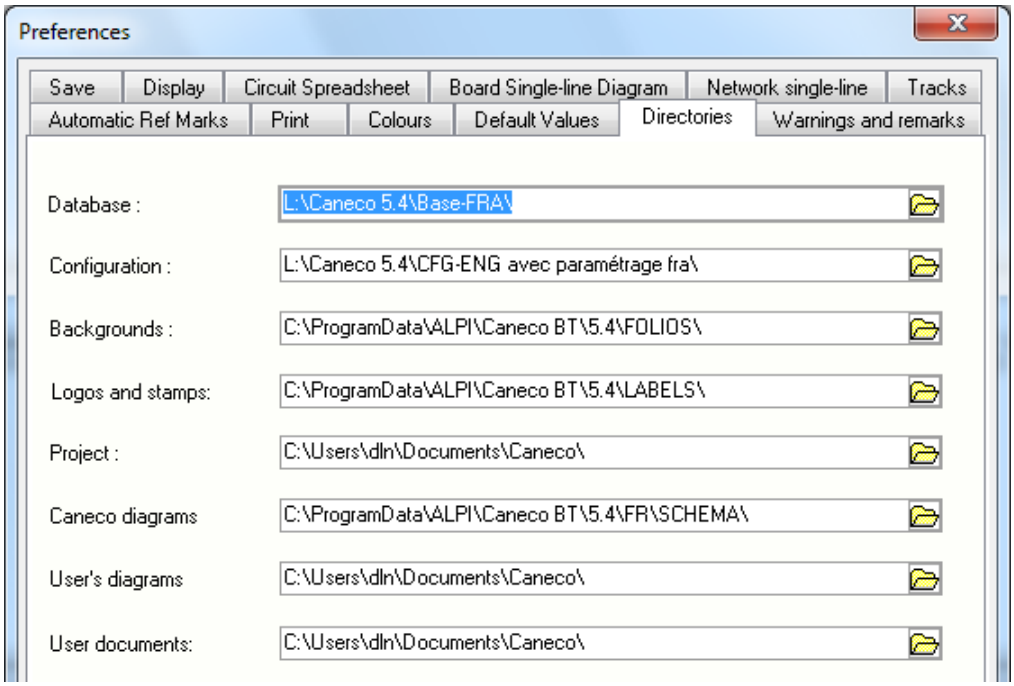
This window enables you to set:

- Default cable type
- Default installation method
- Initial modification index



12.6 Directories Tab

User can not modify the directories containing configuration files and database.
User may put project files, sheet backgrounds and Caneco BIT type diagrams into directories chosen by him.
Caneco BT version 5.4 offers more possibilities, logos and stamps, user diagrams and documents can also be put into directories chosen by the user.



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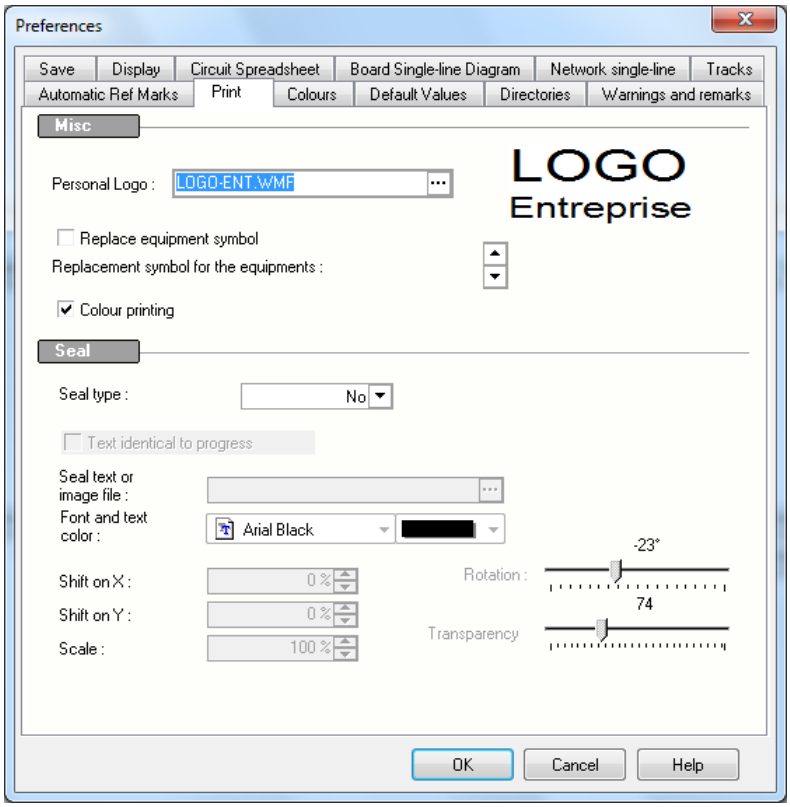
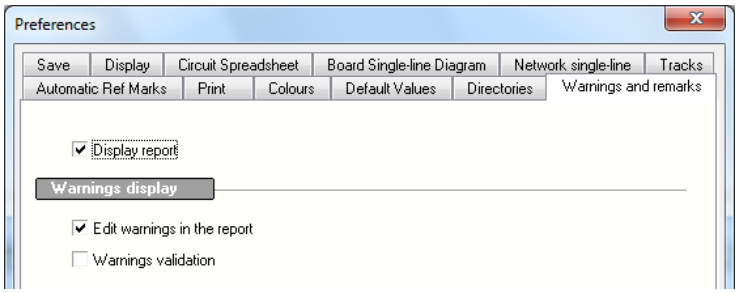
12.7 Print Tab

This window lets you select the company logo and to define a stamp indicating the progress state of the project. Image with the logo must be in the FOLIOS directory.
The user can define a generic default symbol to represent equipment. The specified stamp (text or image) can be positioned and oriented and will appear on print-out documents.



12.8 Warnings and Remarks Tab

This window allows you to set operating mode of warnings and reporting.



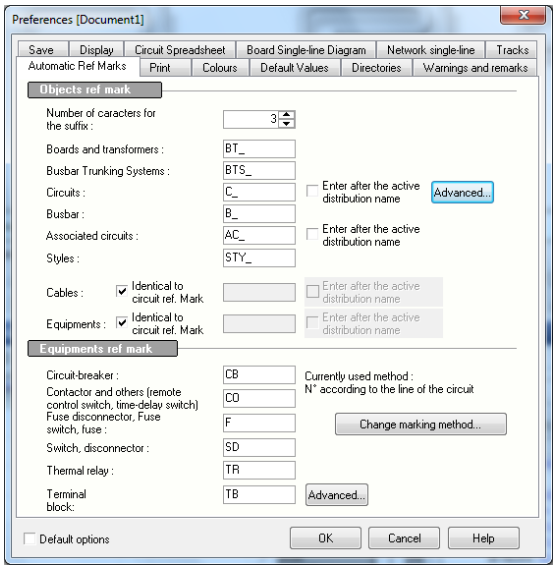
12.9 Automatic reference marks Tab

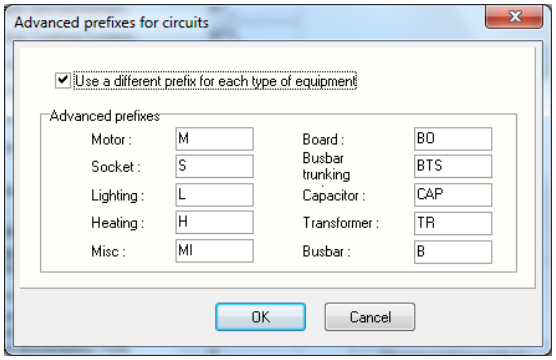
Automatic circuit and equipment ref. marks can be defined under the ‘Automatic Ref Marks’ tab.

This window allows you to set default automatic reference marks.

The button « Advanced... » actives the «Advanced prefixes for circuits» window. So, user may set a different prefix for each equipment.

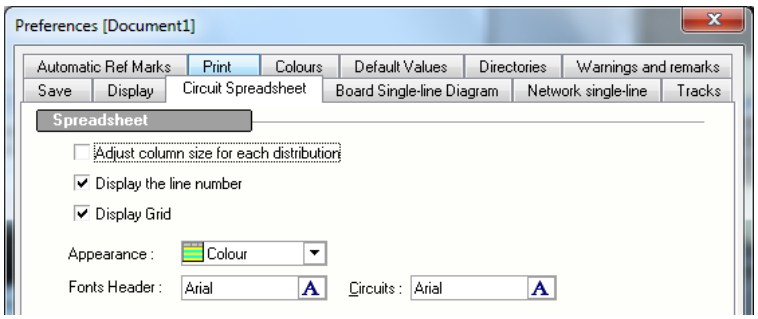
An ‘=’ sign can be placed in front of an object (functional unit) prefix for marking as per the EN 60082 standard.
A number of prefixes are also provided for automatic equipment marking
The default ref. marks are defined as per the EN 60082 standard:
‘□’ sign in front of a device ref. mark
(see ‘Schematics’ section)





12.10 ‘Circuit spreadsheet’ Tab

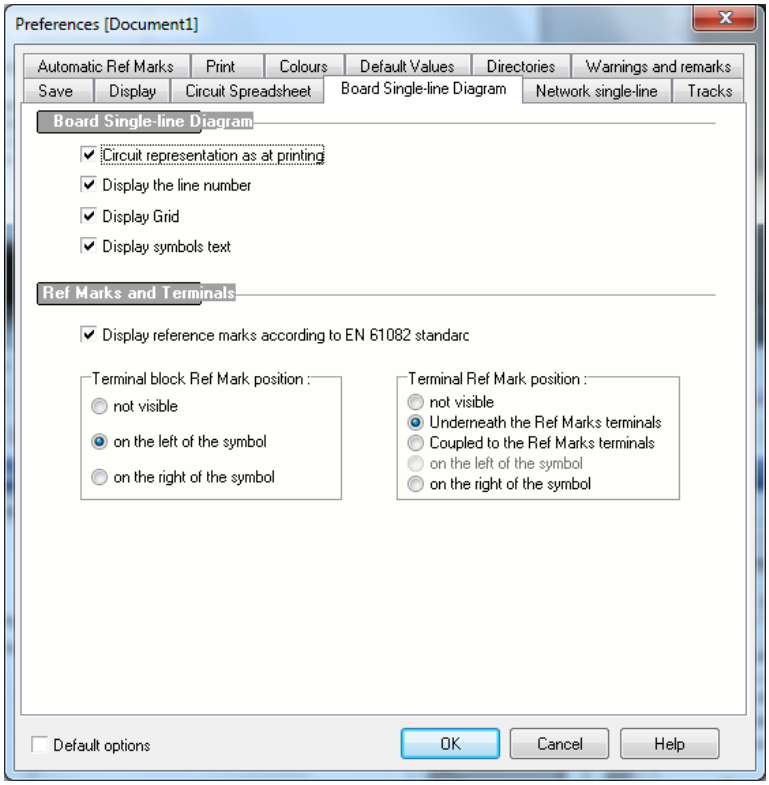
This window allows you to set operating mode of the «Spreadsheet» entry tool.



12.11 'Board Single-line Diagram' Tab

This window allows you to:

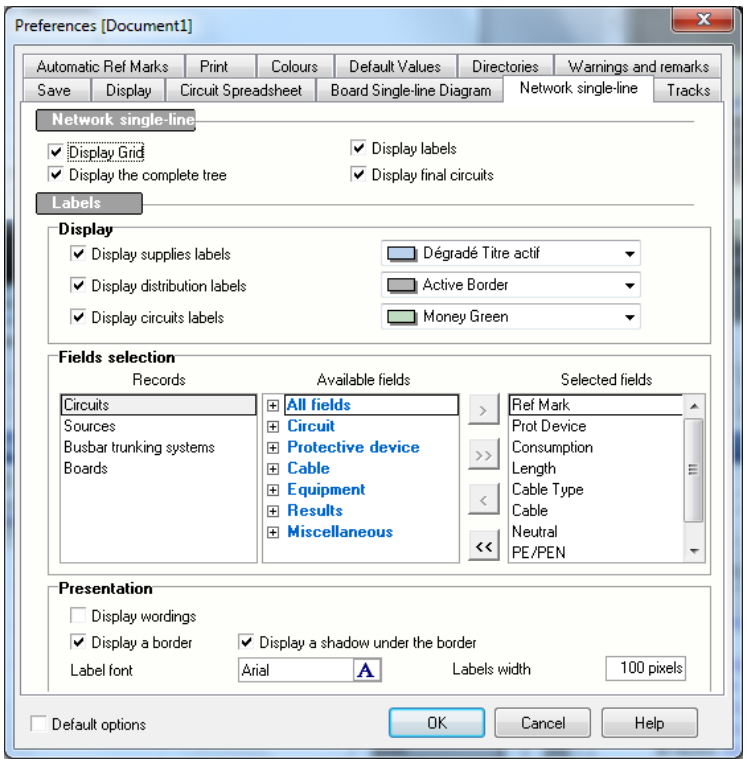
- Define the options for using the 'Board Single-line Diagram' tool,
- Define the position of the ref. marks for terminal blocks and terminals,
- Display device ref. marks as per the EN 60082 standard.



12.12 'Network single-line' Tab

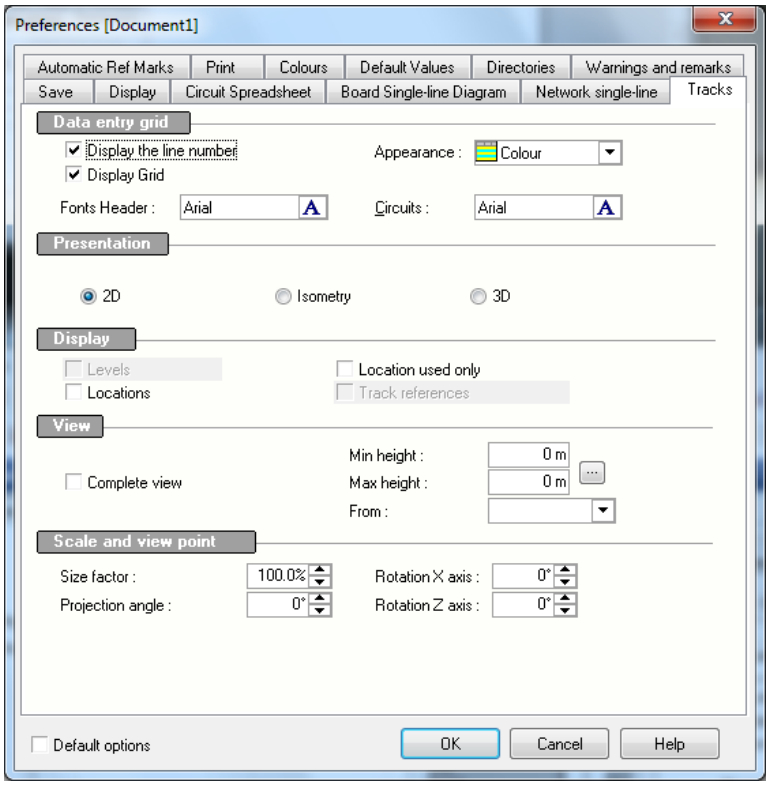
This window allows you to:

- Set operating mode for the «Network single-line» entry tool
- Display circuit and distribution labels.
- Set a background colour for each label type.
- Set fields for each label
- Display field wording
- Set label attributes and field fonts



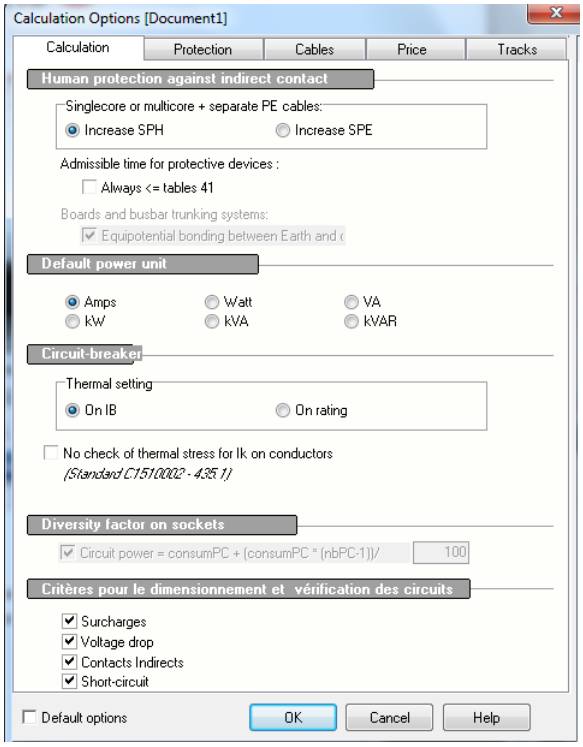
12.13 ‘Tracks’ Tab

This window allows you to set display parameters for cable trays.

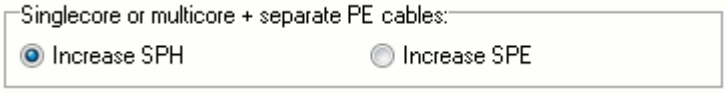


13 Calculation options

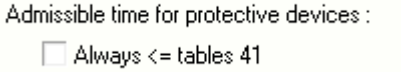
13.1 Calculation Tab



13.1.1 Protection of personnel:



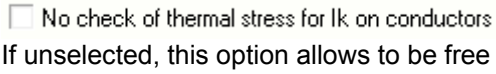
if phase cross-section is equal to PE, you must set a priority to increase the conductor cross-section, according to the choice made by ticking.



If ticked, values from standard board will be applied

Circuit-breaker:

Adjustment of IB allows more favourable cable cross-sections.
In this case ensure that the adjustment value of the thermal trip unit is not modified.



If unselected, this option allows to be free from release condition on Ikmin: Ikmin >= 1,2 x IrMg.
Attention, for more information, see the related standard paragraph.

13.1.2 Sizing criterion:

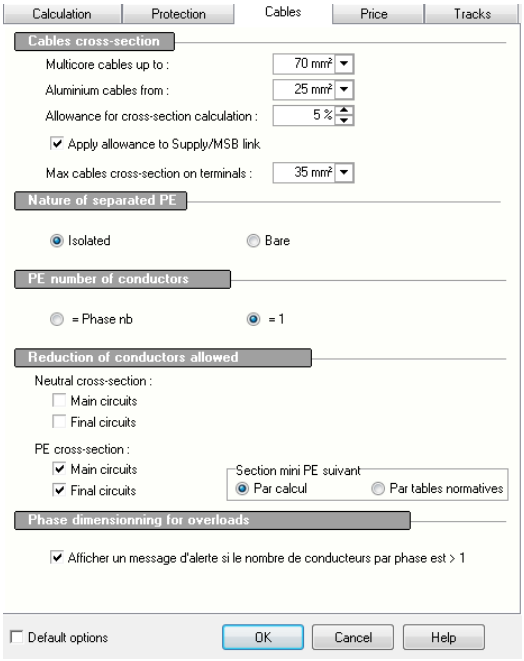
The user can choose not to verify one calculation criterion for a very specific reason.
If the 'Overload' criterion is unchecked, the following message will appear:

A virtually identical message will appear, depending on which criterion is deselected.

- Attention: This section is intended for experienced users only.

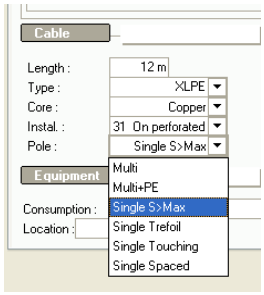
In the event of a reservation expressed by a technical inspection service, the Caneco BT user will be obliged to provide justification.

13.2 'Cables' Tab

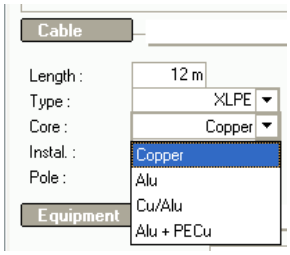


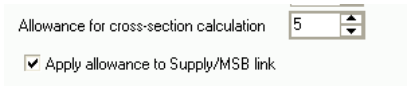
13.2.1 Cables sections

Allows to define the cross-section from which Caneco will choose single-core cables if the « Multi / Uni « option is selected in the Pole field of the circuit sheet



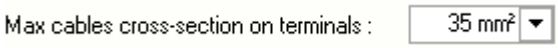
Allows to define the cross-section from which Caneco will choose aluminium cables if the «Cu / Al» option is selected in the Core field of the circuit sheet





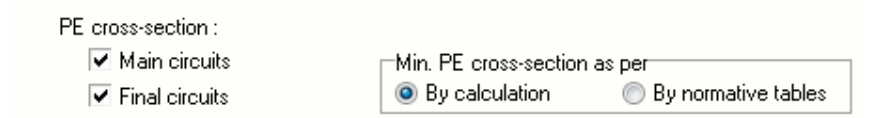
This option enables cross-sections to be calculated applying a tolerance of 5% max. in Iz.

Unselect the box if the specifications say that this tolerance is not to be applied to the Source - MSB link.



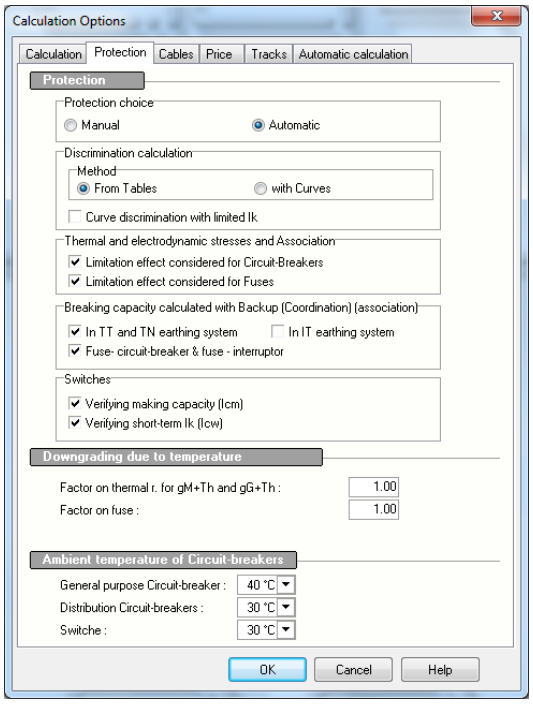
Terminal numbering will be performed for all cable cross-sections ≤ 35 mm²,

13.2.2 Authorization to reduce conductors



The min. PE cross-section can be calculated according to 2 methods defined in standard.

13.3 ‘Protection’ Tab



13.3.1 Discrimination calculation.

Discrimination by board

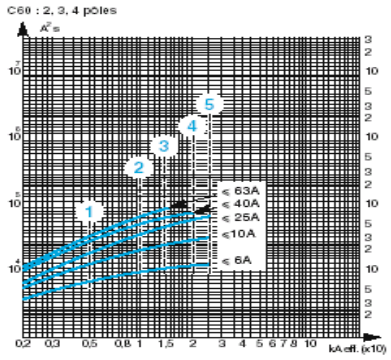
Caneco BT uses the discrimination tables provided by the manufacturers (same brand and catalogue year).

Discrimination by curves:

Caneco BT determines the discrimination by superimposition of the curves.
Check the “Curve discrimination with limited Ik” option in order to make use of the effect of limitation by the downstream circuit-breaker.

13.3.2 Thermal and electrodynamic stress and backup

Use of the limitation curves under thermal stress (I2.t) to calculate cross-sections.

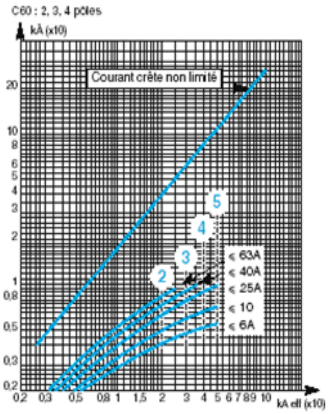


Use of the current limitation of circuit-breakers (determination of limited Ip peak according to the RMS short-circuit current)

This value is used for verifying:

Electrodynamic stress for busbar trunking systems

- Association/coordination with downstream fuses
- The electrodynamic stress of the busbar trunking system



13.3.3 Breaking capacity calculated with co-ordination (association)

TT and TN earthing system:

If checked, Caneco BT will look for upstream and downstream protective devices with cascading.

Fuses and switches:

If checked, Caneco BT handles the co-ordination between fuse and switch.

13.3.4 Switch

For the description of the two fields, see section (15) ‘Circuit-breaker/switch co-ordination’

14 Discrimination

14.1 Discrimination on Ik

Discrimination on Ik takes into account the whole range of overcurrents, from overload to the maximum presumed short-circuit current.
The determination of discrimination can be obtained:

- either from manufacturers' tables: the method **By tables**
- or by superimposition of protection curves if they exist in the Caneco databases: the method **By Curves**

14.1.1 Possible discrimination results:

Nil:
no discrimination (the upstream and downstream protections both trip)

Partial:
Total discrimination up to a maximum value of overcurrent.
Beyond this limit, the discrimination becomes nil.
In which case the diagnosis will be: **I < Limit**

IrMg Max	1386 A
Ik UpStr/DwnStr	15,5 kA/5,9 kA
Discrimination on Ik	I<2,00kA
Thermal discrimination	With
RCD discrimination	Not Applicable

Total:
Discrimination for all downstream circuit over-currents, obtained by offsetting the operating curves with respect to the current axis or by the limitation effect of the downstream protective device.

Functional:
Discrimination for overcurrents at end of the downstream trunking (the most frequent faults).

In general, to obtain discrimination other than «Nil», the ratio between the magnetic setting of the upstream protection and that of the downstream protection must be at least 1.5.

14.2 Discrimination by Tables

14.2.1 Conditions to be met on the Upstream and Downstream

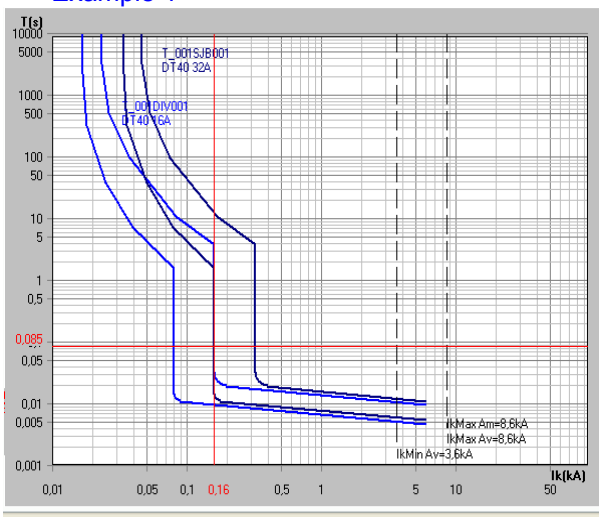
- same manufacturer
- same catalogue year
- conditions of access to tables valid (protections with electronic tripping)

The discrimination result will be that specified in the tables.

If the table specifies a discrimination limit, and if the upstream/downstream thermal curves intersect, the thermal discrimination result will be «Not calculated».
The discrimination on Ik will be equal to the limit indicated by the table. (see example 1).

If the upstream protection is electronic, use of the tables is only possible if the access conditions defined by the manufacturer are present (Im setting, Inst on/off, etc.)
In the opposite case, the discrimination will be defined automatically by superimposition of the curves.

- Example 1



Upstream protection: DT 40 32A
Downstream protection: DT40 16A
The table provides a discrimination limit of 0.25 kA.
The thermal curves intersect and there is no thermal discrimination.
The figure below shows the Caneco BT diagnosis

14.3 Discrimination by Curves

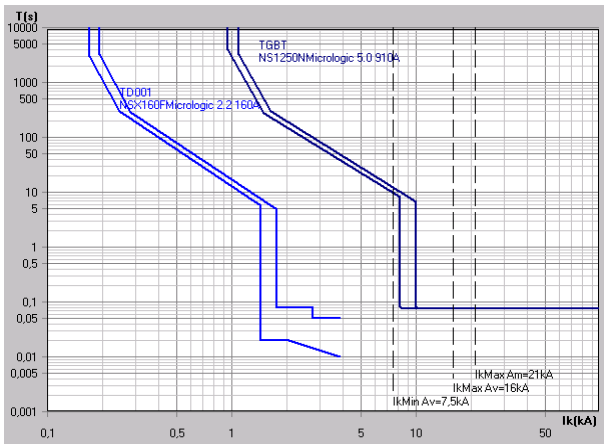
Discrimination will be determined by superimposition of curves in the following cases:

- The selected discrimination option is «By Curves».
- No value in the tables, or the conditions of access to the tables are not met; if the discrimination option is «By Tables».
- The manufacturers and/or the catalogue years of the upstream and downstream protections are not identical.

In this case, the diagnosis is established by a graphical analysis of short circuits according to superimposition of the upstream and downstream curves. See example 2

With a view to optimising discrimination, it is possible to make use of the limitation capability of the downstream protection by ticking «Discrimination by curves with Iks limited» See Example 3

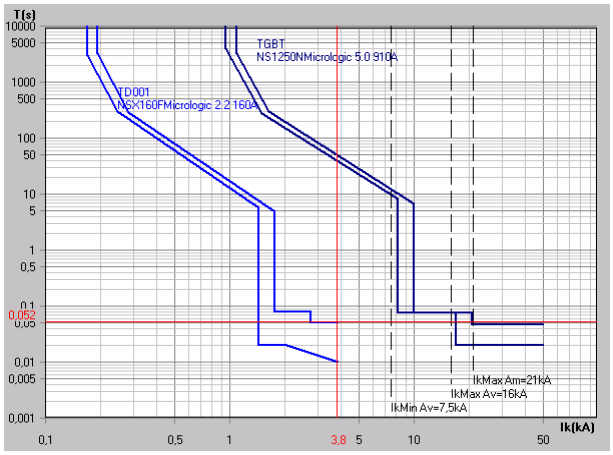
- Example 2:



Analysis of the curves shows that discrimination is total because of the protection settings and the specified time on the upstream protection (difference > 40 ms).

Caneco diagnosis: **Total**

Ik2/3 Max	26325 A
Ik1 Max	16741 A
Ik2 Min	19716 A
Ik1 Min	14244 A
If	9192 A
IrMg Max	7660 A
Ik UpStr/DwnStr	26,3 kA/26,3 kA
Discrimination on Ik	Total
hermal discrimination	With
RCD discrimination	Not Applicable

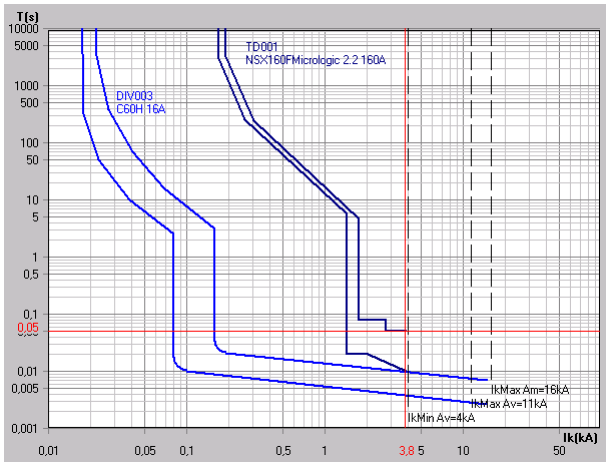


Ik3 Max	15932 A
Ik2 Max	13798 A
Ik1 Max	11799 A
If Max	9968 A
Ik2 Min	11196 A
Ik1 Min	9057 A
If	7503 A
IrMg Max	6821 A
Ik Am/Av	21,0 kA/15,9 kA
Type de sélectivité	Par Courbes
Sélectivité sur Ik	I<3,84kA+?
Sélectivité thermique	Avec

Since Caneco BT does not handle the Reflex zone of moulded-case circuit-breakers, in this case the discrimination limit is therefore 3.84 kA (end of the curve before the Reflex zone).

- Example 3: Using the “Curve discrimination with limited Ik” option.

14.3.1 1 - Option not checked



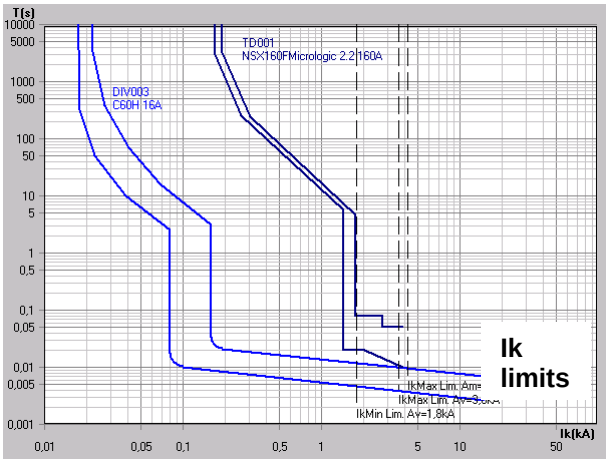
In this case, the calculated short-circuit values are used.

The graphical analysis shows that discrimination is nil.

Caneco diagnosis: I<3.84kA+? Discrimination up to 3.84 kA, not handled above this value

Ik3 Max	11497 A
Ik2 Max	9957 A
Ik1 Max	7233 A
If Max	5482 A
Ik2 Min	7755 A
Ik1 Min	5388 A
If	4005 A
IrMg Max	
Ik Am/Av	15,9 kA/11,5 kA
Type de sélectivité	Par Courbes
Sélectivité sur Ik	I<3,84kA+?
Sélectivité thermique	Avec

14.3.2 2 - Option checked



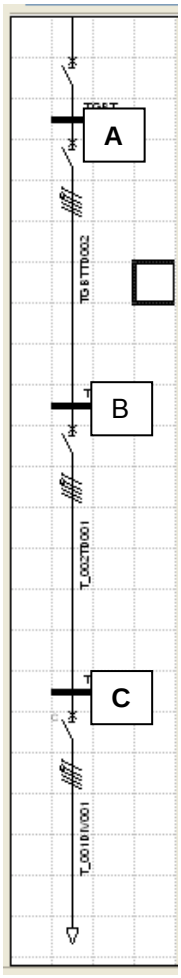
In this case, the limited short-circuit values are used .
The graphical analysis shows that discrimination is total .

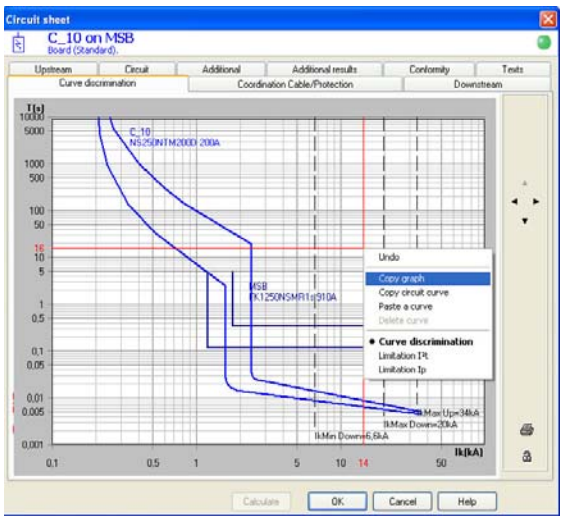
Caneco diagnosis: **Total**

Iks

14.4 Discrimination by Curves on 3 levels

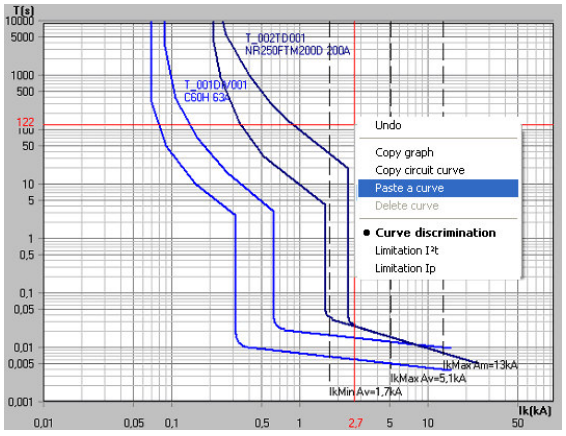
Discrimination can be analysed on 3 levels by superimposition of curves.
The curve for the 3rd protection is obtained by copy/paste in the «Discrimination by curves» tab of the circuit sheet.
The «Copy curve» command in the pop-up menu of the «Discrimination by Curves» tab allows the insertion of the graph representing the superimposition of curves in a text document, for example in order to produce a report on discrimination.





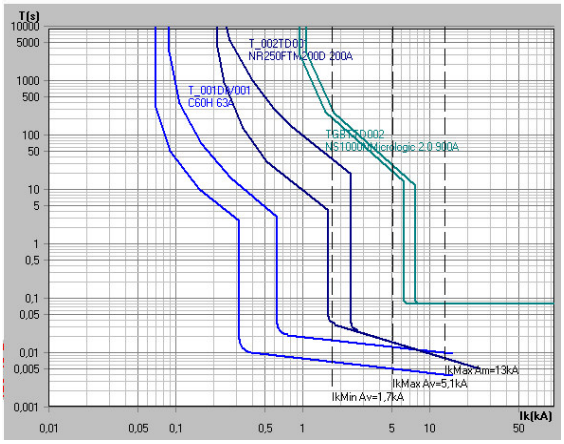
Right click on the « discrimination by curves » tab of circuit A sheet .

Select the « copy the circuit curve » command.



Right click on the « discrimination by curves » tab of circuit C sheet.

Select the « copy the circuit curve » command



The figure opposite shows.

14.5 Differential Discrimination

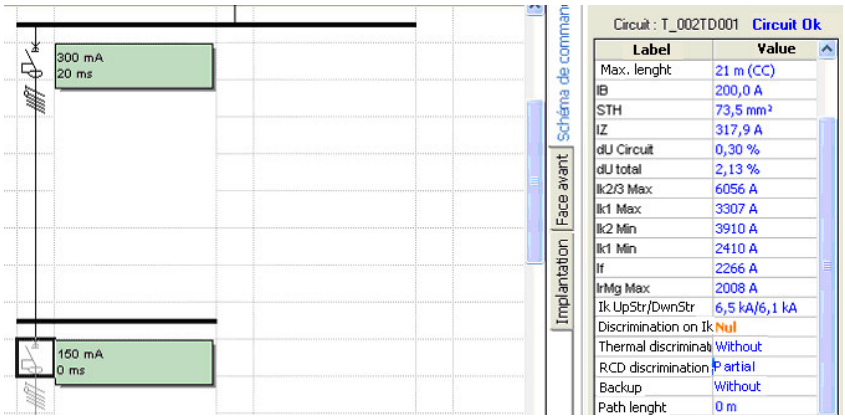
The diagnosis of differential discrimination is done according to the following rule:
Discrimination is total if (I upstream >= 3x $L_{downstreaml}$) [1] and (*t upstream – t downstream*) >= *40ms* [2]

- Discrimination is partial if: one of both conditions above is not met.

Discrimination is nil in all other cases

- Discrimination is not relevant if the upstream circuit has no differential.

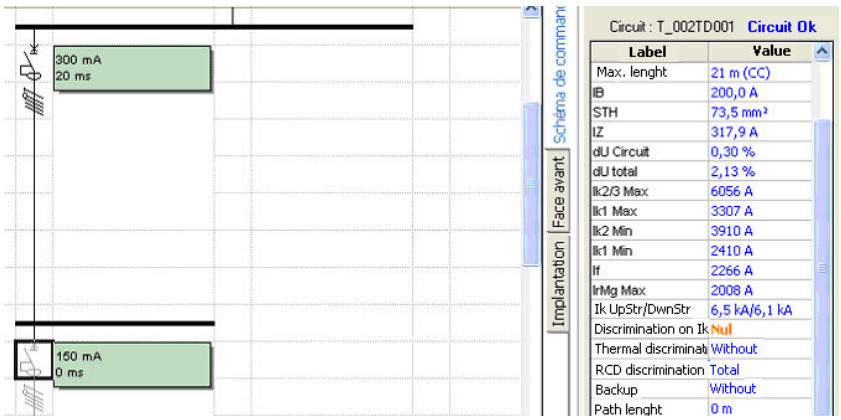
Differential discrimination Nil



$I_{upstream}$ = 300 mA
$t_{upstream}$ = 30ms
$I_{downstream}$ = 300 mA
$t_{downstream}$ = 0ms

The two conditions are not met

Partial differential discrimination



$I_{upstream}$ = 300 mA

$t_{upstream}$ = 0ms

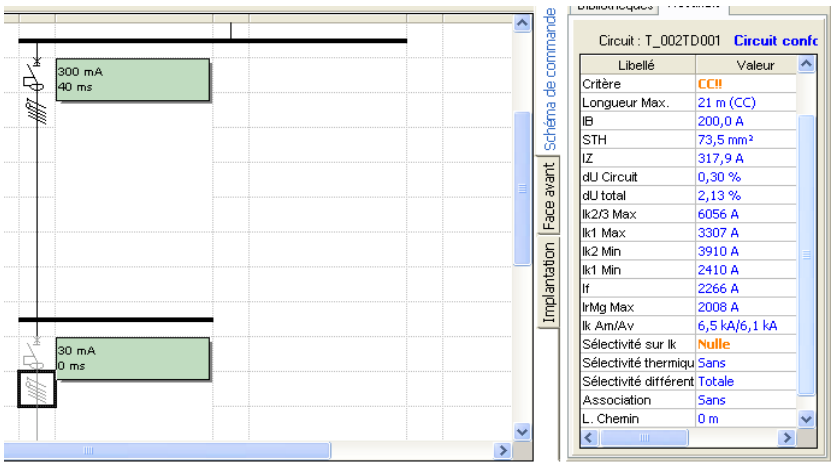
$I_{downstream}$ = 30 mA

$t_{downstream}$ = 0ms

The condition [1] is met.

The condition [2] is not met.

Total differential discrimination

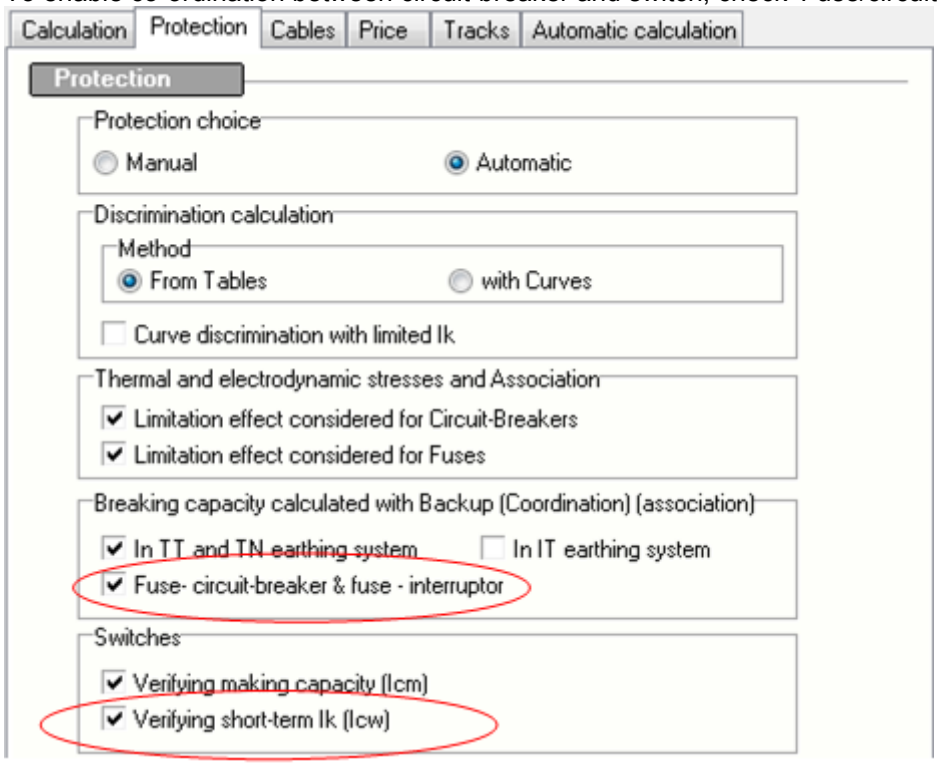


$I_{upstream}$ = 300 mA
$t_{upstream}$ = 40ms
$I_{downstream}$ = 300 mA
$t_{downstream}$ = 0ms

The two conditions [1] and [2] are met

15 Circuit-breaker/switch co-ordination

To enable co-ordination between circuit-breaker and switch, check ‘Fuse/circuit-breaker’ and ‘Fuse/switch’

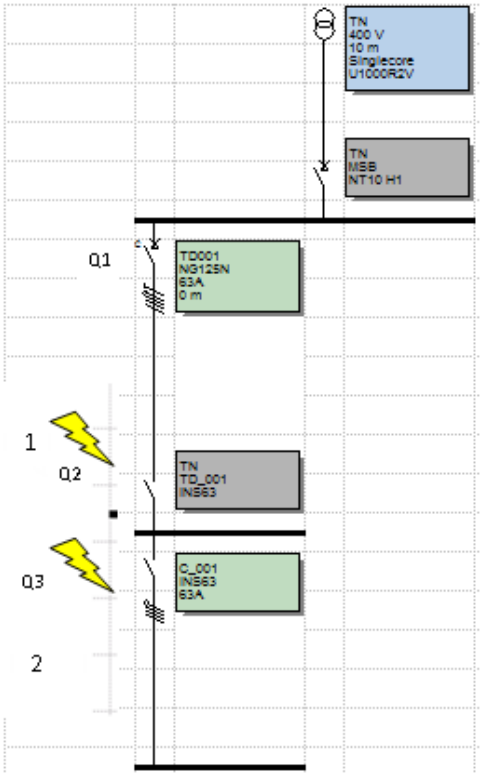


15.1 General rule

Where possible, Caneco uses the circuit-breakers limit curves for selecting the switch.

Hence when a fault appears in 1, switch Q2 is selected using:
Q2 Icm > Ip peak fault in 1 (limited by Q1)

Lastly, if the fault appears at point 2
Switch Q3 is selected using:
Q3 Icm > Ip peak fault in 2 (limited by Q1)



15.2 Application in Caneco BT

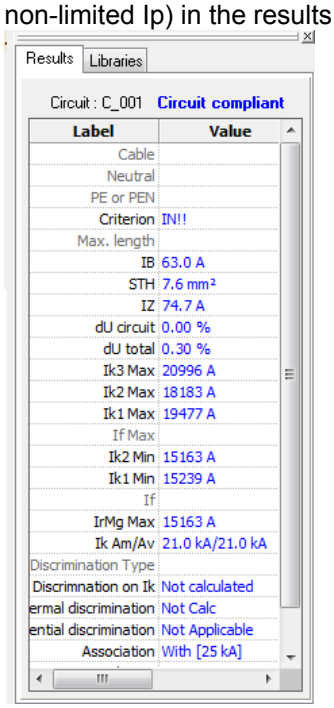
Calculation method

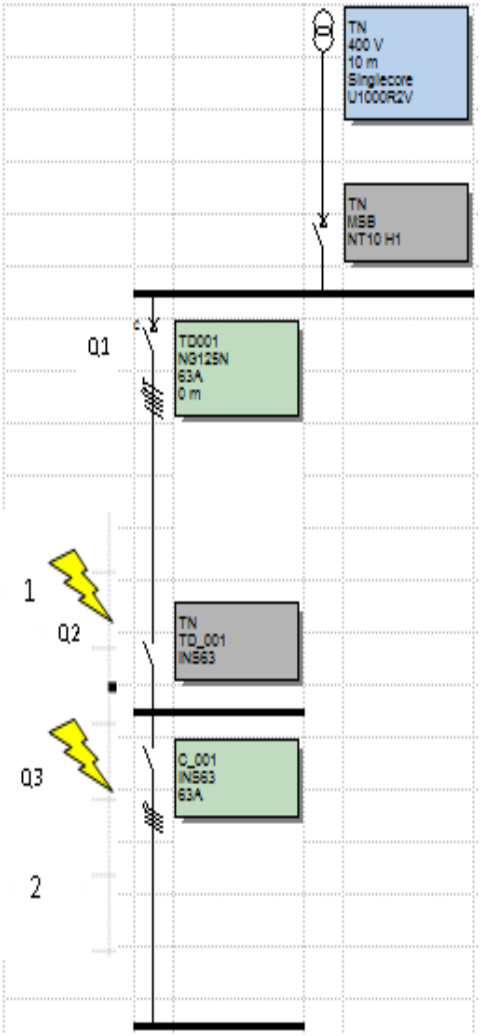
If switch Q2 Icm is < n * Ik Max at the point considered 1:

Calculation of Ip peak limited, by the circuit-breaker (Q1), at point 1
The value of Ip peak limited is displayed in the “Additional results” window of the circuit concerned.

If the resulting Ip peak limited ≤ Icm for switch Q2, this protective device is accepted.

Icm associated = Max rms non-limited Ip in A.
In this case Caneco displays cascading WITH (Max rms non-limited Ip) in the results window.





Icm: Making capacity of the switch or switch/fuse.
Ip pk: Peak current limited by the protective device or non-limited
n: crest factor

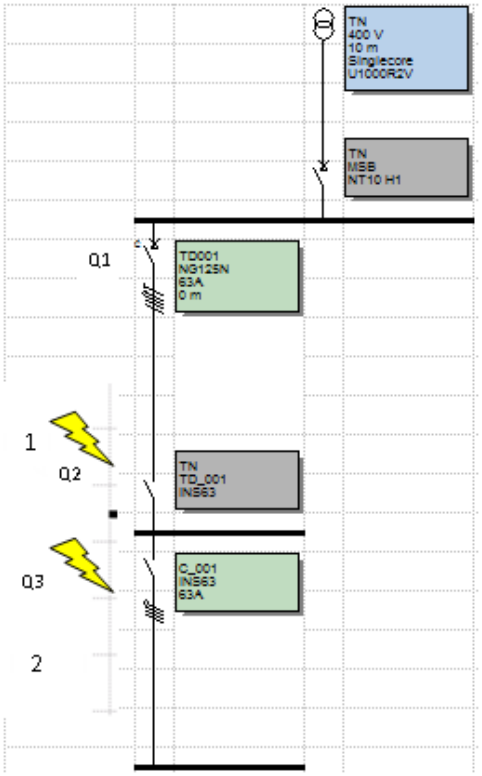
Manufacturer's tables method

If switch Q2 Icm is < n * Ik Max at the point considered 1

Calculation of Ip peak limited or non-limited, at point 1
The value of Ip peak limited or non-limited is displayed in "Additional results" window of the circuit concerned..

If the resulting Ip peak limited ≤ Icm for switch Q2, this device is not valid.
It can only be accepted using co-ordination with Q1.

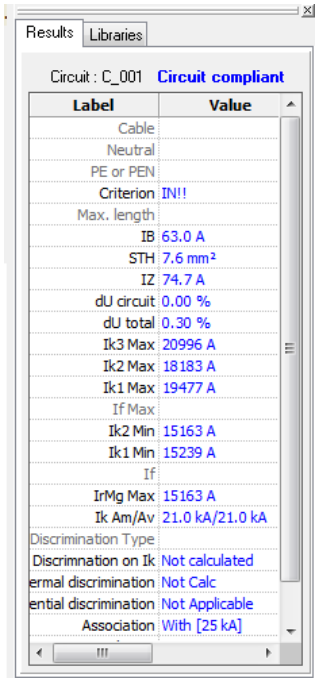
Icm or Icw Associated in kA = co-ordination value given by manufacturer
In this case Caneco displays cascading WITH [Icm or Icw Associated in kA] in the results window.



the

protective

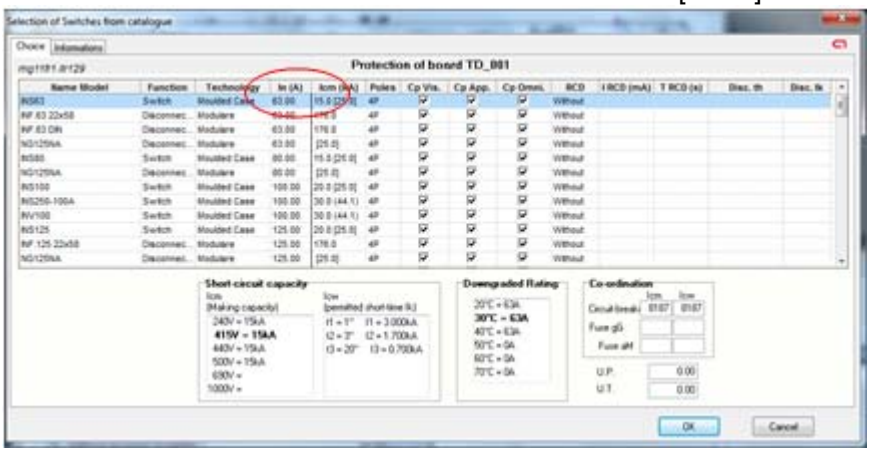
the



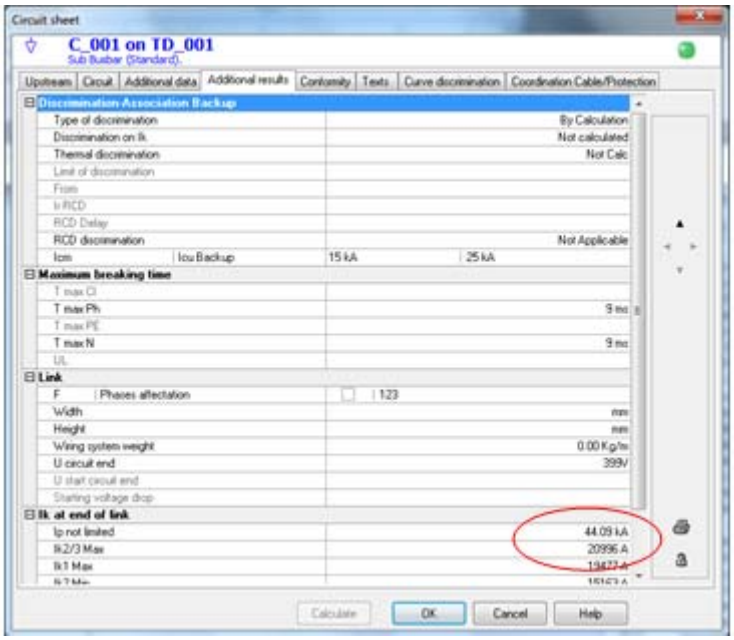
Icm: Making capacity of the switch or switch/fuse.
Ip pk: Peak current limited by the protective device or non-limited
n: crest factor

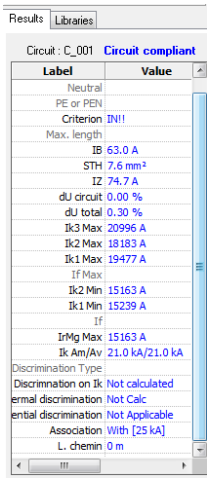
- Example: Upstream circuit-breaker NG125N 63A 4P4D

The INS63 switch handles an Icm of 15 kA and an Icw of [25 kA] in co-ordination with the upstream circuit-breaker



INS63 is non-compliant, as the Icm (15 kA) ≤ Ip peak limited or non-limited (44.09 kA)
By virtue of the co-ordination with the upstream circuit-breaker → INS63 is compliant Icw [25 kA] ≥ Ik Av 20.99 kA





15.2.1 Result Without the limitation of the circuit-breaker with co-ordination taken into account

Type		Switch	
Manufacturer		mg11fr1.itr	
Family		INS63	
Overrating factor		1.00	
✗ Icm	>= Ip upstream	15.0 kA	>= 44.1 kA
✓ Icw (t)	>= I FUnct. (t)	3.0 kA (1.0 s)	>= 0.6 kA (1.0 s)
✓ Icm with Backup	>= Ik Max	25.0 kA	>= 21.0 kA

15.2.2 Result With the circuit-breaker limitation with co-ordination taken into account

Type		Switch	
Manufacturer		mg11fr1.itr	
Family		INS63	
Overrating factor		1.00	
✓ Icm	>= Ip upstream limited	15.0 kA	>= 8.7 kA
✓ Icw (t)	>= I FUnct. (t)	15.0 kA (1.0 s)	>= 0.6 kA (1.0 s)
✓ Icm with Backup	>= Ik Max	25.0 kA	>= 21.0 kA

The Icw (short-term short-circuit current) is only verified if circuit-breaker / switch co-ordination is not requested or if there are no co-ordination tables, or no value in the table.
This verification ($Icw^2 \times t \geq I\,op \times t\,op$) is in addition to verifying the fuse's Icm and Icu, if it is a switch fuse.

Each manufacturer gives Icw values associated with a time, but if this is not the case, according to the 947-3 standard, a value of Icw = 12*In for 1 second must be considered for the verification

16 Schematics

16.1 Functions of the schematics

The functions of the schematics are only effective in the BOARD SINGLE-LINE DIAGRAM entry tool in ***Print preview*** mode.

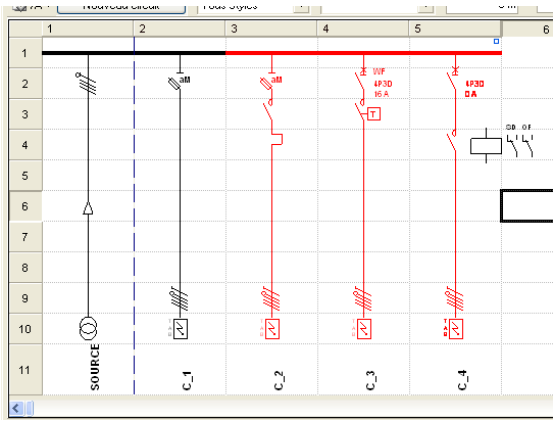
In addition to the possibilities offered by Caneco BT, like creating new styles, creating circuit blocks, creating new symbols, etc., a number of more advanced features are also available:

- Inserting associated circuits in incoming feeders
- Management of parameters for associated circuits
- Ground bar management
- Management of terminals and their numbering
- Automatic marking of circuits and components
- Support of the EN 60 082 marking standard
- Insertion of additional diagrams for each distribution (control, layout, cabinet front panel).
- Definition of the specifications of a cabinet and print-out of the associated manufacturing sheet.
- Insertion of auxiliary diagrams associated with protections Diagram

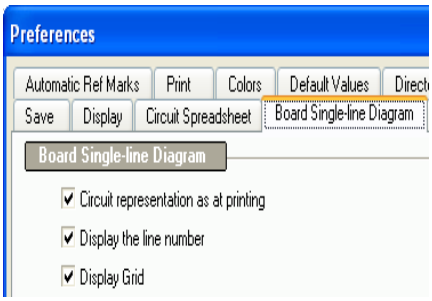
16.2 Diagram representation

16.2.1 Representation as printed (large display)

In this representation, the diagrams (circuits + associated circuits + inserted images) are displayed as at printing.

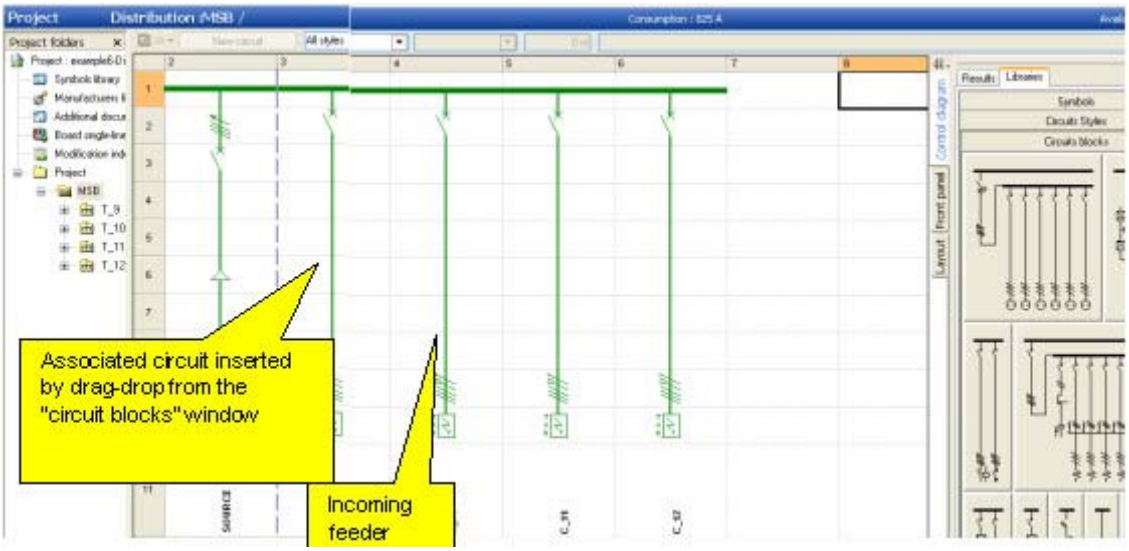


The choice is made in the «Board single-line diagram ‘tab from the “Preferences» window’



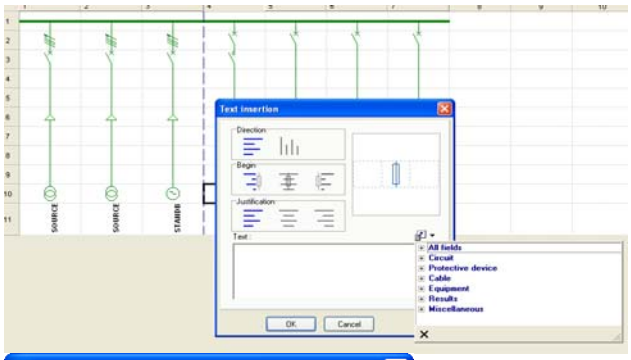
16.3 Insertion of associated circuits in incoming feeders

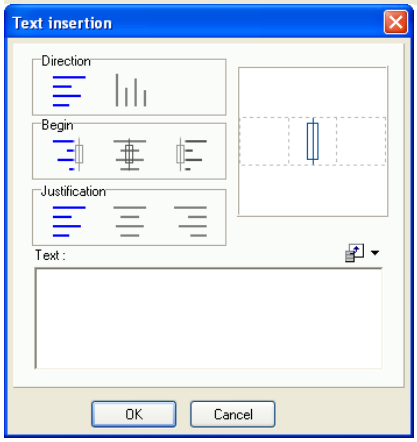
Create the associated circuit using symbols from the library and store it with the circuit blocks.
The drag-drop command allows it to be inserted in the feed.



16.4 Enrich the symbol text

Defining texts associated with symbols is possible in Caneco BT. 'Text insertion' window is used to enter a symbol with circuit parameters.





Choose the parameters you want to display nearby the symbol

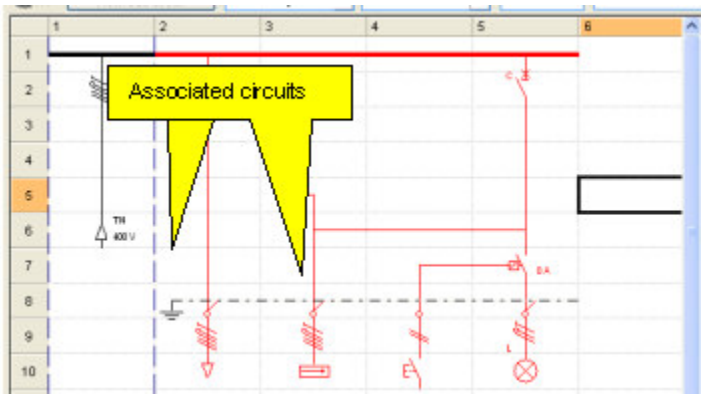
Selected parameter is validated (in this case, circuit ref. mark)

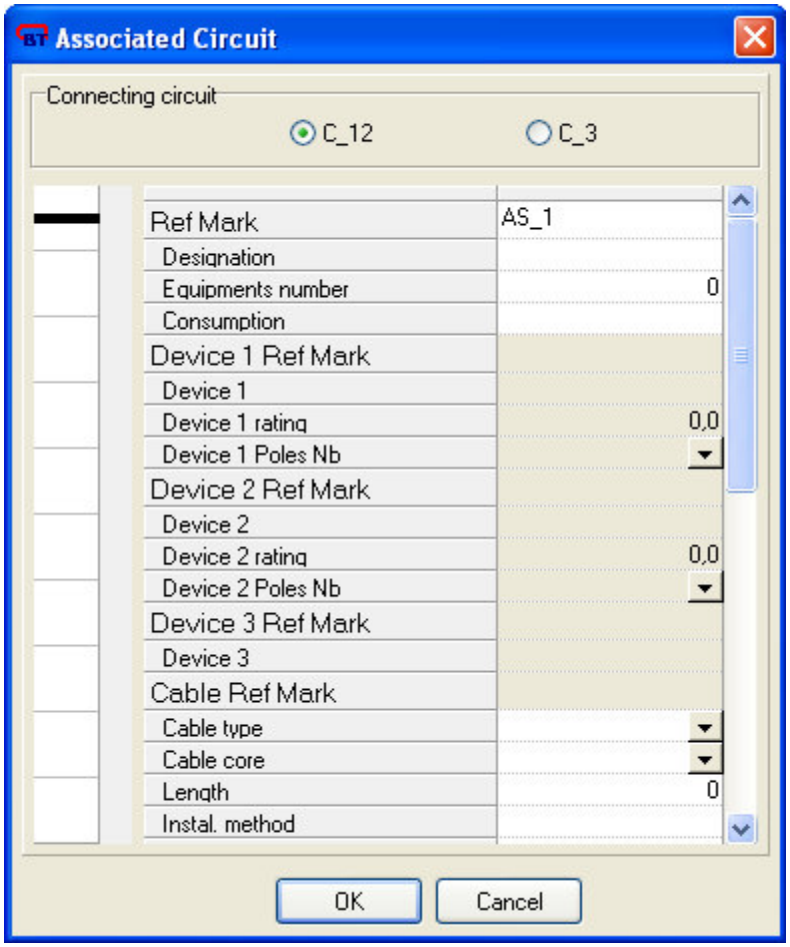
Then, set the field alignment.

16.5 Parameter management for associated circuits

You can enter parameters corresponding to the circuit associated with a power circuit: Ref mark, consumption, trunking characteristics, terminal wiring, terminal numbers, etc.
The window allowing these different values to be entered is displayed by double-clicking on the associated circuit.

- Example: ***Lighting*** + ***BASL***





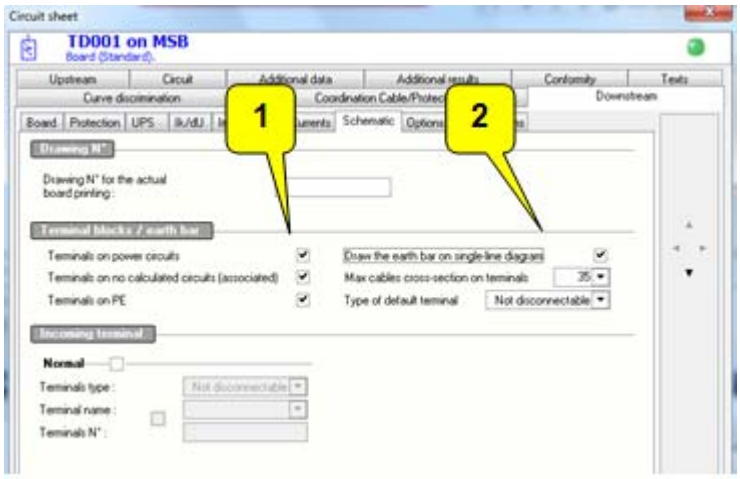
The characteristics of the associated circuit will be defined in the window opposite, displayed by double-clicking on the associated circuit

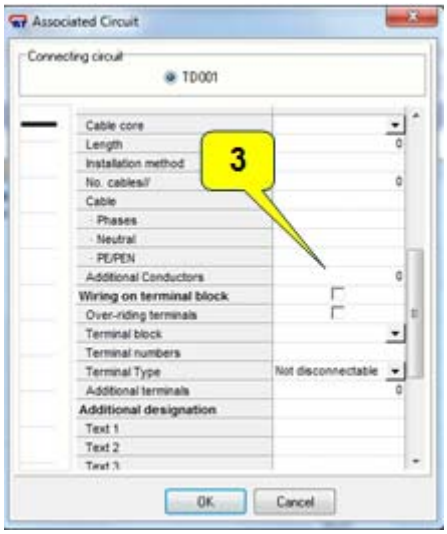
16.6 Management of ground bar and terminals

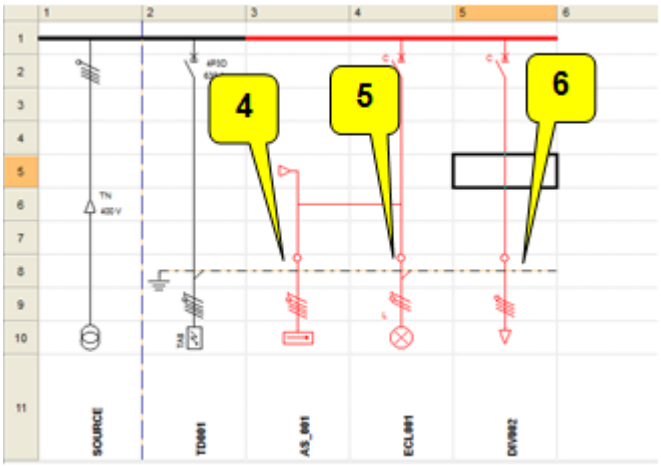
16.6.1 Representation of ground bar and circuit terminals

Caneco BT offers the ability to draw the ground bar and circuit terminals (power circuits and associated circuits).
It is also possible to number the circuit terminals (power circuits and associated circuits).
Insertion of the ground bar and the circuit terminals is done from the «Schematics» option of the «Downstream» tab of a distribution sheet.

Where:
Click on the buttons on the 'Terminals' bar:





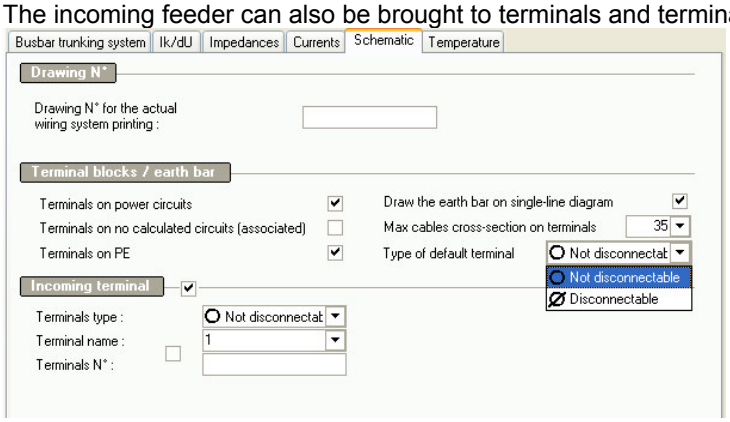


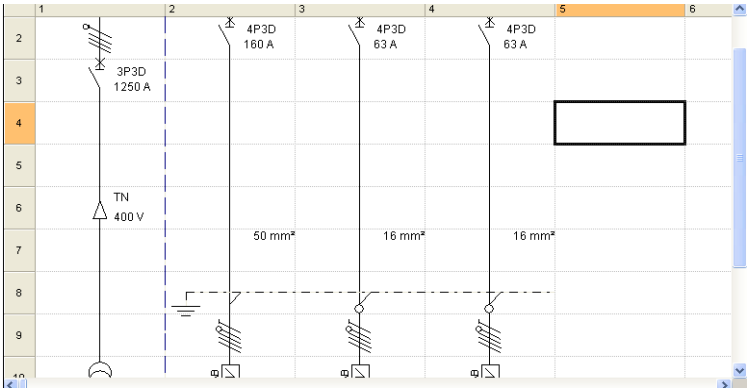
- The terminals will be drawn if options are checked (1).
- The earth bar will be drawn if the option is checked (2).
- The terminals on the associated circuits will be drawn if options are checked (3).
- Associated circuit wired on terminal block.
- Terminals + earth (5)
- The circuit does not include a PE conductor: only the terminals are shown (not the earth) (6).

16.6.2 Terminal block management

A terminal block is assumed to be infinite. The following technologies are available:
Switchable or non-switchable terminals
The default terminal type and the maximum cross-sections on terminals can be defined in the «Schematics» tab of the «Distribution» sheet
Circuit terminals with cross-sections greater than the maximum are not drawn

The incoming feeder can also be brought to terminals and terminal numbers allocated to it.





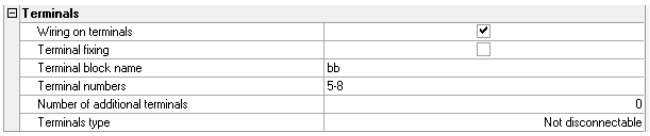
For this circuit, the terminals are not drawn since the cross-section is > 35 mm2

16.7 Numbering terminals

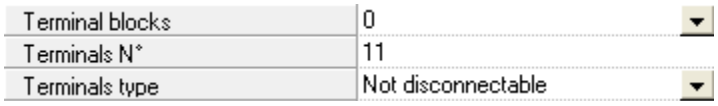
16.7.1 Numbering power circuit terminals

Manually from the 'Additional data' tab on the power circuits sheet.

Select the number of the terminal block in the «Terminal block name» field.
Specify here the terminal numbers in the «Terminal number» field

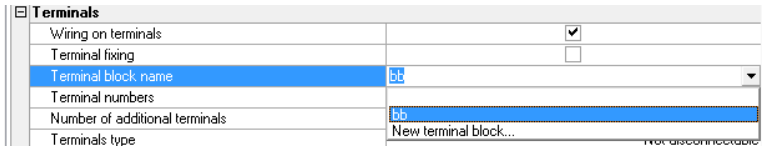


Manually from the associated circuits sheet.

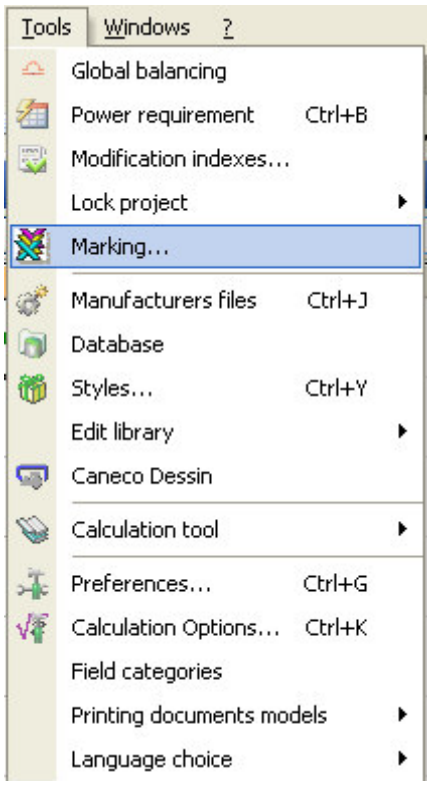


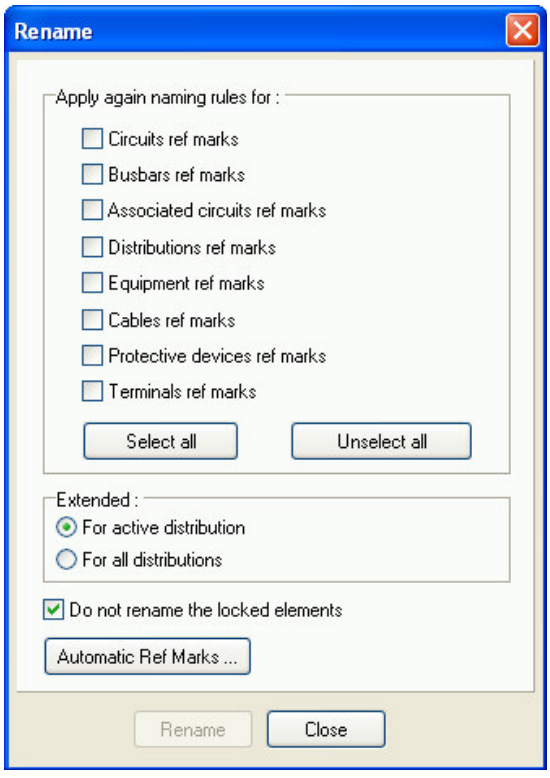
From version 5.4 onwards, you have the possibility of assigning several different Terminal Block Names within the same cabinet

Terminal name for lighting
Terminal name for socket outlets, etc.

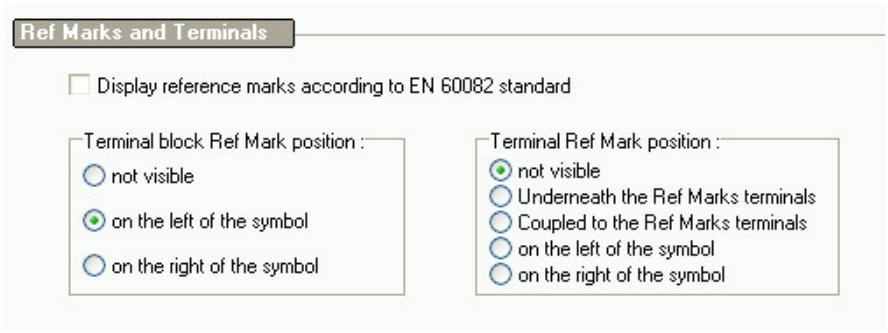


Automatically using the «Marking» command in the «Options» menu

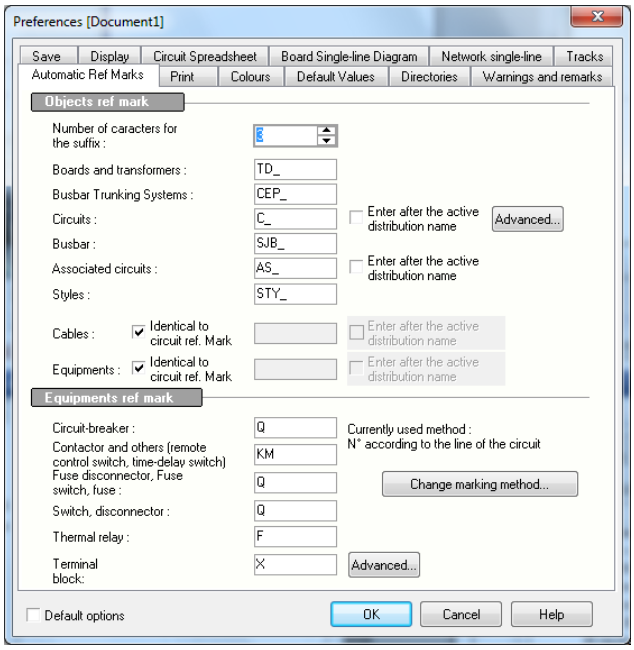




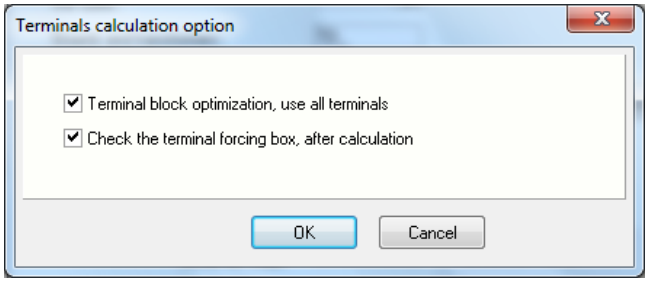
The position of the terminal numbers can be defined from the «Board single-line diagram» tab of the «Preferences» window.



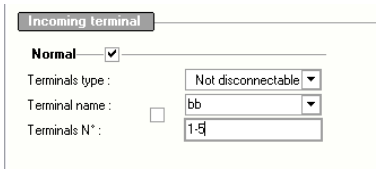
The prefix of the terminal block (1) ref marks can be defined from the «Board single-line diagram» tab of the «Preferences» window



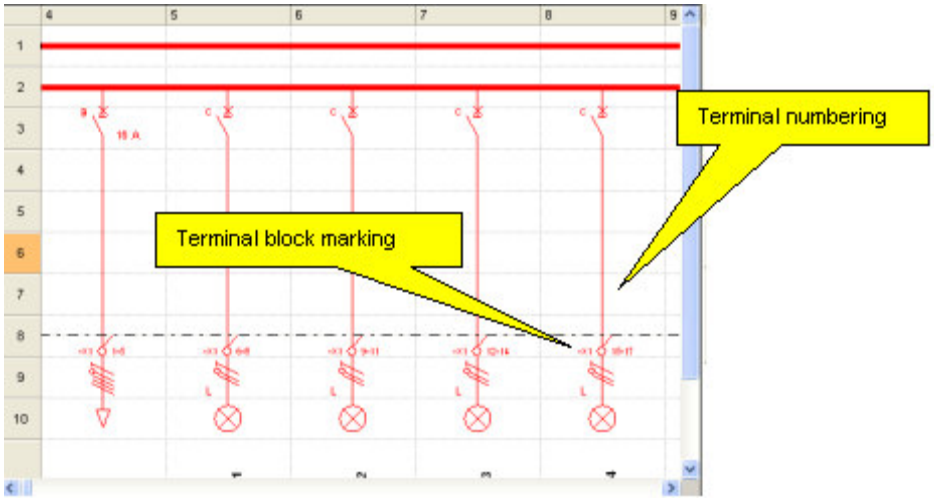
The «Advanced» button allows you to select the terminal management options.



Terminals forced after circuit calculation



Example of terminal block marking and terminal numbering.



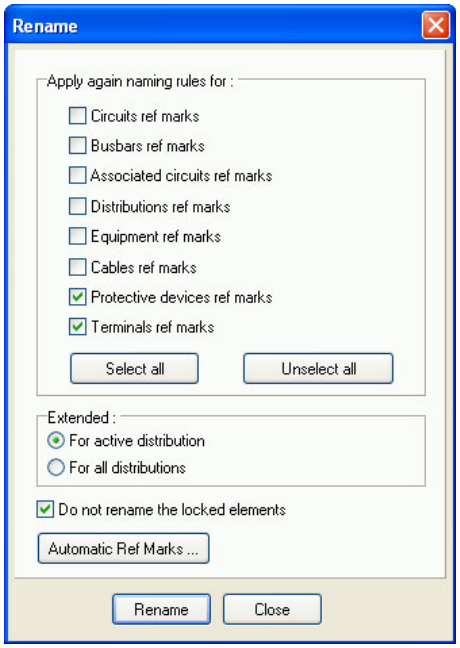
16.7.2 Numbering associated circuit terminals

The number of terminals for an associated circuit is calculated as follows:
N = n1 + n2
Where:
n1 is the number of conductor resulting from Caneco BT's interpretation of the number of conductor of the connecting cable you have defined in the window. If you have defined a 2×1.5 cable for the connection with a wall-mounted P/B within the installation, Caneco BT deduces that n1 = 2 (as many terminals as there are conductors). If you have written 5G1.5, Caneco BT deduces from this n1 = 4 + 1 PE conductor which will be connected to the earth bar, possibly with intermediate terminals, depending on terminal option you have selected.

n2 is the number of additional terminals defined in the associated circuit window.

Automatic Marking

The «Marking» command in the «Options» menu displays the «Rename» window.



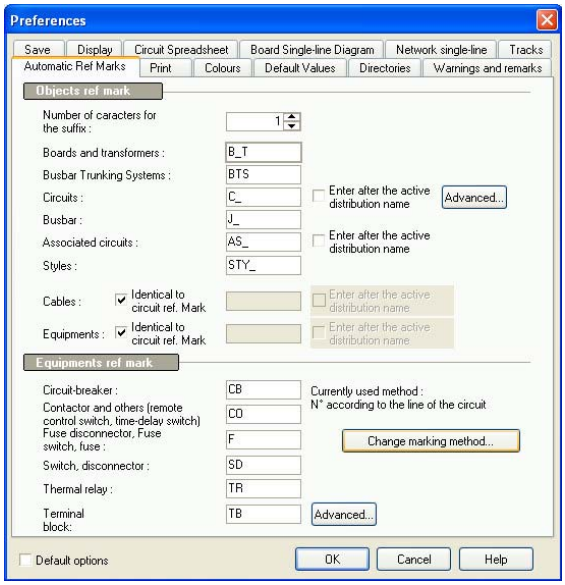
The window allows automatic marking of:

- Circuits
- Equipment
- Protection devices
- Terminals

Various options allow the user to define the operation of the «Rename» function.

.

The «Automatic ref marks» button activates the automatic prefix definition window

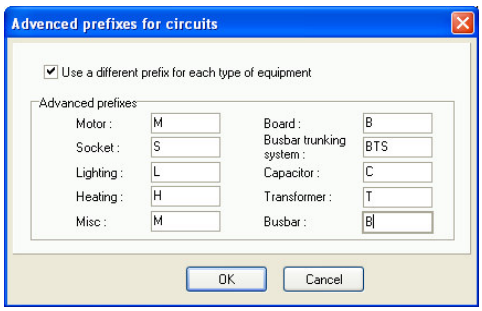


Object ref marks» section»:
Defines the prefixes for different objects
Various options are available to enhance object marking.

The «Advanced» button activates the «Advanced
circuit prefixes» window to enable prefixes to be customised for each type of equipment

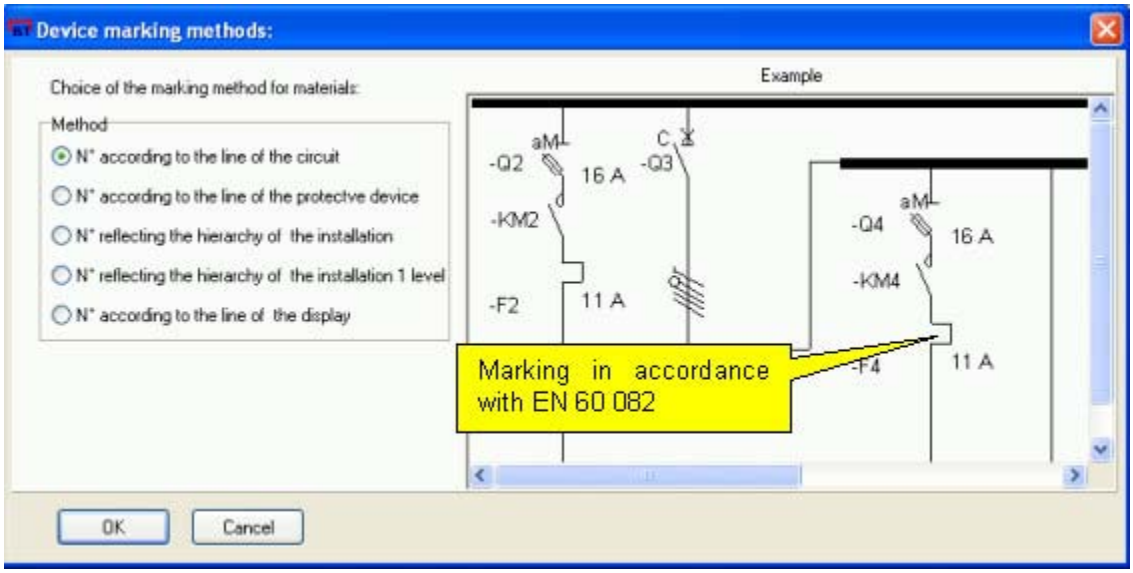
***«Equipment ref marks»* section:**
Allows you to define prefixes for each type of equipment.
Default prefixes comply with the EN 60 082 marking standard

The «Change method of marking» button activates the «Equipment marking method» window to allow a marking method to be selected (see next page).

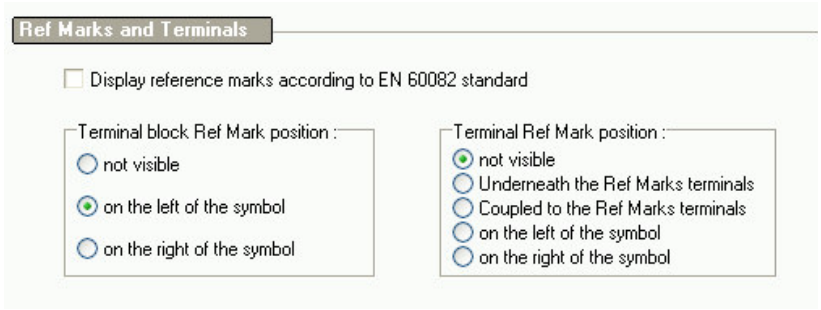


16.8 Methods for marking equipment:

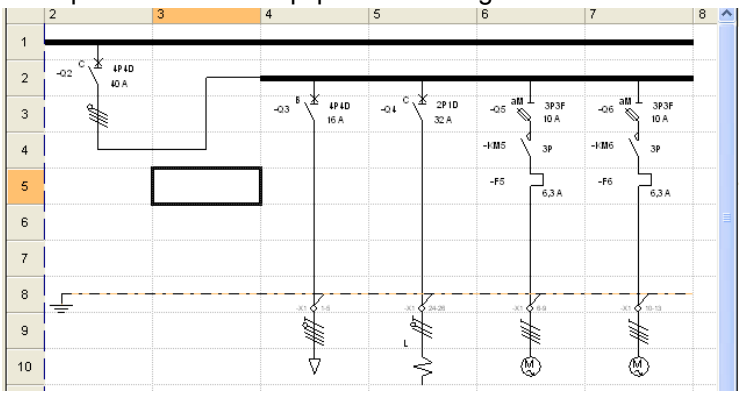
This is where a marking method is selected.
The zone on the right shows a diagram associated with the selected marking method.



The «Display ref marks in accordance with EN 60 082» option in the «Board single-line diagram» tab of the «Preferences» window prefixes with a (-) sign the equipment ref marks according to the EN 60 082 Standard.

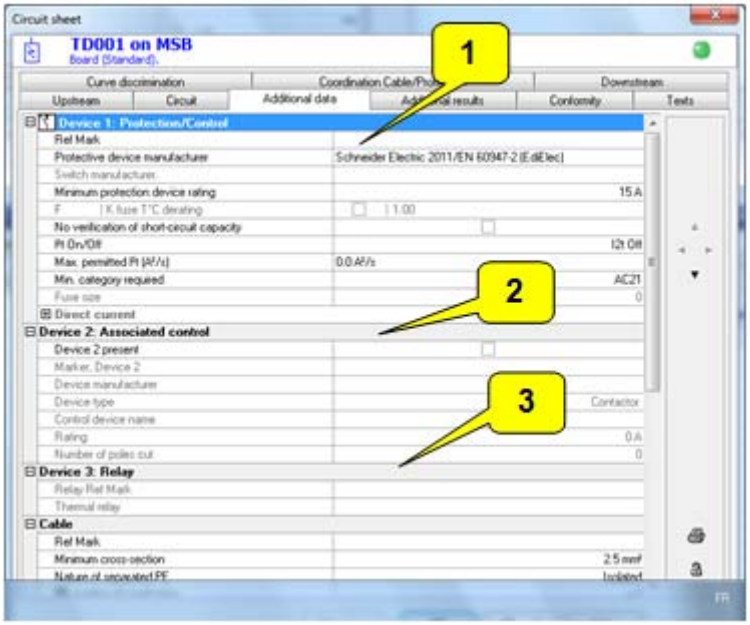


Example of automatic equipment marking



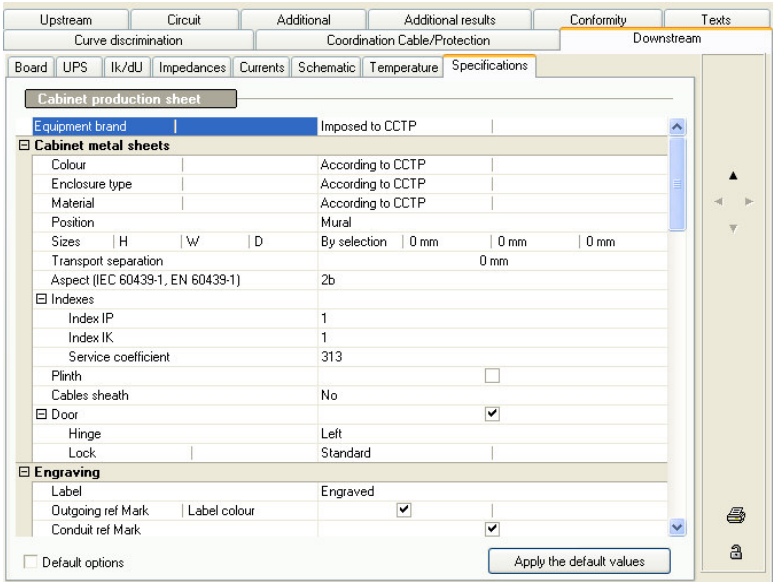
Equipment ref marks can be entered manually from the «Additional data» tab of the circuit sheet.

- 1: Ref mark device 1
- 2: Ref mark device 2
- 3: Ref mark device 3



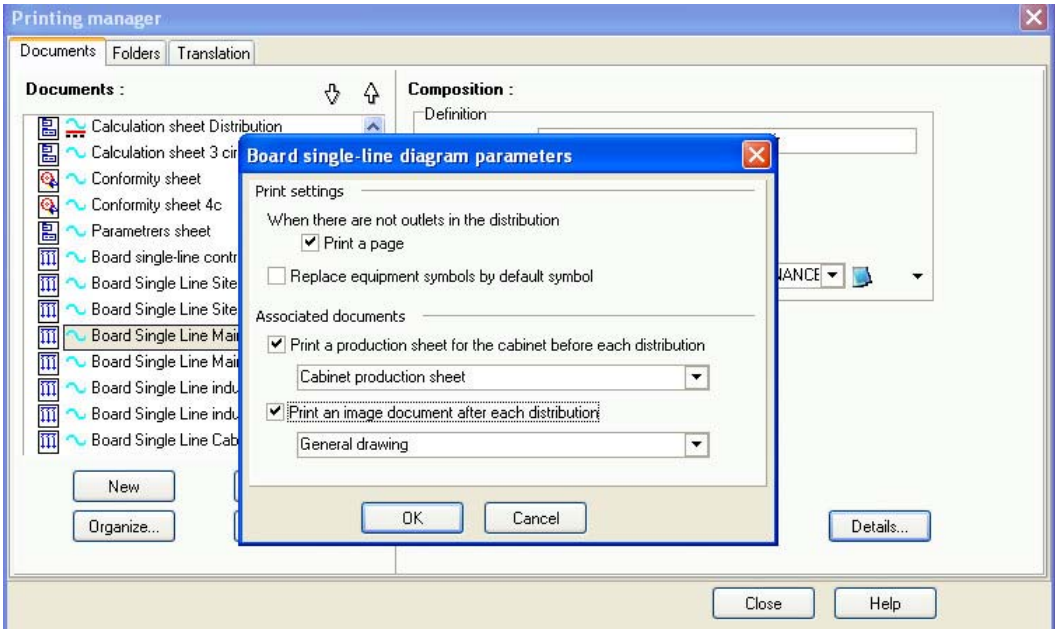
16.9 Specifying the distribution enclosure

The characteristics of a distribution enclosure can be defined in the «Specifications» tab of the «Board» sheet.

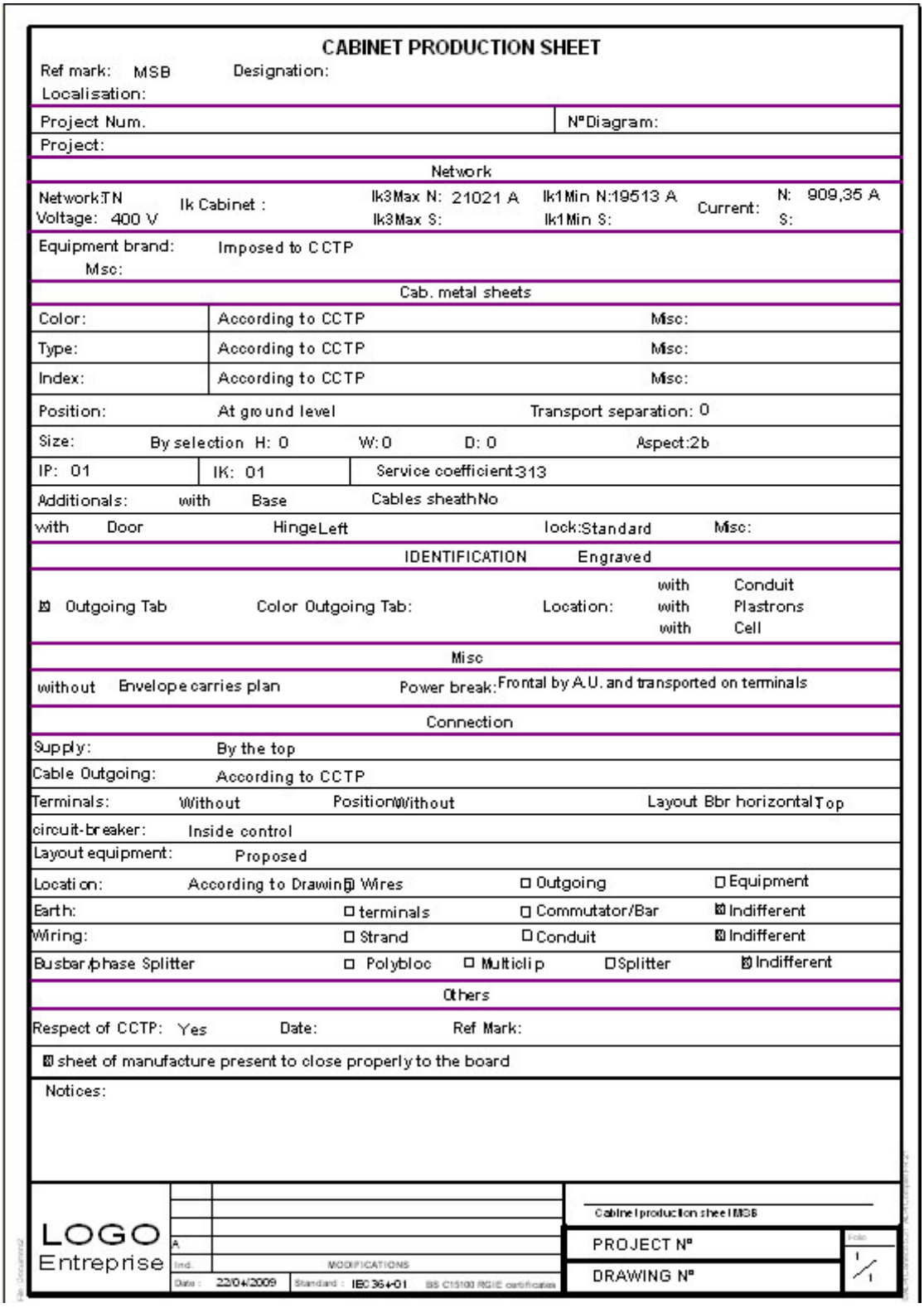


The user can then print a manufacturing form for each cabinet.

The choice to print the manufacturing form is made from the «Board single-line diagram parameters» which is opened by clicking the «Details» button associated with the single-line diagram in the «Document» tab of the «Print manager» window.



The following illustration shows the «cabinet manufacturing form» as it will be printed..



CABINET PRODUCTION SHEET

Ref mark: MSB Designation:
Localisation:

Project Num.	N°Diagram:
Project:	

Network

Network:TN Voltage: 400 V	Ik Cabinet :	Ik3Max N: 21021 A Ik3Max S:	Ik1Min N:19513 A Ik1Min S:	Current:	N: 909,35 A S:

Equipment brand: Imposed to CCTP
Misc:

Cab. metal sheets

Color:	According to CCTP	Misc:
Type:	According to CCTP	Misc:
Index:	According to CCTP	Misc:

Position: At ground level Transport separation: 0

Size: By selection H: 0 W: 0 D: 0 Aspect:2b

IP: 01 IK: 01 Service coefficient:313

Additionals: with Base Cables sheath No

with Door Hinge Left lock:Standard Misc:

IDENTIFICATION Engraved

☒ Outgoing Tab Color Outgoing Tab: Location: with Conduit
with Plastrons
with Cell

Misc

without Envelope carries plan Power break: Frontal by A.U. and transported on terminals

Connection

Supply: By the top
Cable Outgoing: According to CCTP
Terminals: Without Position Without Layout Bbr horizontal Top
circuit-breaker: Inside control
Layout equipment: Proposed

Location:	According to Drawing	☒ Wires	☐ Outgoing	☐ Equipment
Earth:		☐ terminals	☐ Commutator/Bar	☒ Indifferent
Wiring:		☐ Strand	☐ Conduit	☒ Indifferent
Busbar/phase Splitter		☐ Polybloc	☐ Multiclip ☐ Splitter	☒ Indifferent

Others

Respect of CCTP: Yes Date: Ref Mark:

☒ sheet of manufacture present to close properly to the board

Notices:

LOGO Entreprise

Ind.	MODIFICATIONS
A	
Date : 22/04/2009	Standard : IEC 364-01 BS C15100 RGIE certificates

Cabinet production sheet MSB
PROJECT N°
DRAWING N°
Folio 1/1

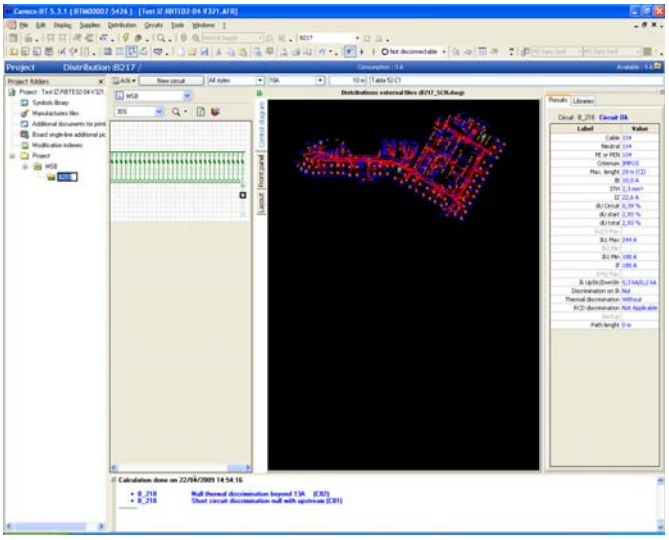
16.10 Insertion of additional diagrams for each distribution

The following additional diagrams can be associated with each distribution:

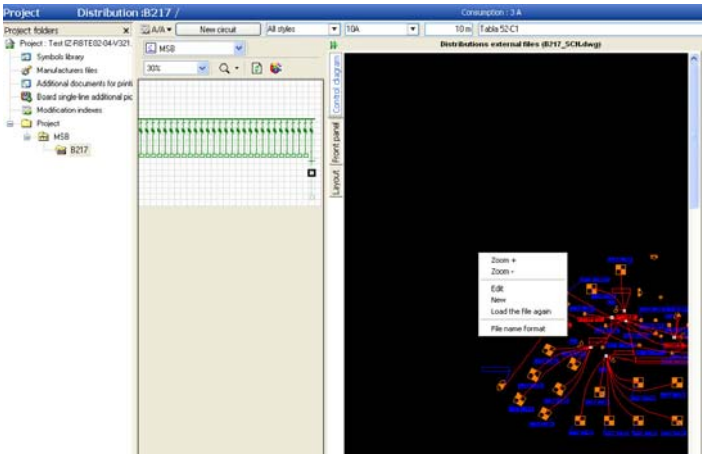
- Cabinet layout
- Front panel of cabinet
- Control diagram

These diagrams can be created in formats such as DWG, wmf, etc.
The files containing the diagrams must have a name identical to the distribution ref mark followed by a suffix corresponding on the type of diagram to be inserted (_FAV, _IMP or _SCH).
They must be saved in the same folder as the project.

- Example of a control diagram in DWG format associated with TD1 distribution panel



A contextual menu allows a certain number of commands

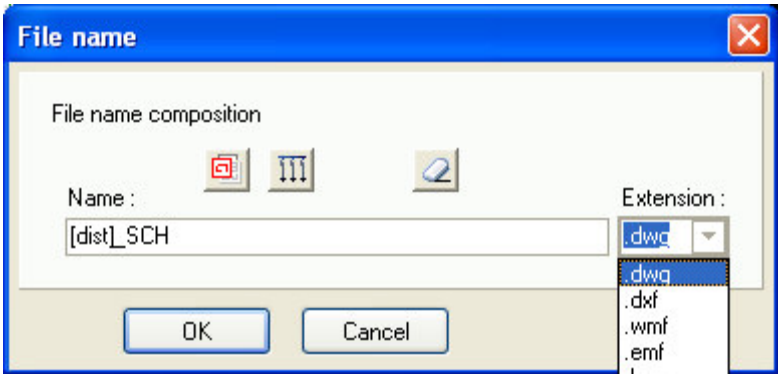


The «Edit» command opens a diagram in the default editor (e.g. AutoCAD)

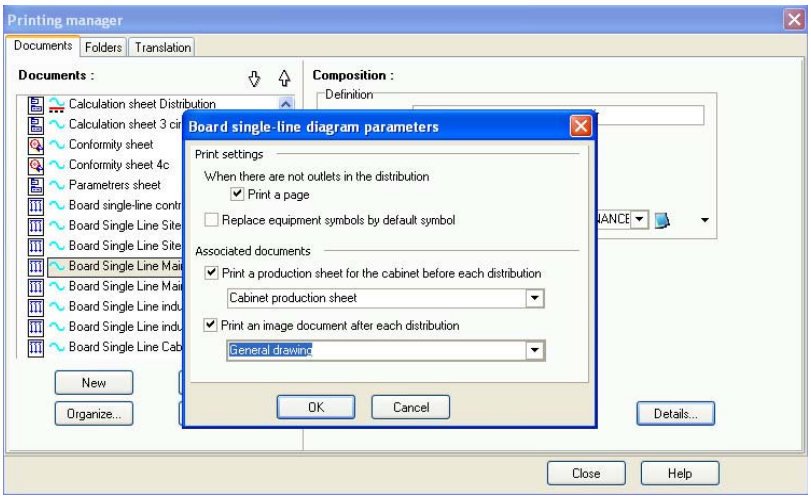
The «New» command opens a drawing editor to create the required diagram.

The «Reload file» allows an image to be updated.

The «File name format» command opens a window for defining the composition of a file name and the file extension.

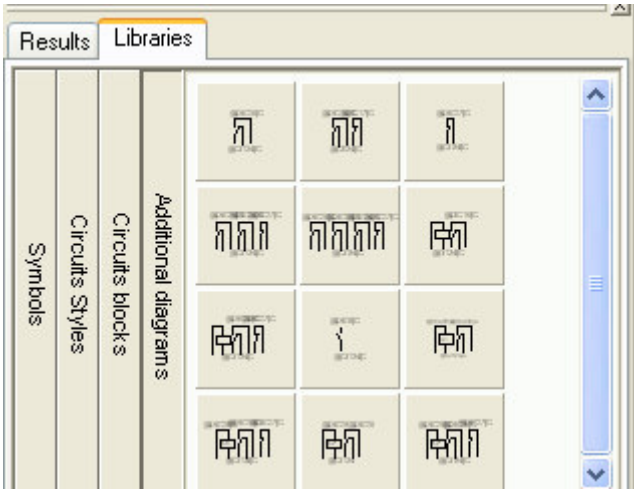


The additional diagram to be printed is made from the «Board single-line diagram parameters» which is opened by clicking the «Details» button associated with the single-line diagram in the «Document» tab of the «Print manager» window.



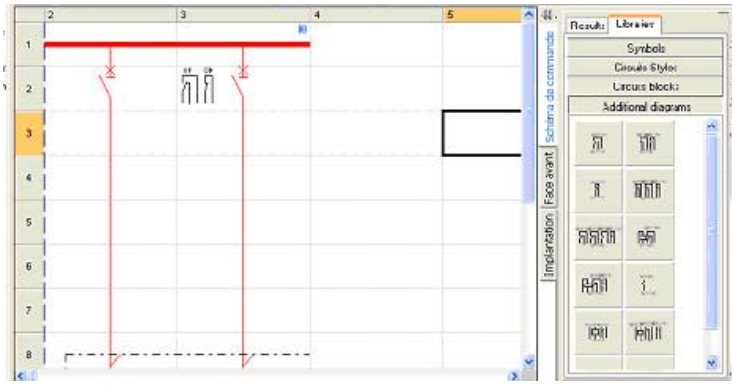
16.11 Inserting additional diagrams associated with protections

A library of additional diagrams representing auxiliary contacts is available from the «Additional diagrams» tab of the library.

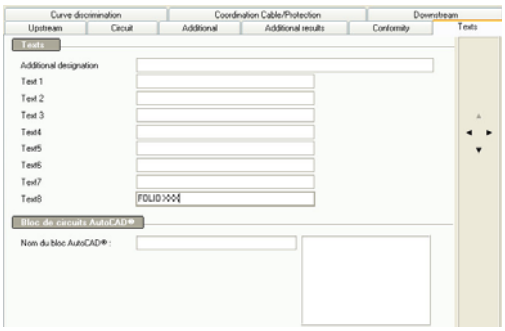


The additional diagrams may be in DWG or wmf format and are found in the following folder:
C:\Documents and Settings\All Users\Application Data\ALPI\Caneco BT\5.4\ENG\Schema

An additional diagram is inserted by drag and drop using the «Board single-line diagram» entry tool.

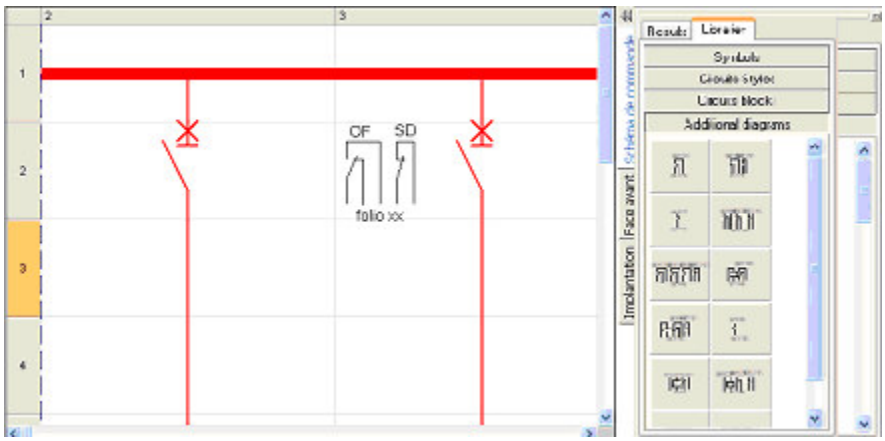


Additional diagrams have an attribute to specify the sheet in the control diagram where their wiring will be represented.
This information is defined in the «Text 8» field of the «Circuit sheet text» tab (see below).



The sheet number is entered in the Text 8 field

Result obtained


2
3
1
2
3
4
CF
SD
folio xx
Implantation
Face avant
Results
Library
Symbols
Circuits styles
Layouts blocks
Additional diagrams

17 Printing

17.1 General

Caneco BT produces *documents* or *folders* according to standard or customizable *models*.

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To customize printing content

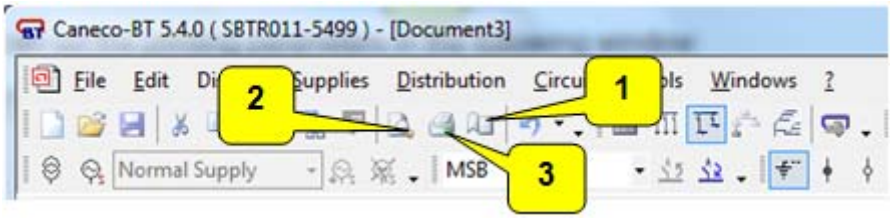
you must use the Printing Models / Documents Models or Printing Models/Folders commands from the Tools menu.

To run printing,

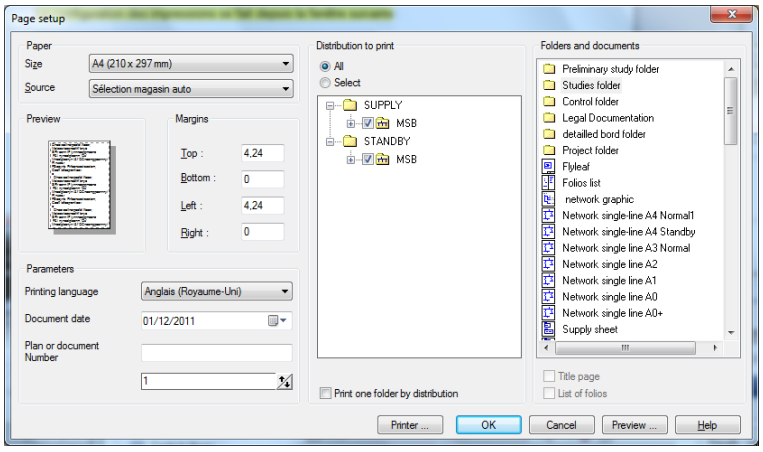
Vous devez vous servir des commandes figurant dans le menu Fichier:

- Page setup
- Preview + Button « Setup »
- Print

or from Tool Bar: Buttons « Preview « (1) or « Page Setup « (2) or « Configure » (3)

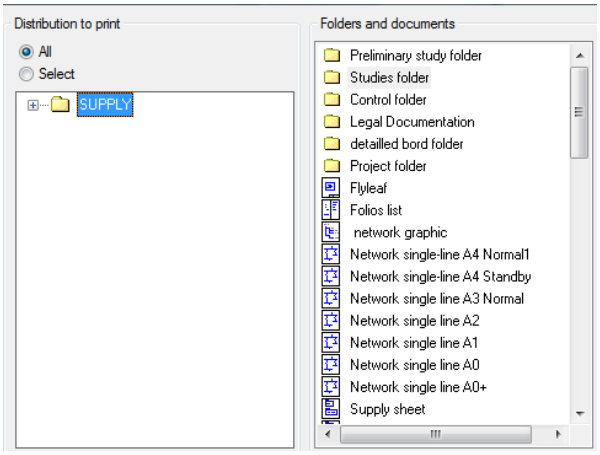


You can set the printing parameters in the following window:



17.1.1 Print setup

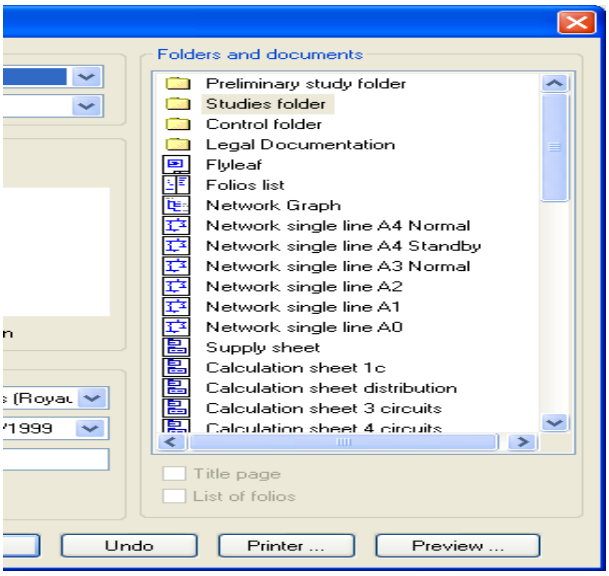
Caneco BT enables various document editing modes:
Global editing of given folder content (see Folders models)



- Select the folder to edit and Documents».

- Select «All» option in the zone

17.1.2 Editing a folder for selected distributions

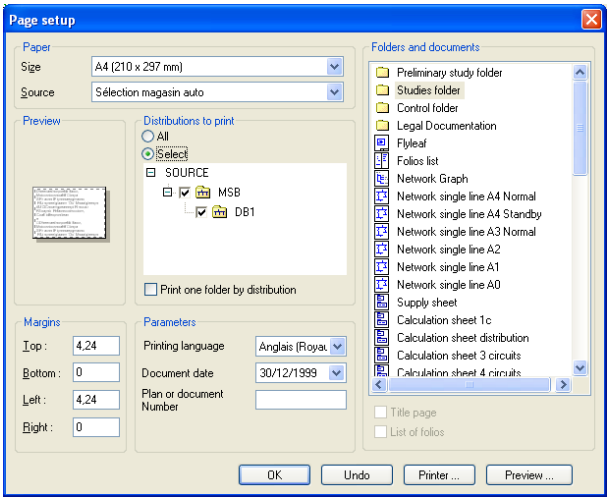


- Select the folder to edit in the window « Folders and Documents ».

- Click on option « Select « in the zone Distributions to print «

- Select the distributions to print in the tree structure.

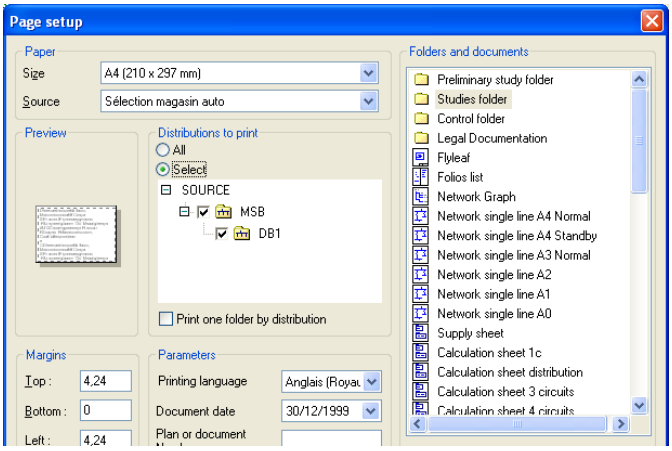
17.1.3 Editing a document type



- Select the document to edit in the window « Folders and Documents ».

- Select distributions to edit.

17.1.4 Editing a folder by distribution



Caneco BT enables to edit a folder by distribution. Editing will have as many folders as selected distributions.

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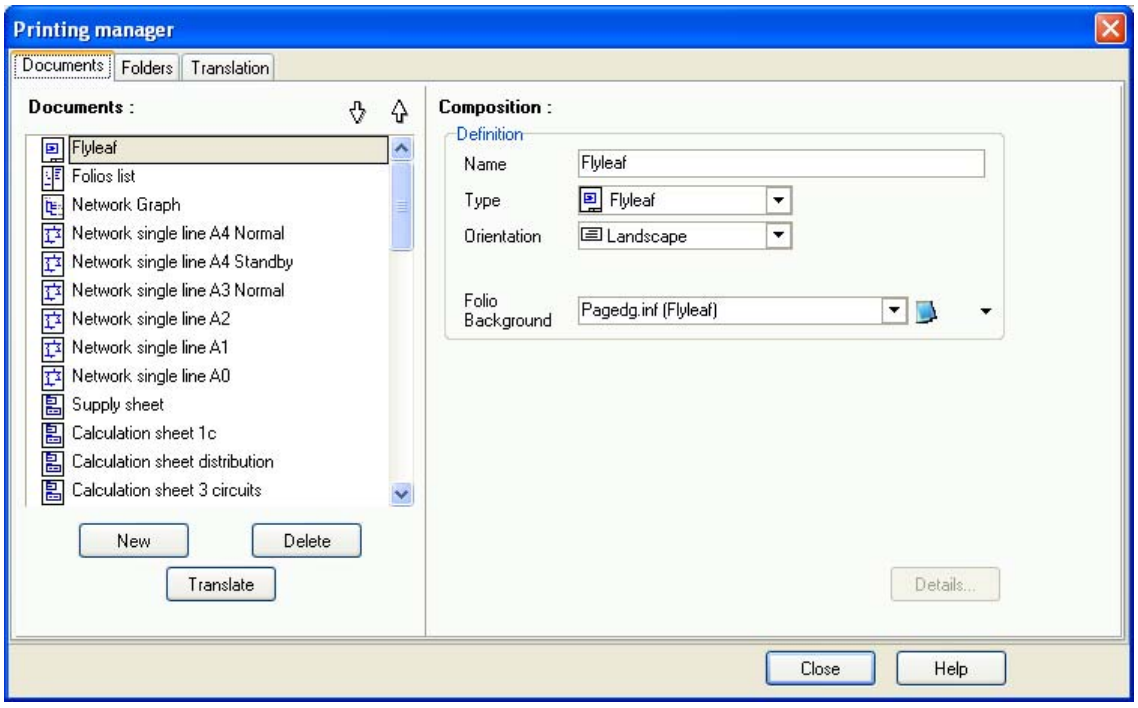
17.2 Documents models

This command of Option menu is used to work with documents models given, personalise documents models (Customisation Pack).
A document model is a model which characterizes a printed document: presentation, content...

The command opens the following window:



17.2.1 Composition

Configures the selected or created mode.

Definition topic

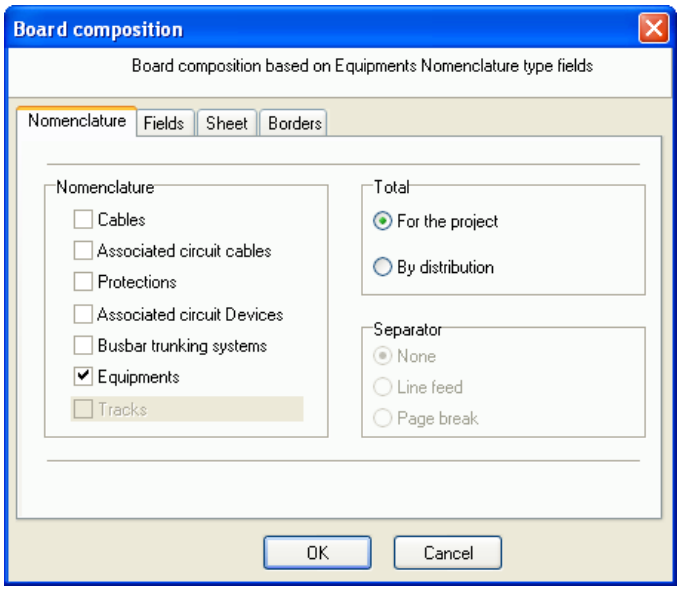
Name: Name of the document model used to select it for printing.
Type: This is the document printing type
The different types are:

N°	Document type	N°	Document type
1	Flyleaf	14	Nomenclature
2	List of folios	15	Power requirement
3	Supply	16	Distribution tree
4	Circuits	17	Tracks
5	Boards	18	Discrimination
6	Transformers	19	Compliance
8	Busbar trunking system	20	Curve I^2t
9	Sheets		
10	General single-line diagram		
11	Board Single-line Diagram		
12	Text File		
13	Image File		

Orientation: Portrait or landscape
Folio background: Choice of the Folio background.

17.2.2 Details button

To choose the document setup.



17.3 Print settings

17.3.1 Caneco BT offers the following printing possibilities: The possibility of creating 'text' document templates in enriched 'rtf' (rich text format) format.

This is the exchange format for word-processing applications. Word lets you save document in rtf. This format saves text enhancement features, including in particular customization of fonts and colours.

17.3.2 The possibility of creating 'image' document templates in 'dxf' format

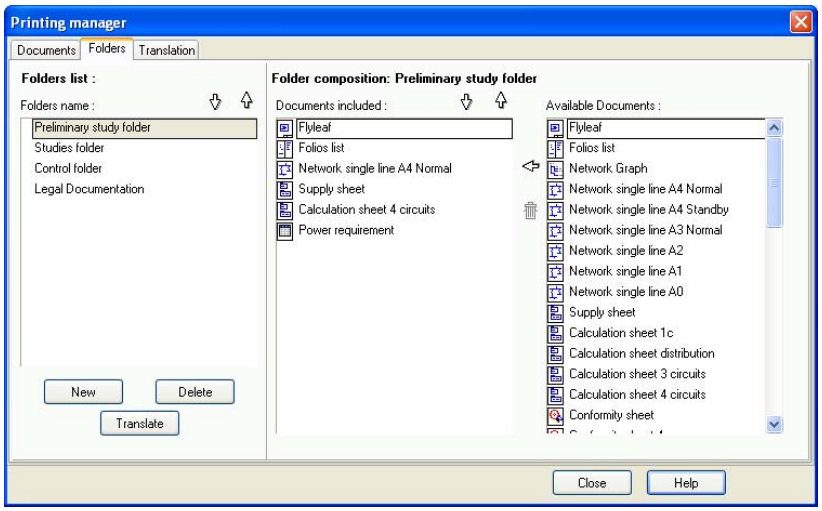
This format is the exchange format for AutoCAD as well as for vector drawing applications.
AutoCAD lets you save document in dxf, which respects the idea of image blocks and layers. Only users with the "Import/export" Pack are able to save a Caneco BT document or folder in dxf.

17.3.3 Printing one folder per distribution

Define a number for each distribution
Insert empty folios
Insert page breaks
Choose the folio numbering from a start value (this lets you add documents in front of the Caneco folder).

17.4 Folder templates

This command of Tools menu (Tools / Print templates / Folder templates) allows to manage and customize the folder templates.
A folder template is a template which differentiates a printed folder. It is set by the list of document templates making it up.



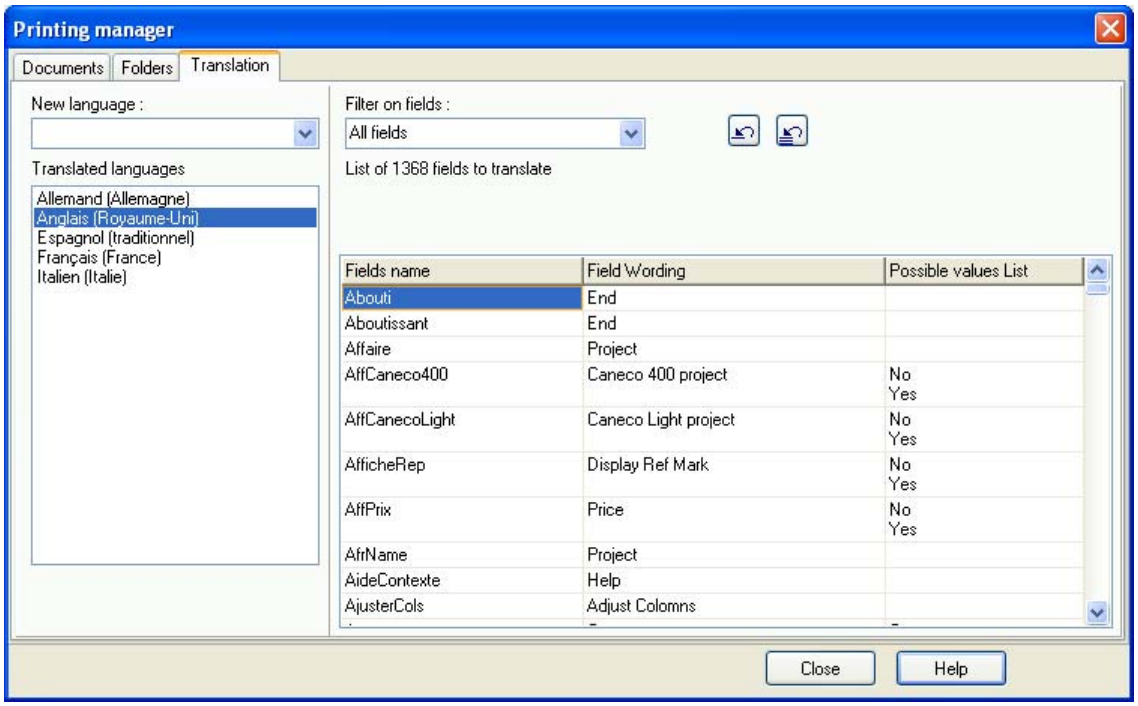
In the active window, you can choose (in the left side) the folder template you want to modify. You may also create (or delete) a template using the New (or Delete) command.

The content of a folder is set choosing the available document templates in the right side of the screen and putting them on the central zone, using the slide - release control.
To remove a document from the folder, choose it and click on the trash can icon.

To change the order of a document in a folder, select it and then use Up and Down arrows on the top central zone of the screen.

17.5 Printing language

This function is operational if **International Pack** is present.

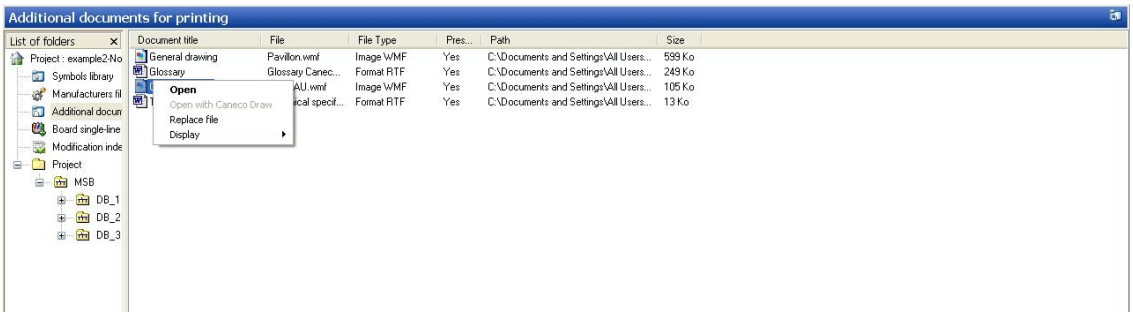


17.6 Documents with external files

For any printing document with an image file (in wmf, dxf, bmp, jpg format) or text (txt, rtf) it is necessary to set the link between this template and the external file. You can see and modify this link in the « project specific documents » of the project tree. To set this link, click-right on the file – link which you attach, for this project, to the Caneco BT document or folder templatel, and use the « Replace file » command.

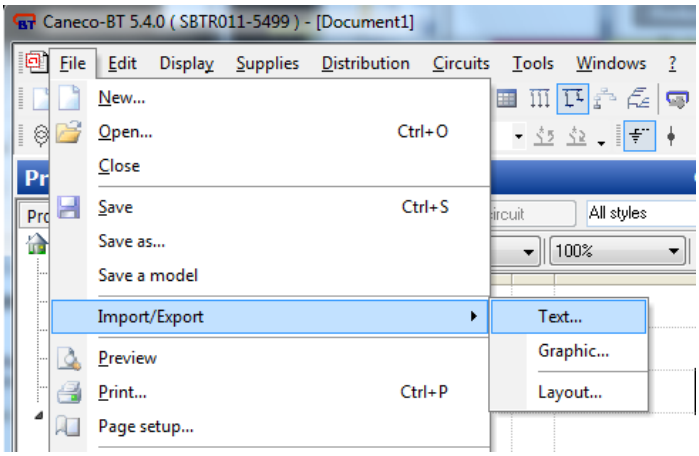
In the example below, you can see the «Chassis plan» document template used in «Decree of 10 October 2000» folder template. Caneco BT notify that the external file is missing (document template is not attached to any other external file).

In this example, you can see a « premises plan with earthing system » document linked to an external file called « track » and whose access path is indicated at right.

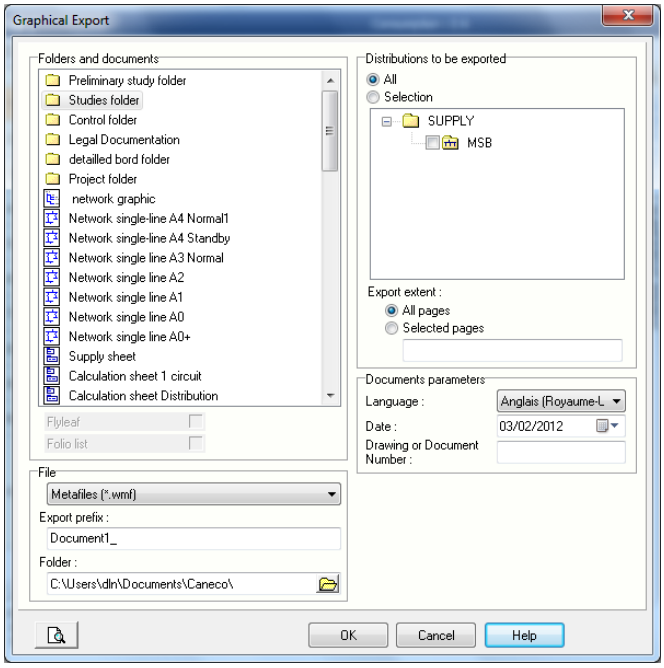


18 Import / Export

Caneco BT offers import and export functions for text and graphics
The commands are accessible from the «File» option in the main menu



18.1 Graphic export (Import/Export Pack)



The graphic export function enables

Caneco BT documents to be exported in wmf or DXF format.

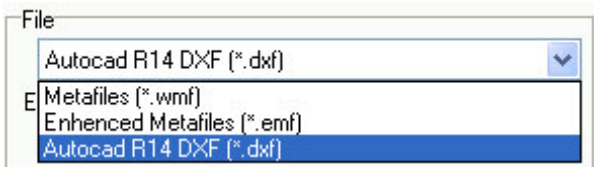
Various options are available for defining the export parameters.

The name of a document to be exported must be preceded by an Export prefix

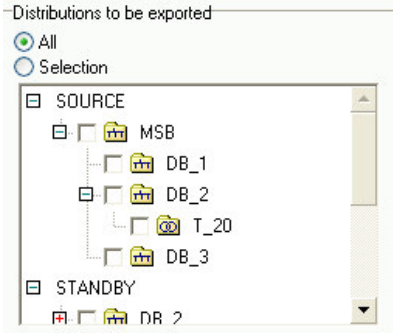
Documents will be exported to a folder defined in the **Folder** field.

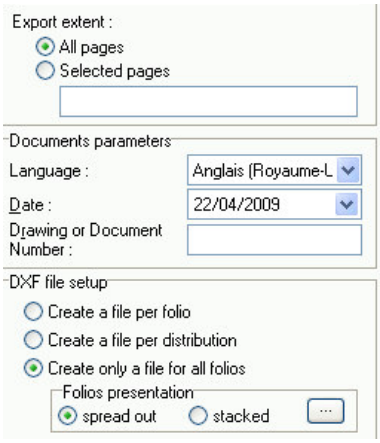
The method for creating DXF files can be selected in the section named **DXF file configuration**

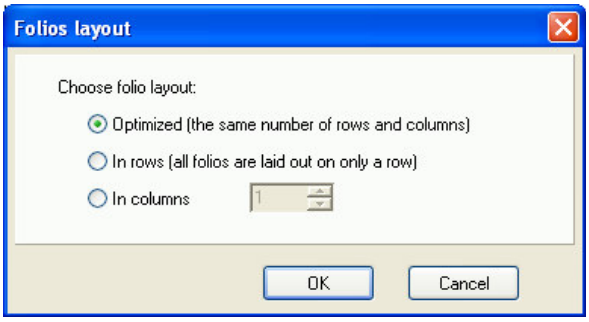
The export format can be defined in the «File» field



Selection of distributions concerned by the export of documents







Different export options can be selected

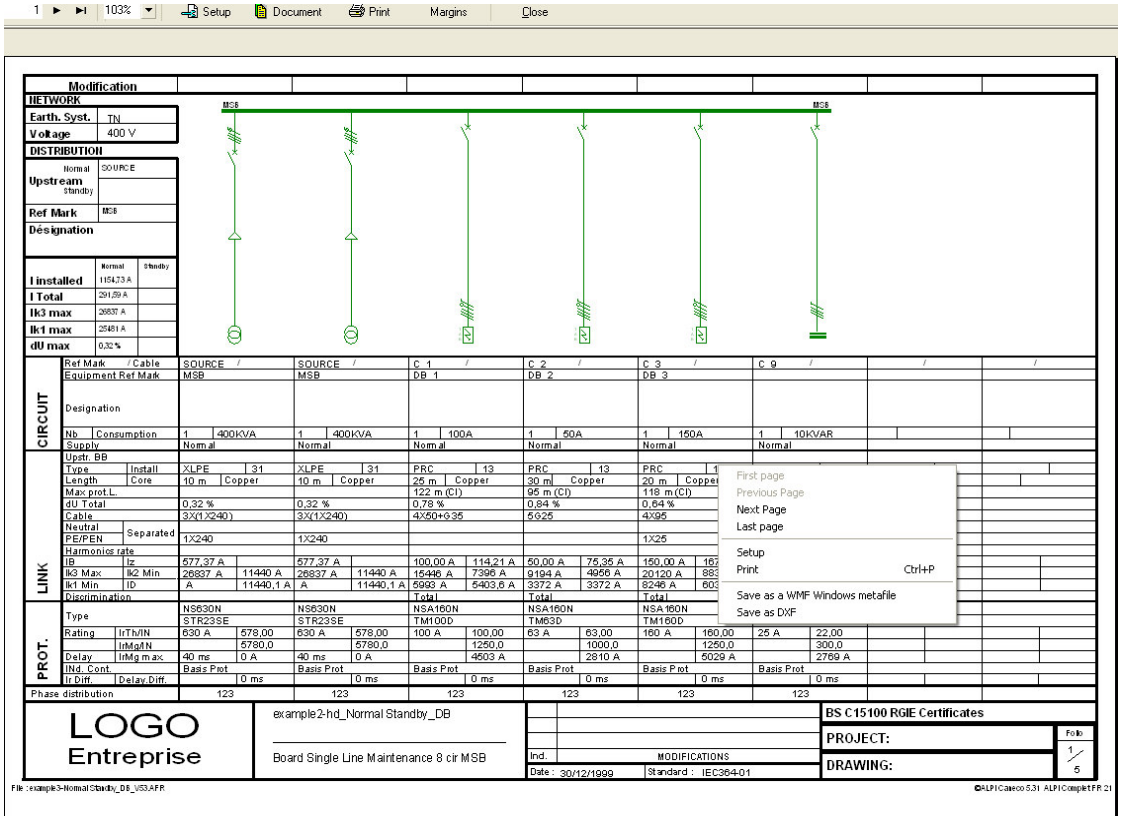
Caneco BT creates files according to the options selected. You can then modify them using a suitable editor (e.g. AutoCAD for DXF files).
When creating a single file for all the sheets, the user can select the presentation and layout of the sheets.

If you wish to complete the Caneco BT diagrams using AutoCAD or another DXF editor, it is advisable to:

- create a special layer for the additions, so as to avoid modifying the original Caneco BT layers
- previously allocate the space necessary in Caneco for the diagram additions
- To this end, you can use **blank pages** function in Caneco BT.

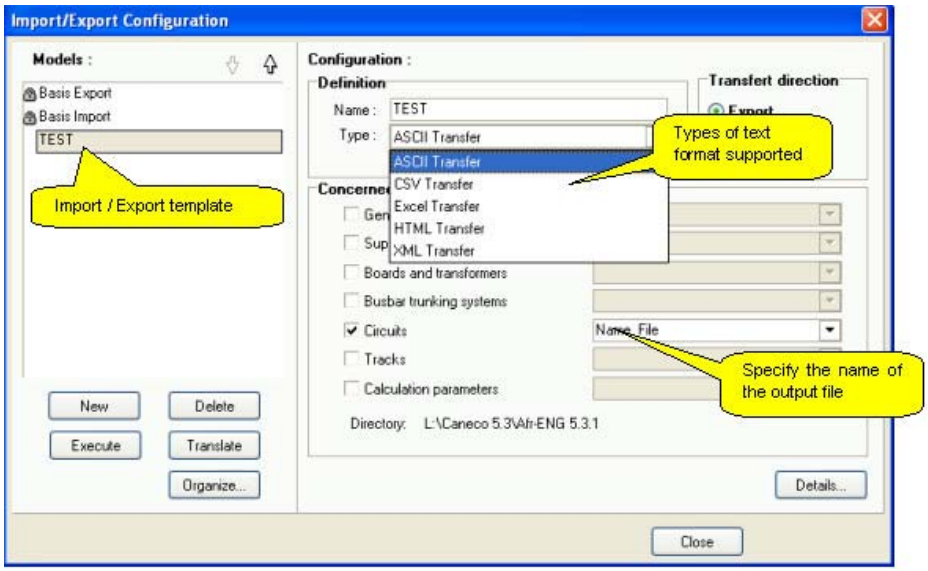
18.1.1 Export a single sheet

A single sheet can also be exported
This requires you to display the print preview for the sheet to be exported. Then request the export of the sheet in DXF format, using the pop-up menu activated by a right click:



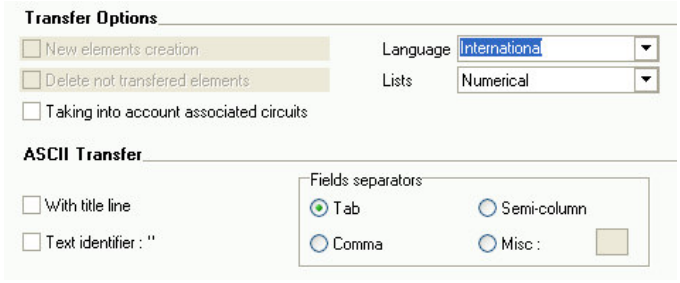
18.2 Text export (Import/Export Pack)

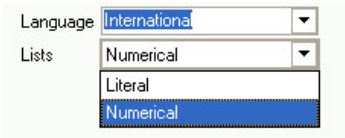
The export text function allows the user to export project data in various text formats.



18.2.1 Procedure:

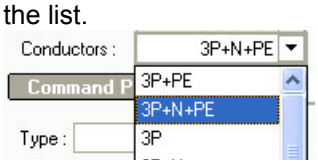
1. Create an export template using the command «**New**»
2. Define the export format in the «**Type**» field
3. Tick «**Export**» in the «**Transfer direction**» area
4. Tick the data to be exported in the «**Concerned data**» area
5. Specify the file name(s) to be associated with the data
6. The «**Details**» button gives access to the setting window for export files
7. Validate the «**Transfer options**» window after defining the transfer options.
8. Activate the «**Execute**» command to create the export files





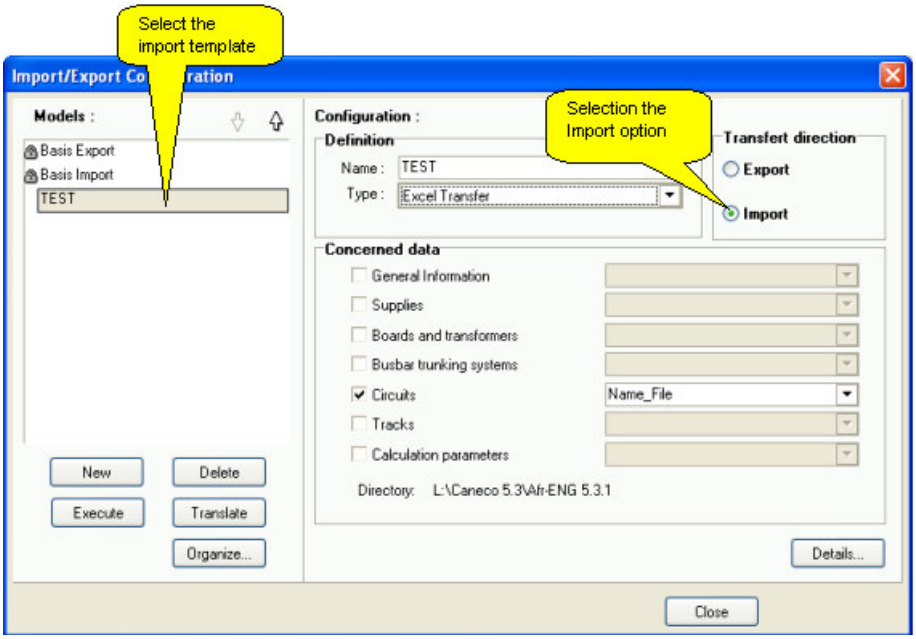
Select «*Literals*» to enter item names
in the Lists field instead of a number
indicating their position in the list.

Example: Conductors scrolling field – the
content 3P + N + PE is the 2nd in the list.



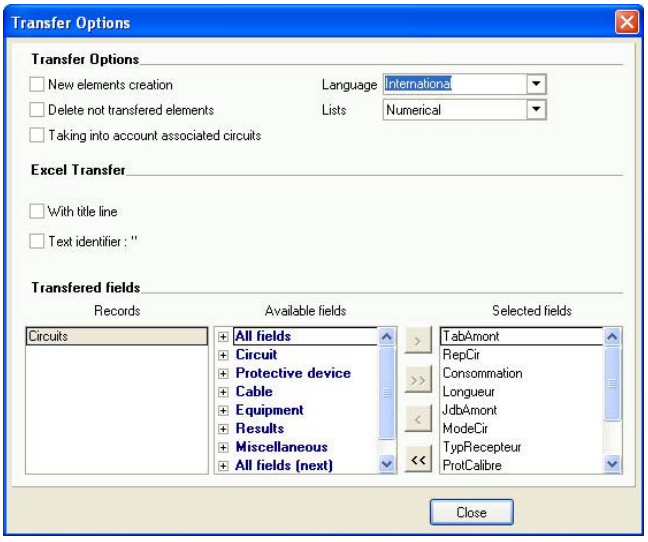
18.3 Text import (Import/Export Pack)

The import text function allows Caneco BT to take account of modifications made in the exchange file (e.g. xls).
This gives valuable flexibility in cases where the user wishes to enter the circuits for a project directly in Excel (modification, addition and deletion of circuits).
Importing the Excel file will apply the necessary updates in the project which is active in Caneco BT (the data imported must of course correspond to the active project)



Procedure:

1. Open the project concerned by the data import
2. Activate the Import Text command
3. Select the required import template
4. Tick «**Import**» in the «**Transfer direction**» area
5. The «**Details**» button gives access to the setting window for import conditions
6. Tick the desired import options (creation of new circuits, etc.)
7. Validate the «**Transfer options**» window after defining the transfer options.
8. Activate the «**Execute**» command to update the data for the active project.



Tick the desired update options

Define the data to be imported

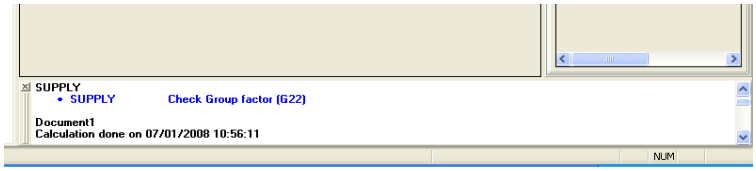
19 Warnings and remarks

19.1 Generalities on warnings and remarks

This chapter concerns warnings and remarks produced by **Caneco BT**.
Warnings and remarks have been identified for easier use. The identifier is made up of one letter followed by figures:

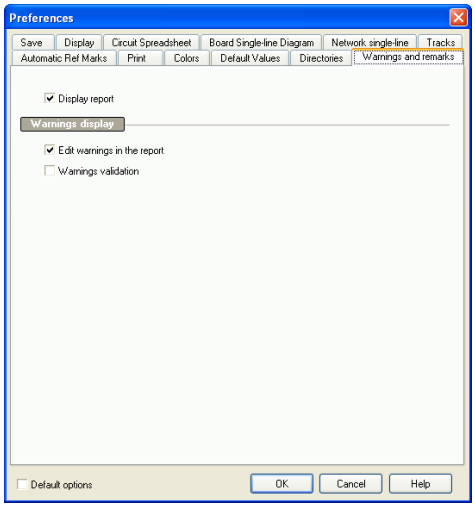
- S ...: general warnings concerning system or **Caneco BT**
- G ...: warnings concerning source supply
- C ...: warnings concerning circuits (cable and protection)
- T ...: warnings concerning boards

Warnings and remarks generated by Caneco BT may be:
saved in the calculation report:



or shown in a dialog box after you have typed a data entry or a calculation. Example:

You can personalise these possibilities by means of *Preferences* command in «Tools» menu:



19.2 Editing of calculation report

Calculation report is a file which fills itself automatically with the data resulting from the last calculations made.
If the file becomes too large Caneco BT will ask you to either save it or erase it.

You may print the report at any time. To do so, put your cursor in the part reserved for report. Click the mouse right button to see the following contextual menu:

- Click «Reach circuit» to see the circuit sheet

Click «Help on remark» to see a help bubble corresponding to the message

19.3 List of warnings and remarks, and suggested remedies

19.3.1 General warnings concerning the system or Caneco BT

S1: Manufacturers directory not found.
Caneco cannot find the manufacturers directory where the manufacturers' files are stored. This directory is normally Caneco BT's BASE sub-directory, the Caneco installation directory. Check it is there, and if not, re-install Caneco.

S2: File format error saving no.?
Project file write error.

S4: File read error.
The file is not recognized by CANECO. Wrong format: check that it is indeed a project file.

S6: Impossible to write changes.
File access is denied: check it is not open in another application.

S7: Invalid manufacturers directory
Attention, it is imperative that the manufacturers' file directory is located below your application.

S8: No manufacturer type file
Check the contents of the CFG directory.

S9: Too many manufacturer type files
You have reached the maximum number of manufacturers' files of the same type.

S10: Impossible... You do not have this module available.
Check in the 'Help' menu under the option 'About' to see if the module/pack concerned is validated.

S11: Standards file (*.NRM) not found
The standards file has been deleted in the CFG directory.

S12: Delete report file?
If you answer 'Yes', the modifications written into the report file will be deleted. If you want to keep these comments, you can print or save this data in a text file (editable using a word-processor for Windows).

S13: The report file is getting large. Delete the file?

When you perform an automatic calculation of your whole project, the 'Print report' option saves a file name_project.rap in the working directory. This file is limited to 64 kB. CANECO asks if you want to delete it or keep it. If you keep it, the most recent modifications will not be saved.

S14: Dongle not found. Unable to continue.

Check that your dongle is properly plugged in to the parallel port on your computer. If your printer is connected, check that its power is on. Contact ALPI to check if your dongle is in the correct format.

S15: No clock available. Quit an application that is running.

The number of clocks available in Windows has been exceeded. Quit an application in order to free up a clock.

S16: File ? empty or does not exist. Select another file.

You are trying to use a file that has not been declared in CANECO's parameters (usually a manufacturer's file).

S17: CANECO has detected a change in format. Convert the project.

You have saved your project using an older version of CANECO. The program proposes converting the project to the new format (recommended).

S18: The file is already open

You are trying to open the same file twice (sharing violation). Warnings and comments about the supply.

S19: Standards file (*.NRM)

The standards file does not contain the standard selected. Check the project parameters and the installation of the application.

19.3.2 Warnings concerning the supply

G1: Calculation impossible, power not in accordance with standard

Change the power of your supply (which does not correspond to the values of the selected file), or opt to determine the characteristics of your supply by Ucc for transformers or by X' and Xo for alternators.

G2: This length may possibly compromise the following calculation

The magnitude of the length may require a protective device upstream of the cable instead of downstream. Check that the voltage drop is not excessive; if it is, override the conductor cross-sections to higher values.

G3: The connection cannot be calculated because of the overridden values

Calculation is prevented by an inconsistency in the overridden values.

G4: Working current too high, the Cross-section cannot be calculated
The current of your supply is too great for Caneco to be able to calculate the connection to it. Try a connection using a busbar trunking system.

G5: Override the number of conductors first

G6: Override values contradict data
Identify and correct the inconsistency between the override values and the data.

G7: only the TT earthing system makes it possible to accept this data
You are entering data that is contradictory with the earthing system being used.

G8: Override cross-section too small
The override cross-section you have entered will not carry the permanent current of your supply. Modify your override value or correct your supply.

G9: Override neutral cross-section too small or calculation not programmed
Modify your override values for the number of neutral conductor and their cross-sections.

G10: Non-standardized cross-section
Modify the cross-section you have entered, as it does not appear in the file of standardized cross-sections.

G12: Cable not in catalogue (price = 0 in the price standard)
The cable selected by Caneco has a zero price in the *.PRX price file in the manufacturers' file selection window (first command on the 'Options' menu). This may indicate that the cable is not listed in the supplier's catalogue.

G13: Current too high for the busbar trunking systems on file
Check in the busbar trunking system file if there are any busbar trunking systems with a rated current higher than the load current of your supply. Where applicable, add the missing item to this file or try with another manufacturer's file.

G14: The selected busbar trunking system will not withstand the electrodynamic forces.
Override the type of busbar trunking system chosen.

G15: No check is performed for non-standard busbar trunking systems.
The busbar trunking system you have imposed is not in the busbar trunking system file.

G17: The calculation does not take the imbalances between conductors into account
You are advised to add a permitted current reduction factor for the cables in order to allow for the adverse current distribution between the different conductor on each phase. See "Standard calculations / high-current circuits – parallel conductors" section.

G18: Supply from electricity company: You must specify this in the supply type

G19: Supply file to be defined

G20: Transformer Ukr (%) to be defined

G21: Selection impossible... Ref mark reserved for the supply

G22: Check the proximity factor

The proximity factor proposed by Caneco corresponds to the installation method on the cable tray. Modify this factor in accordance with the indications given in the “Warnings and comments about circuits” help section.

G23: One or more supply parameters have been modified.

You must calculate the supply in order to be able to calculate the project circuits.

19.3.3 Warnings concerning circuits (cable and protective device)

C2: Upstream magnetic trip set too high

The short-circuit currents are too low to operate the magnetic trip on the circuit-breaker protecting your circuit. Reduce this setting or increase the conductor cross-sections.

C3: This ref. mark is already in use for another circuit

Change this ref. mark, as Caneco does not allow two identical ref. marks.

C4: Operating current too high, impossible to calculate the cross-section

The program only calculates cable connections if there are no more than 6 conductors per phase and if the cross-section does not exceed 800 mm².
Check your data, then correct if necessary by:
• Changing to a busbar trunking system.
• Changing the parameters affecting the cable conductivity (factors, installation method, etc.)

C5: Situation not handled, modify or override values where necessary

C6: Override values contradict data

Cancel the overridden conductors (neutral or PE) that are not included in your connection, or modify the contents of your circuit.

C7: The upstream switchboard conductors do not allow this choice

Check (and correct if necessary) that the upstream circuit of the upstream distribution (switchboard or busbar trunking system) does indeed have the necessary conductors: Neutral, PE, or 3-phase, or modify the conductors for the circuit you are working on.

C8: Upstream circuit not identified, cannot calculate

Check the existence or validity of the circuit powering the active distribution.

C9: Upstream board not identified, impossible to calculate

Check the existence of the upstream board and the cable feeding it (upstream circuit).

C10: Short-circuit protection is provided by the overload protective device.

In the configuration window (‘Options’ menu, ‘Cross-sections’ command), you have opted for the circuit-breaker not to be tripped as a matter of course on Ik Min. Your circuit-breaker’s magnetic trip does not trip when a short-circuit occurs at far end of the circuit (Ik Min). See “Standard calculations / Short-circuit protection / protection by circuit-breaker” section.

C11: Operating current or breaking capacity too high for the type of protective device

The type of protective device you have selected does not offer equipment with the current or breaking capacity required. If you have selected a modular circuit-breaker (curve B or C), select a general-purpose circuit-breaker.

C12: Out of calculation (voltage drop condition)

The voltage drop condition gives a cross-section greater than 800 mm² and a number of conductors greater than 6. This usually means there is an error: you are imposing on your circuit a maximum voltage drop that it is not able to obtain, either because this value is too low, or because the upstream voltage drop is too great. In the latter case, recalculate this upstream circuit, imposing on it a lower maximum voltage drop or overriding the cross-section value.

C13: Non-standardized override rating, impossible to calculate

Modify this rating or override the thermal and magnetic trip settings.

C14: No discrimination table with this choice of manufacturer

The (general-purpose and modular) circuit-breaker filenames shown in the window called up by the 'Manufacturers' files' command from the 'Options' menu do not have discrimination tables. The manufacturers' files must be from the same year.

C15: Short-circuit protection override forbidden

Case of a g1 fuse: as the rating of the overload protective device is the same as that of the short-circuit protective device, by convention, only the former is allowed.
Case of a modular circuit-breaker (curves B, C, and D):
As the magnetic trips for these devices are set by manufacture, you are not allowed to override these values. You are allowed to override only the thermal trip value (rating, in this case).

C16: Out of calculation (personnel protection condition)

See "Standard calculations / Indirect contact protection" section.
The fault current If (phase/PE) at far end of your circuit is not high enough to trip your protective device within the time required by the standard.
You can correct this problem:
Whatever the protective device:
By choosing for protecting personnel against indirect contact: a differential protective device, protection by SPEB (Supplementary Protective Equipotential Bonding) or by overall protective equipotential bonding of exposed conductive parts.
If your protective device is a general-purpose circuit-breaker:
By selecting a circuit-breaker with a low magnetic trip setting
If your protective device is a curve C or D circuit-breaker:
By selecting a curve B circuit-breaker

C17: Override obligatory

C18: The data entered is contradictory

Override values are present that contradict the options selected.

C19: The cable insulation cannot withstand the ambient temperature you have selected

Modify the temperature factor.

C20: Delete use of neutral override or revert to 3-phase.

C21: Protective device / terminal equipment combination inadvisable

Change the type of protective device, taking account of the type of terminal equipment in your circuit.

C22: Add the PE or select* protective equipotential bonding *of exposed conductive parts

Absence of a PE is only acceptable if the ground of the terminal equipment you are powering is connected, independently of the cable connection, to an overall equipotential system.

C23: Provision to be made for additional mechanical cable protection
This remark concerns A05 VV-U cables when installed underground.
Change the cable type, installation method, or make provision for additional mechanical protection.

C24: Neutral-free IT earthing system appears to contradict the presence of the neutral
Delete the neutral or correct the earthing system of your supply.

C25: The PEN conductor may only be used with the TN earthing system
Your connection has a PEN conductor, which is prohibited in TT or IT earthing systems.

C26: Replace the neutral by a PEN conductor, or opt for separate neutral and earth
Above 10 mm², the PE and neutral must be separate.

C27: Consumption unit not allowed for this type of terminal equipment
Choose a different consumption unit, e.g. kW for indicating the mechanical power of a motor.

C28: Single-core 1000 RVFV cables not allowed

C29: Cable not in catalogue (aluminium cross-section too small)
Select copper as the conductor core.

C30: Cable not in catalogue (max. cross-section for A05VV-U cables: 25 mm²)
This type of conductor does not exist in cross-sections above 25 mm².

C31: Cable not in catalogue (max. cross-section for multicore cables: 240 mm²)
Multicore cable become very hard to use above 120 mm². Change to single-core cables.

C32: Cable not in catalogue (max. cross-section for H07RN-F cables: 95 mm²)

C33: Invalid override of number of neutral conductors
Perform calculation, releasing the override on the neutral conductors.

C34: Cables ex-catalogue, price calculated based on standard
Your override corresponds to a non-standard cable. The price has been calculated anyway, but corresponds to the calculated cable and not the override cable.

C35: In order to reduce the SPE, we have adopted a lower magnetic trip value
The cross-section of the PE can be reduced using this choice of equipment.

C36: In order to reduce the SPE, select and over-rated C/B with a low magnetic trip value
SPE is the cross-section of the PE. The program has selected a low magnetic trip for the general-purpose circuit-breaker
If you don't want the automatic choice of a low magnetic trip in order to reduce this cross-section, change the "Choice of low magnetic trip" parameter ('Protective devices' command from 'Options' menu).

C37: In order to avoid increasing the cross-section, we have adopted a low magnetic trip value
See "Standard calculations / Indirect contact protection" section.

C38: Supplementary Protective Equipotential Bonding obligatory
Your cable does not have a PE. Select SPEB or introduce a separate earth (select Multi + E).

C39: In order to reduce the phase cross-section, select a circuit-breaker with a low magnetic trip
A low magnetic trip exists in this range of circuit-breakers and will make it possible to reduce the cross-section of the phase.

C40: The cross-section or type of cable requires the neutral to be separated
Above 10 mm², the PEN must be replaced by a separate neutral and PE.

C41: It is forbidden to protect or disconnect the PEN
In a TNC earthing system, select a 3P3D trip unit.

C42: In IT, the neutral must be protected if there is no differential device.
Delete the neutral use override you have carried out.

C43: PE cross-section too small
The PE conductor's thermal stress is exceeded. Override the cross-section of this conductor or make provision for an additional protective device.

C44: The override on the number of neutral conductors is in conflict with its use

C45: To reduce the neutral, change to single-core or separate the PE

C46: Out of calculation (short-circuit)
The conductor heating condition following a short-circuit gives a cross-section greater than 800 mm² with a number of conductors greater than 6.
See "Standard calculations / Indirect contact protection" section.
If your protective device is a circuit-breaker, try to reduce the magnetic trip setting, so it will trip on a min. short-circuit at far end of the circuit.

C47: 30 mA differential device mandatory
For power outlet circuits, differential protection is mandatory. Fit this differential device, set to a maximum of 30 mA, either in the circuit under consideration, or in a circuit upstream (sub-busbars powering the power outlets).

C48: Override neutral cross-section too small
The neutral conductor's thermal stress is exceeded. Override the cross-section of this conductor.

C49: Override cross-section too small
The operating current is too high. Check your data.

C51: Error, unknown protective device
Delete your override, correct the name of this protective device, or override the thermal and magnetic settings. This protective device is not known in the range selected.

C52: Selecting a curve B circuit-breaker might reduce your cross-section

The short-circuit currents (IkMin or ID) are not high enough to trip your circuit-breaker's magnetic trip. Caneco has therefore increased the cross-section to achieve this tripping. Select a curve B circuit-breaker is this is possible and verify if this reduces your cross-section.
Choosing an SPEB or protective equipotential bonding of exposed conductive parts may also be advised, if the criterion for determining your cable is "IC" (protection against indirect contact).

C53: This rating appears too high for a modular circuit-breaker

Opt for a general purpose circuit-breaker.

C54: The cross-section is non-standard

C55: Very unfavourable calculation criterion!!

Remember that the program calculates the phase cross-section (and number of conductors) according to 4 criteria:
• Overload condition (IN). This determines a minimum STH cross-section to carry the maximum continuous current liable to not trip the protective device.
• Voltage drop (DU criterion)
• Human protection against indirect contact (IC criterion)
• Heating of the conductor following a short-circuit (SC criterion)
The cross-section adopted is that for the most unfavourable criterion.
If this differs by more than 2 cross-sections from the most unfavourable of the other criteria, message C55 appears. You must then interpret the results so as to obtain, if possible, a reduction of the cross-section due to this criterion.

C56: Check if the protective device is suitable for this type of terminal equipment

In the case of an LV/LV transformer or a capacitor, the protective device rating has been chosen using an approximate over-rating factor. You must check this value in accordance with the exact characteristics of your terminal equipment.

C57: Error in indicating the location of one of the circuit destinations

The geographic location you have entered for your circuit (or for the switchboard feeding it) is not in the list of geographic locations defined in the routings (source and destination of the runs).

C58: Non-standard motor power Enter its consumption in amps.
Caneco accepts that the consumption for a motor circuit is entered in kW. This consumption is deemed to be a mechanical power. In order to deduce from this the corresponding operating current, Caneco looks for this power in the standard powers file (default: CANECO.STD). If this power is not in the file, Caneco refuses to calculate and obliges you to define the consumption in amps.
C59: Override the number of conductors first
An overridden cross-section can only be valid if the number of conductors is also overridden.

C60: Overriding the no. of PE or neutral conductors is not allowed for multi, unless the no. of phase conductors is also overridden

Change to single-core cables or override the number of phase conductors.

C61: Override phase conductor cross-section first

C62: Cables coming from a busbar trunking system do not accept help with bill of quantities

The geographic location entered for your circuit does not enable Caneco to deduce how long it is. The cable trays feeding this circuit will not take this length into account either.

C63: Protection is obligatory for cables coming from a* busbar trunking *system

Caneco's calculation module does not let you design a case where there is no protective device on a circuit feeding a busbar trunking system.

C64: Check that the max. C/B operating time is less than 20 ms

The cable selected by the program will only carry the maximum short-circuit current (thermal stress) at the far end of the circuit if it lasts less than the time shown. The operating time for the circuit-breaker indicated by Caneco is longer than this value. This exceptional case usually corresponds to short, low cross-section circuits connected to a switchboard with a high short-circuit current capacity.
In this case, you can:
• override the phase conductor cross-section to the suggested figure,
• opt for a fuse,
• increase the length of the cable to reduce the Ik values.
In certain (rare) cases, the personnel protection condition may be the reason for this message. In this instance, the problem can be solved by choosing a differential device or an LES.

C65: The 'Poles' information has been changed from "Uni / Multi" to multi-pole or single-pole

Your override and the "Uni / Multi" information led to ambiguity as to the nature of the cable. The program has resolved this ambiguity by changing the information to single-pole or multi-pole.

C66: The connection includes an unlisted cable

One of the cables selected by the program is not listed in the catalogue (its price is zero in the price standard).
• Where applicable, replace the zero price in the cable price file.
• Where necessary, modify the minimum or maximum cross-sections in the cable cross-section file.

C67: We have selected a COPPER cable and changed the conductor core information to COPPER

Caneco has taken into account the minimum value for aluminium cables which is given in the window called up using the 'Cables' command from the 'Options' menu.

C68: No circuit-breaker with adequate breaking capacity
This case usually corresponds to a modular circuit-breaker (curves B, C, or D) installed in a switchboard with a high short-circuit current capacity.
Opt for a general purpose circuit-breaker or a fuse.

C69: This data is not listed

C70: The calculation does not take the imbalances between conductors into account

The number of conductors per phase is greater than 3. In this event, the current in each phase is not shared evenly between the different conductors. In any one phase, certain conductors carry a current greater than IB divided by the number of conductors per phase. You must allow for this mutual inductance phenomenon by entering a reduction factor for the permitted current (Caneco's KD miscellaneous factor). For 4 conductors, take KD as around 0.8.

C71: For conductors > 3 → override the no. of conductors and the Ph, N, and PE cross-sections

C72: Are you selecting a low magnetic trip value in order to reduce the phase cross-section?

The choice of a low magnetic trip value should makes it possible to reduce the phase conductor cross-section. Do not select a low magnetic trip value for circuits subject to a high inrush current (motor, LV/LV transformer, capacitor).

C73: Are you selecting a low magnetic trip value in order to reduce the PE cross-section?

The choice of a low magnetic trip value should makes it possible to reduce the PE cross-section. Do not select a low magnetic trip value for circuits subject to a high inrush current (motor, LV/LV transformer, capacitor).

C74: Destination not found

The geographic location you have entered for your circuit (or for the switchboard feeding it) is not in the list of geographic locations defined in the routings (source and destination of the runs). Modify the location entered or add it to the routing list.

C75: The calculation does not take the imbalances between conductors into account

Above three conductors per phase, the currents are not shared evenly between the each conductor. To allow for this imbalance, reduce the proximity factor by at least 20 %.

C76: Unknown cable type!

The cable type entered for your circuit is not in the cable type file for your project (*.CBL). This error usual arises when you have imported from an external application.
Modify the cable type for your circuit, or add it to the cable list in the cable cross-section file.

C77: Apply modifications to existing circuits?

The configuration modification you've just made may affect some existing circuits. If you answer "Yes", Caneco will regard all the circuits affected by the modification as "to be recalculated". Hence you will then have to recalculate these circuits, which may lead to significant modifications.
Answer "No" if you want your modification to only affect new circuits.

C78: Cable type file not found

The cable type file is missing, show in the window called up by the "Manufacturers' files" command from the 'Options' menu. By default, this file is CANECO.CBL and is located in the CFG sub-directory of the directory where CANECO is installed.

C79: Busbars ref mark already exists

Sub-busbars in the same switchboard have the same ref. mark. Modify the ref. mark.

C80: Incorrect installation method

The installation method indicated in your circuit does not appear in the list of installation methods associated with the standard. This error arises from:
• an error importing data from an external application,
• a change to the standard for the project.
In this event, Caneco automatically replaces the incorrect installation method by the one shown in the window called up by the 'Preferences' command in the 'Options' menu. Modify the latter in order to automatically replace any installation method not complying with the calculation standard with the one you want.
Before making any changes, check that the calculation standard shown in the supply window is indeed the one you want.

C81: Zero discrimination with the upstream

There is a risk of tripping of the upstream device if a high short-circuit current flows in the circuit in question. For this situation not to exist,
IrMagnUpstream must > 1/5 IrMagnDownstream.
You have 3 possibilities for correcting this anomaly:
• Increase the upstream magnetic trip setting, if necessary by overriding the type of protective device.

• Carry out time-dependent discrimination by adding a time delay to the magnetic trip or the short-delay protective device.
• Override the setting of the magnetic trip for the current circuit to a more reliable value.

C82: No thermal discrimination over and above the setting of the upstream thermal trip

If your circuit carries an occasional overload, this fault may cause the upstream circuit's protective device to trip before the current circuit's protective device trips.
The probability of this type of failure is very low. To correct this, increase the upstream circuit's thermal trip setting or over-rate its protective device.

C83: Zero differential discrimination

In the event of a Phase–PE fault, there is a risk that the upstream circuit's protective device will trip before the current circuit's protective device trips.
To correct this, you can modify the upstream circuit protection:
• increase the setting of its differential protective device,
• or eliminate its differential protective device,
• or add a time delay to its differential protective device (type 'S' differential or time-delay differential relay).
You can also take action on the current circuit's protective device:
• reduce the setting of its differential protective device,
• or add a differential protective device, if it doesn't already have one.

C84: Attention, the starting voltage drop is greater than 15 %

This case concerns motors. A voltage drop greater than 15 % risks causing the motor to fail to start.
• Override the phase conductor cross-section to a higher value
• Possibly select a type of starter that limits the starting current.

C85: Do you want to select a single-core cable?

C86: Selected cross-section within a tolerance of X % lower than the calculated cross-section.

The standard you are using allows you to select a cross-section with a permitted current X % lower than the theoretical cross-section calculated, according to the overload condition.
See User Manual / Standard calculations / Overload condition.
You can remove this tolerance by modifying the corresponding information in the window called up by the 'Cables' command in the 'Options' menu.

C87: Check the proximity factor (KN), taking into account the no. of conductors / phase

The proximity factor for your circuit must take into account the fact that your circuit includes several cables per phase. In this instance, the standard considers that there are as many circuits (the number to be taken into consideration when determining the proximity factor) as there are conductors per phase in parallel.

C88: Program cross-section search error

C89: Attention: available power is negative!

The current distribution (switchboard or busbar trunking system) does not have a high enough permitted current.
See User Manual / Power requirement.
• Check the simultaneity factor for this distribution
• If necessary, increase the current of the circuit feeding your distribution (this value defines the permitted current in the distribution).

C90: No cascading table with this choice of manufacturer

The (general-purpose and modular) circuit-breaker filenames shown in the window called up by the 'Manufacturers' files' command from the 'Options' menu do not have cascading tables.

C91: Error in circuit, to be deleted

This circuit has not been saved correctly. We advise you to delete it. If there are any circuits connected downstream, use copy/paste to save them.

C92: Nonexistent circuit block

Circuit block does not exist in the list.

C93: Enter new name for diagram template

C94: This circuit block already exists in the list.

Modify circuit block name

C95: Maximum number of circuit blocks reached

You cannot create any more new circuit blocks.

C96: Impossible to insert associated circuits without a base circuit

You can insert a maximum of nine circuits associated with a single main circuit. An associated circuit has to be attached to a base circuit.

C97: Delete the circuits coming from this busbar?

Deleting this circuit feeding a sub-busbar will lead to the circuits it feeds being deleted too.
If you do not want this to happen, use the table to modify the busbar upstream of these circuits, then delete the current circuit.

C98: Circuit XXXX already exists

Modify the ref. mark of your current circuit. Ref. marks are unique.

C99: The upstream voltage drop is ignored from this transformer onwards

Caneco's voltage drop calculations ignore the voltage drop upstream of the transformer.

C100: Protective conductor cross-section to be checked

Check that the Spo cross-section is adequately sized.

C101: Style XXXX already exists!

Modify the ref. of your current style.

C102: Problem with this project!

Some sub-busbar circuits are looped within the same distribution. Check the circuits interconnections.

C103: The switchboard ref. mark does not exist

C104: Looped switchboards

C105: System library read error

C106: Consumption of circuit is obligatory
Enter a consumption in amps, kW, kVA, or in the form of a standard power.

C107: Delete the circuits fed from the downstream distribution first
Deleting a distribution means the circuits fed from it will be deleted too.

C108: Impossible to create a busbar trunking system circuit on this distribution
It is not possible to create a busbar trunking system downstream of a Standby supply. The upstream circuit must be N or N+S

C109: You are not allowed to create a transformer circuit from this distribution
It is not possible to create a low-voltage transformer downstream of a Standby supply only. The upstream circuit must be N or N+S

C110: Impossible to redirect the Standby
Several switchboards are fed with N and S separately. Look for the Standby circuits feeding these switchboards and redirect them.

C111: Impossible to redirect the Standby
Look for circuit XXXX and redirect it.

C112: Switchboard XXXX contains circuits
Delete these or redirect the Standby from them.

C113: Risks of looping
Caneco does not calculate looped networks.

C114: Upstream switchboard forbidden

C115: Inconsistency on downstream switchboard. The Standby circuit feeding the switchboard has been deleted.

C116: Inconsistency on downstream switchboard. Delete the Standby circuit feeding the switchboard.

C117: File not found for specified cable.
The cable type file is missing, shown in the window called up by the “Manufacturers’ files” command from the ‘Options’ menu. By default, this file is CANECO.CBL and is located in the CFG sub-directory of the directory where CANECO is installed.

C118: Unsuitable protective device

C119: Risk of tripping when circuit is closed (start-up, ignition)
The circuit-breaker’s magnetic trip setting is too low to avoid a risk of tripping when the circuit is powered up.

C120: Switchboard prohibited in Standby mode

You cannot connect your Standby supply to this switchboard because of an incompatibility in:
• voltage
• earthing system
• contents
Check and where necessary modify the values for your Standby supply or for the Normal feed circuit to the switchboard you want to back up. It may be necessary to insert an LV/LV transformer in order to modify the earthing system.

C121: Transformer prohibited in Standby mode

It is not possible to connect a transformer in Standby alone.

C122: Busbar trunking system prohibited in Standby mode

It is not possible to connect a busbar trunking system in Standby alone.

C123: Unauthorized type of protective device

Your version or your licence does not allow you to use this type of protective device. Please choose a different type of protective device for this circuit.

K1: The busbar trunking system requires the neutral and PE to be separated

Change the busbar trunking system to 3P+N+PE.

K2: Error in busbar trunking system, to be deleted

Impossible to read the information about the trunking system. Delete this circuit then create it again.

K3: This ref. mark is already in use for another busbar trunking system

Attention, each ref. mark is unique, change the ref. mark for this busbar trunking system.

K4: Busbar trunking system length is zero!

Fill in this length. Click on the button downstream of the circuit feeding the busbar trunking system. The default length is 0 m.

K5: Distance from origin > length of busbar trunking system

The value you have quoted is the length between the origin of the busbar trunking system and the point where your circuit fed by this busbar trunking system is connected. Hence at most it is the same as the length of the busbar trunking system.

K6: Distance greater than the length of the busbar trunking system!

Check the connection distance from the origin, or the length of the busbar trunking system.

K12: Operating current too high for the type of busbar trunking system

Your current is too high or the file you are using does not include a busbar trunking system of a sufficient rating.

K15: The upstream circuit conductors do not allow this choice

Change the content of the cable or of the busbar trunking system.

K16: The busbar trunking systems in the catalogue do not allow this choice

K21: Out of calculation: cable neutral thermal stress

The neutral of the circuit feeding your busbar trunking system cannot carry the maximum single-phase short-circuit current, at the input to the busbar trunking system Override the cable's neutral or phase cross-section to a higher value.

K22: Out of calculation: cable PE thermal stress
The PE of the circuit feeding your busbar trunking system cannot carry the maximum phase–PE short-circuit current (ID), at the input to the busbar trunking system Override the cable's PE or phase cross-section to a higher value.

K23: Out of calculation: cable Phase thermal stress
The phase conductor of the circuit feeding your busbar trunking system cannot carry the maximum 3-phase short-circuit current, at the input to the busbar trunking system Override the cable's phase conductor cross-section to a higher value.

K24: Out of calculation: BBTS neutral thermal stress
The neutral of your busbar trunking system cannot carry the maximum single-phase short-circuit current, at the input to the busbar trunking system Override to change the type of busbar trunking system, or try to reduce the short-circuit current.

K25: Out of calculation: BBTS PE thermal stress
The PE of your busbar trunking system cannot carry the maximum phase-PE short-circuit current (ID), at the input to the busbar trunking system. Override to change the type of busbar trunking system, or try to reduce the short-circuit current.

K26: Out of calculation: BBTS Phase thermal stress
The phase conductor of your busbar trunking system cannot carry the maximum 3-phase short-circuit current, at the input to the busbar trunking system Override to change the type of busbar trunking system, or try to reduce the short-circuit current.

K28: Out of calculation: personnel protection
The impedance of the Phase–PE fault loop is too high to ensure personnel are protected from indirect contact.
Where necessary, increase the cable's PE and phase conductors, or try to provide personnel protection using a differential device or SPEB, or overall equipotentiality.

K29: Out of calculation: magnetic trip set too high (neutral)
The impedance of the Phase-Neutral fault loop is too high to ensure the magnetic unit will trip.
Where necessary, increase the cable's neutral and phase conductors, or adjust your magnetic trip to a lower value, or select a circuit-breaker with a low magnetic trip value.

K30: Out of calculation: magnetic trip set too high (PE)
Your magnetic trip unit does not provide adequate breaking to protect your PE.

K31: Out of calculation: magnetic trip set too high (Phase)
Your magnetic trip unit does not provide adequate breaking to protect your Phase conductor.

K32: Out of calculation: electrodynamic stress
The peak current calculation exceeds the Ik value laid down by the manufacturer. Check if the circuit-breaker is limiting the energy (limit curves)

19.3.4 Warnings concerning switchboards

T1: Error in switchboard, to be deleted
The switchboard has been saved incorrectly, delete the circuit feeding it.

T2: Downstream switchboard incorrect, as fed from two different earthing systems.
This switchboard is connected by 2 circuits with different earthing systems. If this involves a transformer circuit, create another circuit downstream if the earthing system is different.

T3: This ref. mark is already in use for another switchboard
Each ref. mark is unique.

T4: The maximum number of switchboards or busbar trunking systems has been reached
You can handle a maximum of 300 distributions in any one project.

T5: Error in distribution, unable to calculate
The distribution is unknown or incorrectly saved.

T6: The modification to the distribution is not taken into account in the diagram
The distribution input diagram does not match the calculation.

T7: Downstream switchboard incorrect, as fed from two different voltage levels.
There is too great a voltage difference between the Normal and Standby circuits for it to be calculated.

T8: Error in upstream distribution, unable to calculate
Check the validity of the upstream circuit.

T9: Selection not possible on a circuit fed from the first switchboard

T10: Deleting a switchboard
Attention: All the circuits fed from this distribution will also be deleted.

T11: Downstream switchboard incorrect, as the types of the supply circuit conductors are incompatible
This switchboard is connected by 2 circuits with incompatible conductors.

20 Glossary

20.1 Source Glossary

Power	Source standardized Power in KVA. (1 to 2500 kVA)
File	Dry95.ZTR: File for dry transformers Oil95.ZTR: File for oil transformers
Ukr	Short circuit voltage in %
Xd	Transient direct Reactance in % (standard 30%)
Xo	Steady state direct Reactance in % (standard 6%)

Network

LV Voltage	Source operating voltage, between phases, on load (default 400V). No load voltage is equal to 1.05 times operating voltage
Frequency	Network frequency 50Hz or 60Hz
Funct. T. Prot HV	Operating time for HV protective device at transformer HV/LV primary level.
Pcc. HV Min	High voltage Min short circuit Power (default 500 MV)
Pcc. HV Max	High voltage Max short circuit Power (default 500 MV)

Factors

Temperature (K T)	Temperature factor downgrading Cable current carrying capacity.
Group (K prox)	Conductors group factor
Symmetrical fs	fs Symmetrical factor according to standard NFC 15-100 § 523.6

Conductors

Phase	Phase conductor cross-section
PEN	Neutral/PEN conductor cross-section
Po	Protective conductor cross-section
RA	Earth resistance
Input from motors	Factor taken into account for calculating Ik Max values
Ratio Ib connection / In Supply	Value in % allowing the Supply/MSB connection to be calculated in accordance with the thermal setting of the supply circuit-breaker.
Loaded Neutral	Factor of 0.84 applied to the cable's Iz

Results

IB	Transformer Nominal intensity calculated with on load voltage (between phases)
STH	Theoretical cross-section calculated according to overload condition
dU total	Voltage drop % at MSB level from transformer
Ik3 Max	Maximum 3-phase short-circuit current at far end of connection
Ik2 Max	Maximum 2-phase short-circuit current at far end of connection
Ik1 Max	Maximum single-phase short-circuit current at far end of connection
Ik2 Min	Minimum 2-phase short-circuit current at far end of connection
Ik1 Min	Minimum single-phase short-circuit current at far end of connection
If	Default short circuit current (phase - PE), at MSB level (in A)

20.2 Circuit Glossary

Upstream	Distribution upstream reference mark
Ref Mark	Circuit reference mark (15 characters maximum)
Style	Circuit style (template)
D/Origin	Connecting distance from the beginning of the Busbar trunking system
Bus Bar	Upstream sub-busbar Ref Mark
Supply	Circuit supply (Normal, Standby, N and S)
Content	Wiring system distribution (3P+N+PE, P+N+PE…)
Designation	Circuit designation (36 characters maximum)
Index	Circuit modification index

Protection

Type	Type of protective device used (General purpose Breaker, C curve breaker, B curve breaker…)
Indirect Contacts	Protection against indirect contacts
Rating	Circuit breakers rating or support rating (Switch, disconnector or Disconnector switch) or fuse rating
K on C	Oversizing factor for overload setting
Thermal relay	Thermal relay reference
In/Irth/IrLR	Circuit-breaker thermal setting or fuse rating insuring protection against overload.
IrMg/In	Circuit-breaker magnetic setting insuring protection against short-circuits or fuses rating value
Cal. gG	Fuse rating
Delay *(SC CC)*	Circuit breakers magnetic delay in ms
Differential protection setting	Circuit breakers residual current (differential) setting in mA
Delay *(Prot. Diff)*	Time delay on RCD relay in ms

Cable

Type	Type of cable (PVC, XLPE, PRC…)
Core	Core nature (Copper or Aluminium)
Pole	Single-core or multi-core cables
Install method	Installation method according to standard
Length(m)	the cable length in meters
1st Equip(m)	Distance from protective device to nearest equipment
K Temp	Temperature factor on IZ (from 0.4 to 1.3 - 1.0 for 30°C)
K Group	Group factor on IZ (from 0.2 to 1.3) according to installation method and number of cables
K Additional	Additional downgrading factor on IZ (explosive atmosphere 0.85, unbalanced neutral 0.84…)
Symmetrical factor fs	Symmetrical factor (0.8) for wiring systems with cables in parallel
Total Correction	Total correction factor (K Temp x K Group x K Addit x fs x Neutral factor)
Phase	Phase cross-section
Neutral	Neutral cross-section
PE/PEN	PE or PEN cross-section
Loaded Neutral	apply an additional factor of 0.84 to current carrying capacity if Neutral is loaded

Equipment

Nb	Equipment number for final circuits
Consumption	Consumption for each equipment (in A, W, kW, VA, kVA and kVAR)
Location	Circuit Geographical location (used in cable tracks module)
TH<= 15%	Level of 3rd order harmonics < 15%
15% < TH <= 33%	Level of 3rd order harmonics between 15% and 33%
Use factor	Circuit use factor
Coincidence factor	Coincidence factor (Diversity, simultaneity) of equipments fed by same circuit
Cos phi	Equipment Cosinus phi (Circuit Power Factor)
Cos phi (Start)	Cosinus phi at start
ID/IN	Starting current, ratio between Starting current and steady current
dU max	Maximum admissible voltage drop in %from beginning of installation

20.3 Circuit window Additional Tab

Manufacturer	Manufacturer's catalogue used for the protective device
Minimal Protection	Protective device minimum rating (also defined in circuit style)
Icu (kA)	Protection breaking capacity in kA
With backup	Protection breaking capacity with backup (coordination) in kA
Thermal discrimination	Thermal discrimination with upstream
Differential discrimination	Differential discrimination with upstream
Limit (A)	Current discrimination limit on short-circuit in Amps
From (m)	Distance from which there is total discrimination on short-circuit
Ir Diff	Differential Residual Current Device adjustable in mA
Diff delay	Residual Current time delay in ms
Max operating Time	
IC	Max operating time for a circuit-breaker protection not to exceed human protection against electrical shocks condition (ms)
Ph	Max operating time for a circuit-breaker protection not to exceed phase cable thermal stress (ms)
PE	Max operating time for a circuit-breaker protection not to exceed PE cable thermal stress (ms)
Ne	Max operating time in ms for a circuit-breaker protection not to exceed Neutral cable thermal stress (ms)
Link width (mm)	width of the link on cable track
Link height (mm)	Link height on cable track
Weight (Kg/m)	Link weight for one metre in kg
Ip limited or not	Maximum peak short-circuit current limited or not in kA at beginning of circuit

20.4 Results window

Cable	Multi-core cable conventional writing, or phase conductors if the link is of single-core type **Examples:** 4G1,5 means 4 conductors out of which 1 is earth (yellow-green) (G = ground 3*50+N35 means 3 phase conductors + 1 N conductor of 35 mm^2
Neutral	Neutral conductors conventional writing if the link is of single-core type.
PE or PEN	PE/PEN conductors conventional writing if the link is of single-core type.
Criterion	Criterion for the phase cross-section calculation **MINI:** Minimal cross-section (ex 1.5mm2 for Light, 2.5 mm2 for Socket motors…) **IN:** overload condition **DU:** Voltage drop **IC:** Indirect contacts, Human protection against electrical shocks **SC:** Thermal stress after Short-Circuit **FIXED**: Fixed value by user
Max Length	Cable maximal length to keep protection and circuit design conditions
IB (A)	Circuit design current directly deducted from consumption in A
STH (mm²)	Theoretical cross-section calculated in mm^2, according to overload condition.
IZ (A)	Current carrying capacity of the link, adjusted with correction factors this value gives the maximum protection thermal setting**.**
dU circuit (%)	Circuit voltage drop in % on the *cable length*
dU total (%)	Total Voltage drop in % from source supply
dU start	Voltage drop at start (motors) or when switching on (lights)
Ik3 Max	Circuit maximum 3-phase short-circuit current (at A)
Ik2 Max	Circuit maximum 2-phase short-circuit current (at A)
Ik1 Max	Circuit maximum single-phase short-circuit current (at A)
If Max	Circuit maximum fault short-circuit current (at A)
Ik2 Min	Minimum 2-phase short-circuit current at far end of connection (at A)
Ik1 Min	Minimum single-phase short-circuit current at far end of connection (at A)
Cable	Multi-core cable conventional writing, or phase conductors if the link is of single-core type **Examples:** 4G1,5 means 4 conductors out of which 1 is earth (yellow-green) (G = ground 3*50+N35 means 3 phase conductors + 1 N conductor of 35 mm^2
Neutral	Neutral conductors conventional writing if the link is of single-core type.
PE or PEN	PE/PEN conductors conventional writing if the link is of single-core type.
Criterion	Criterion for the phase cross-section calculation **MINI:** Minimal cross-section (ex 1.5mm2 for Light, 2.5mm2 for Socket motors…) **IN:** overload condition **DU:** Voltage drop **IC:** Indirect contacts, Human protection against electrical shocks **SC:** Thermal stress after Short-Circuit **FIXED**: Fixed value by user
Max Length	Cable maximal length to keep protection and circuit design conditions
IB (A)	Circuit design current directly deducted from consumption in A

20.5 Board Glossary

Ref mark	Board Downstream Ref mark.
Designation	Board designation
Coincidence factor t	Diversity/Simultaneity factor for circuits fed by the considered board.
Geographical location	Equipment geographical location.
Earthing system	Board Earthing system: TT, TNC, TNS, IT
Voltage	between phase and neutral, in a single phase board (Phase-Neutral), between phases in other cases
No load voltage	No load voltage in V, used to calculate Ik3 Max.
Upstream circuit ref mark	Circuit Upstream ref mark. (feeding board)
Breaking device	Board breaking device (generally a switching device in distribution boards).
IC Protection	Nature of the human protection against electrical shock (RCD…)
I Allowed	Allowed current downstream board.
I available	Available current downstream board.
S Intensities	Design current IB sum of all circuits issued from the board multiplied by the board diversity/simultaneity factor.
Mean cos phi	Mean cosinus phi at board level, taking into account downstream circuits and eventual capacitors
R=S IZ cables / Irth board	Ration between: sum of *IZ* of downstream circuits (IZ calculated without taking into account group factor) and upstream thermal relay setting.

20.6 UPS Glossary

Power	Power in kVA
Tsc	sustaining time of the UPS in ms
Ik3	Maximum three-phase short-circuit current (in A)
Ik2	Maximum two-phase short-circuit current (in A)
Ik1	Maximum single-phase short-circuit current (in A)
If	Fault current (phase/PE) (in A)

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