

# DOC

ABB SACE – A Division of ABB S.p.A., MK-TO, 2011

## DOC

# Electrical Installation Calculation and Dimensioning

# Contents



## **Introduction**

- Aim of the application
- Target users
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## **How it works**

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- ABB Software Desktop
- Assistance
- How to obtain the software



# DOC Introduction

# Aim of the application



## Introduction

### Aim of the application

Target users  
Product managed

## How it works

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## Support Tools

ASD  
Assistance  
How to obtain the  
software

- DOC is the software for Electrical Installations Calculation and Dimensioning
  - Draw single-line diagrams
  - Perform electrical calculation according to the Standards
  - Choose the correct switching and protecting devices (MV and LV devices)
  - Set the trip units and check for discrimination
  - Prepare a complete project documentation

# Target user



## Introduction

Aim of the application

Target users

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## How it works

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## Support Tools

ASD

Assistance

How to obtain the software

- DOC is complete and precise, but smart and flexible and can be used from everyone interested in calculating electrical installation or part of them
  - Consultants
  - Electrical Engineers
  - Panel builders
  - Installers
  - ABB Technical Support

# Product managed



- DOC allows and the selection of a wide range of ABB Products
  - Medium Voltage products
  - Low Voltage products
  - Motors
  - Transformers

## Introduction

Aim of the application

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# Product managed



## ■ Low Voltage Products

### ■ Air Circuit- Breakers

- New Emax
- Emax

#### Introduction

Aim of the application

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How to obtain the software

Circuit-breaker (-QF7)

Circuit-breaker

User

Ib 1500.0 [A]

Iz 2670.0 [A]

LLLN 400 [V]

TT 50 [Hz]

+Q1

Standard IEC 60947-2

Board properties>>

Ik Max [kA]

Ik Min [kA] Details >>

Type Overload and Short Circuit protection

Idn [A]

Version <All possibilities>

Poles 4P

Family Air CB Emax new

Release <All possibilities>

E4V 4000 PR121-LI 4000A

Horizontal flat-bar rear terminals

Select >>


Symbol <default>

Advanced options >>>

OK Cancel

# Product managed



- Low Voltage Products
  - Molded Case Circuit Breakers
    - Tmax
    - Isomax
    - Tmax XT 

## Introduction

Aim of the application

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How to obtain the software

Circuit-breaker (-QF7)

Circuit-breaker

User

Ib 400.0 [A] LLLN 400 [V]

Iz 700.0 [A] TT 50 [Hz]

Ik Max [kA]

Ik Min [kA] Details >>

Type Overload and Short Circuit protection

Version <All possibilities> Idn [A]

Family Moulded case CB Tmax Poles 4P

Release <All possibilities>

TGN 630 TMA630-6300 Extended front terminals Select >>

Symbol <default> Advanced options >>>

OK Cancel



# Product managed



## ■ Low Voltage Products

### ■ Miniature Circuit Breakers

- System PRO M
- System PRO M Compact
- S800
- Smisline

#### Introduction

Aim of the application

Target users

Product managed

#### How it works

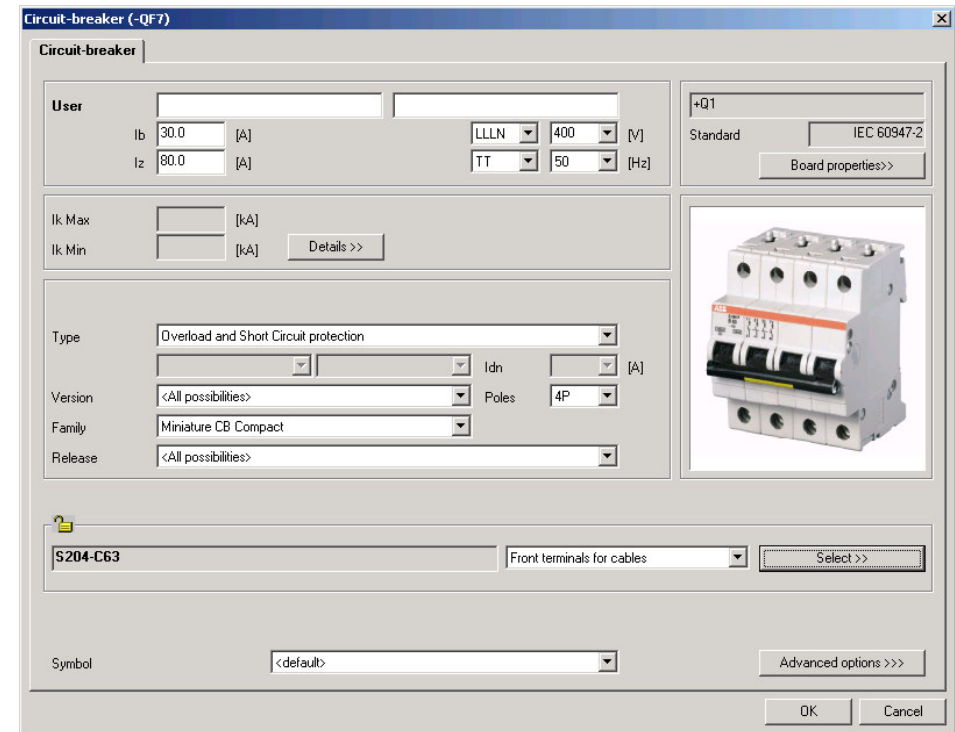
Features

#### Support Tools

ASD

Assistance

How to obtain the software



# Product managed



## ■ Low Voltage Products

- RCCBs
  - System PRO M
  - System PRO M Compact

### Introduction

Aim of the application

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### How it works

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How to obtain the software

Residual current circuit breaker (-QF8)

Residual current circuit breaker

User

lb [A]

LLLN [V]

400 [V]

TT [Hz]

50 [Hz]

I<sub>k</sub> Max [kA]

I<sub>k</sub> Min [kA]

Details >>

Family

<All possibilities>

<All possibilities>

<All possibilities>

Poles 4P

Idn ... [A]

+Q1

Standard

Board properties >>

F204 AC-63/0,1

Select >>

Symbol <default>

Protected objects

OK Cancel

# Product managed



## ■ Low Voltage Products

### ■ Fuses

- OFAX
- OFASB

#### Introduction

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How to obtain the software

Fuse (-FU1)

**Fuse**

User

lb [A] LLLN 400 [V]

lz [A] TT 50 [Hz]

I<sub>k</sub> Max [kA]

I<sub>k</sub> Min [kA] Details >>

Family <All possibilities>

Links <All possibilities> Size <All possibilities>

Poles 3P

+Q1

Standard

Board properties >>

OFAX 2 P3 + OFAA 2gG 200A

Select >>

Symbol <default>

Protected objects

OK Cancel

# Product managed



## ■ Low Voltage Products

### ■ Switch Fuses

- E930
- OESA
- OS

#### Introduction

Aim of the application

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# Product managed



## ■ Low Voltage Products

### Introduction

Aim of the application

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## ■ Disconnectors

- New Emax MS

- Emax MS

- Tmax D

- Isomax D

- OT

- OETL

- E200

The screenshot shows a software window titled "LV disconnector (-Q515)". The interface is divided into several sections:

- User:** Includes input fields for "lb" [A], "LLLN" [V] (set to 400), and "TT" [Hz] (set to 50).
- Standard:** Includes a field for "+Q1" and a "Board properties>>" button.
- Ik Max / Ik Min:** Fields for maximum and minimum short-circuit current in [kA], with checkboxes for "Use Icw" and "Use Icm".
- Family:** A dropdown menu set to "Standard disconnectors OT-OETL".
- Version:** A dropdown menu set to "<All possibilities>" and a "Poles" dropdown set to "4P".
- Product Selection:** A field containing "OETL 1250 4P F" and a "Select>>" button.
- Symbol:** A dropdown menu set to "<default>".

At the bottom right, there are "OK" and "Cancel" buttons. A 3D image of a disconnector is shown in the top right corner of the window.

# Product managed



## ■ Low Voltage Products

### Introduction

Aim of the application

Target users

Product managed

### How it works

Features

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How to obtain the software

## ■ Contactors

- A
- AF
- EN
- ESB
- E250
- E259
- E260

# Product managed



## ■ Low Voltage Products

### ■ Manual Motor Starter

- MS116, MS325, MS450, MS495, MS496
- MO325, MO450, MO495, MO496 , MO497

#### Introduction

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#### How it works

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How to obtain the software

The screenshot shows the 'Feeder properties' dialog box for a 'Manual motor starter (-QF1.3)'. The dialog is divided into several sections:

- User:** Fields for 'User' (empty), 'Ib' [A] (empty), 'Iz' [A] (empty), 'LLL' [V] (400), and 'TT' [Hz] (50).
- Standard:** 'Standard' dropdown set to 'IEC 60947-2' and a 'Board properties>>' button.
- Currents:** 'Ipk Max' [kA] (empty) and 'Ipk Min' [kA] (empty) fields, with a 'Details >>' button.
- Family and Poles:** 'Family' dropdown set to 'Manual Motor Starter thermomagnetic MS' and 'Poles' dropdown set to '3P'.
- Product Selection:** A field containing 'MS116-16.0' and a 'Select >>' button.
- Symbol:** A dropdown menu set to '< default >'. At the bottom right are 'OK' and 'Cancel' buttons.

A 3D model of the MS116 motor starter is shown in a window on the right side of the dialog.

# Product managed



## ■ Low Voltage Products

### ■ Thermal Overload

- TAxxDU, ExxDU
- UMC-22

#### Introduction

Aim of the application

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How to obtain the software



# Product managed



- Medium Voltage Products

- Circuit breaker

- Secondary distribution SF6 and Vacuum up to 24kV 630A 16kA
    - Primary distribution SF6 and Vacuum up to 36kV 3150A 50kA

## Introduction

Aim of the application

Target users

Product managed

## How it works

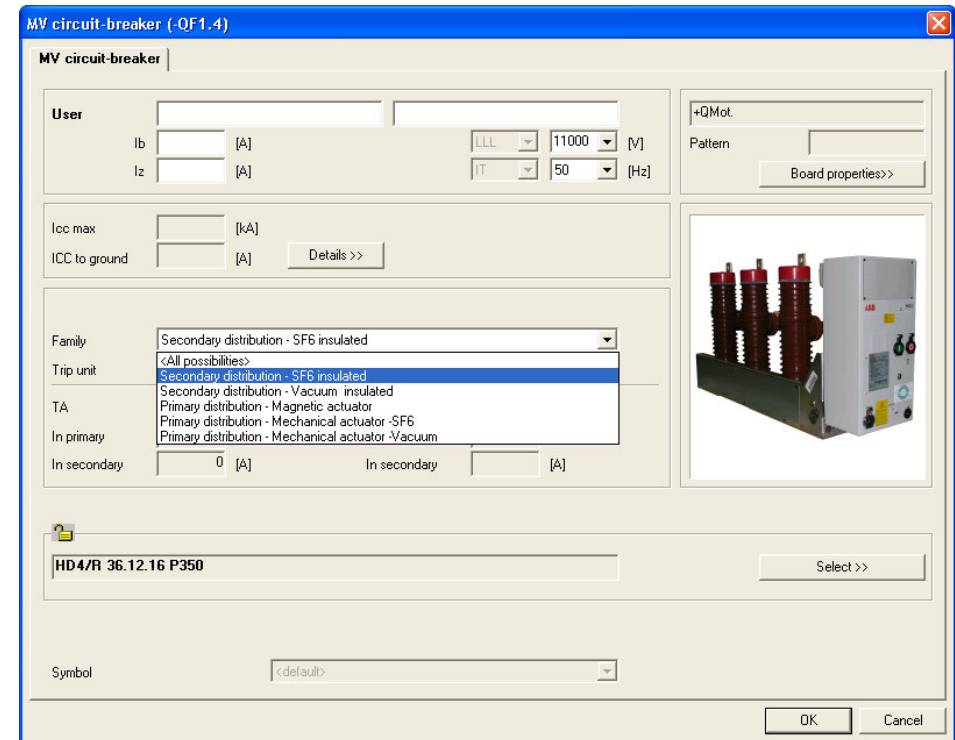
Features

## Support Tools

ASD

Assistance

How to obtain the software



# Product managed



## ■ Medium Voltage Products

### Introduction

Aim of the application

Target users

Product managed

### How it works

Features

### Support Tools

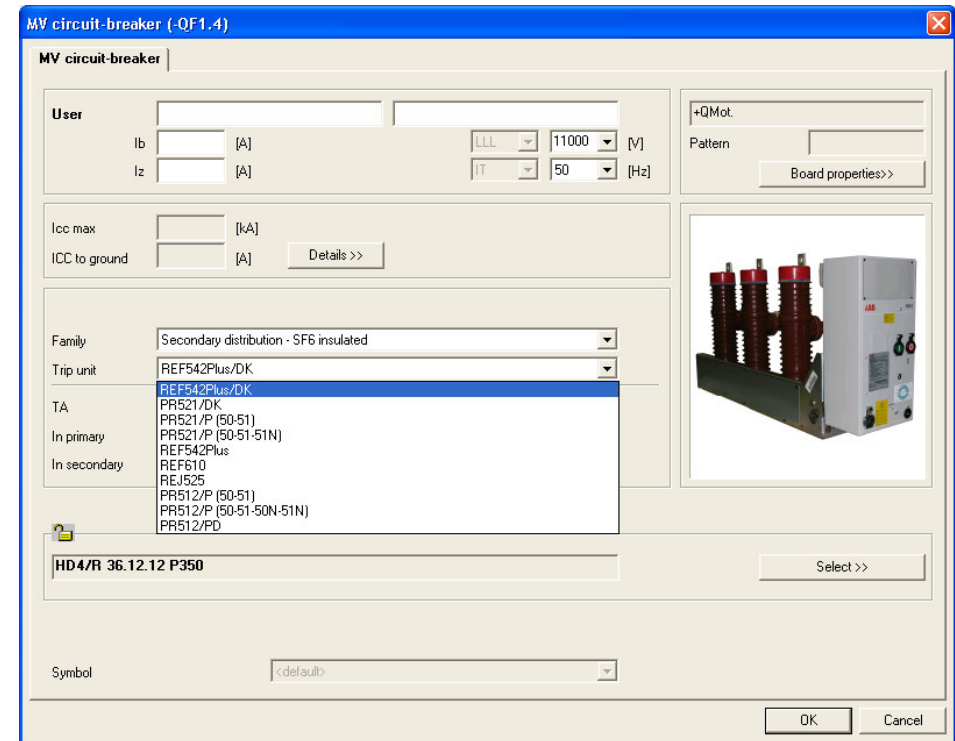
ASD

Assistance

How to obtain the software

## ■ Circuit breaker

- REF542Plus/DK
- PR521/DK
- PR521/P (50-51)
- PR521/P (50-51-51N)
- REF542Plus
- REF610
- REJ525
- PR512/P (50-51)
- PR512/P (50-51-50N-51N)
- PR512/PD



# Product managed



## ■ Medium Voltage Products

### Introduction

Aim of the application

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Product managed

### How it works

Features

### Support Tools

ASD

Assistance

How to obtain the software

## ■ Disconnectors

- SHS2/A

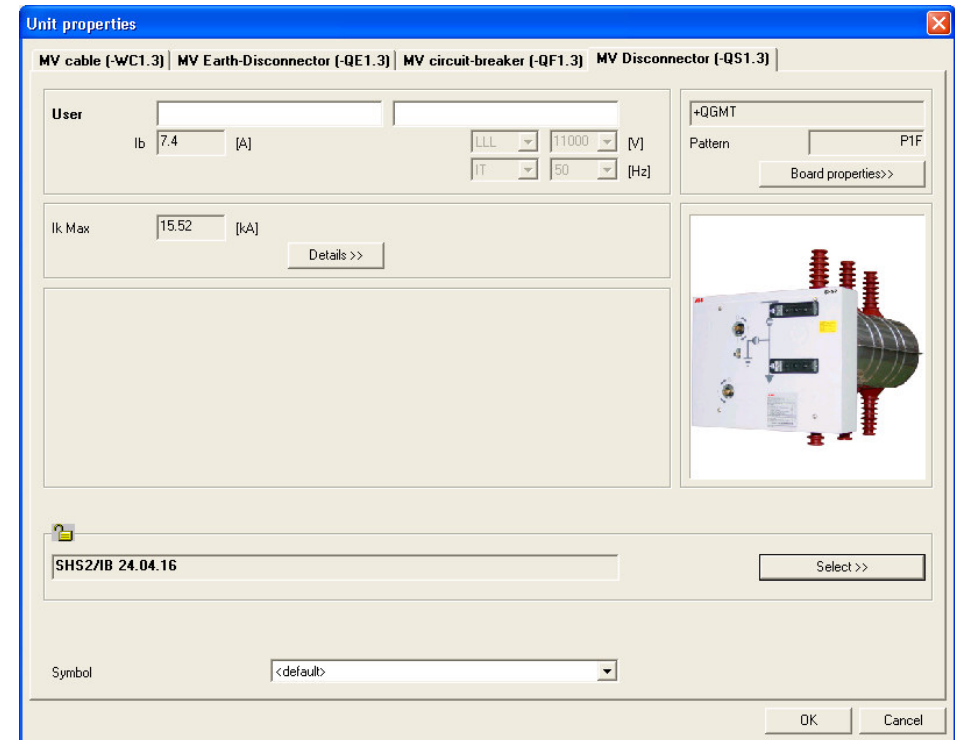
- SHS2/I

- SHS2/IB

- SHS2/IF

- SHS2/N-I

## ■ Earth Disconnectors



# Product managed



## ■ Medium Voltage Products

### Introduction

Aim of the application

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### Support Tools

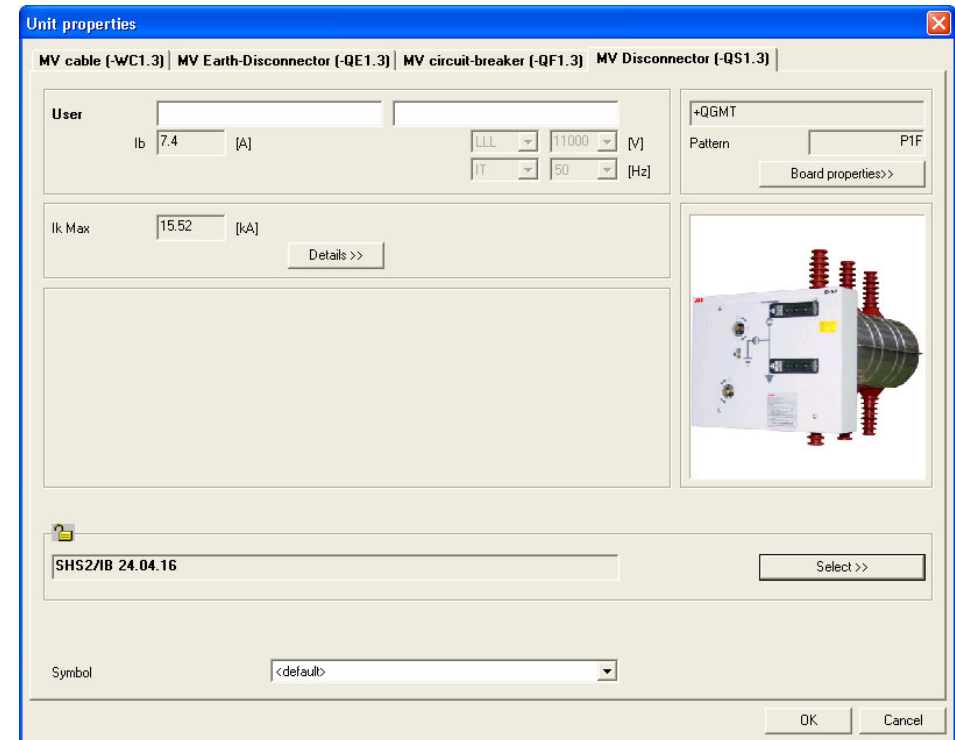
ASD

Assistance

How to obtain the software

## ■ Switch Disconnectors

- SHS2/T1
- SHS2/T1M
- SHS2/T2
- SHS2/T2F
- SHS2/T2M
- SHS2/T2MF
- SHS2/N-T1
- SHS2/N-T1M
- SHS2/N-T2
- SHS2/N-T2F
- SHS2/N-T2M
- SHS2/N-T2MF



# Product managed



## ■ Medium Voltage Products

### ■ General Purpose Fuses

- CEF 7.2kV 200A
- CEF 12kV 125A
- CEF 17.5kV 100A
- CEF 24kV 80A

### ■ Motor Fuses

- CEM 7.2kV 315A
- CEM 12kV 100A

#### Introduction

Aim of the application

Target users

Product managed

#### How it works

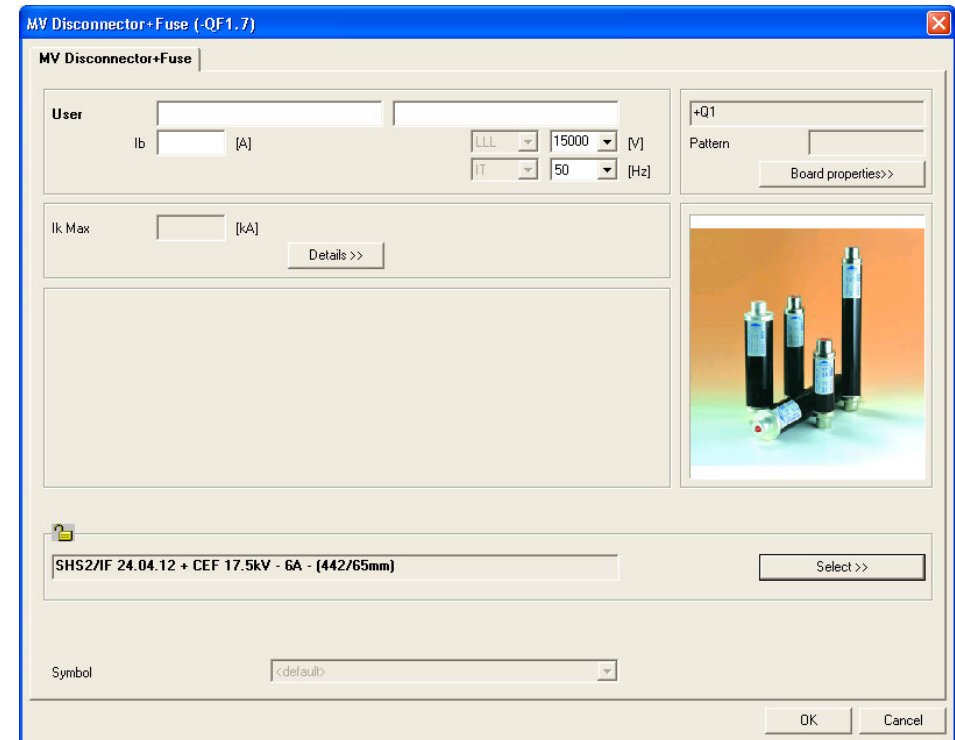
Features

#### Support Tools

ASD

Assistance

How to obtain the software



- Medium Voltage Products

## Introduction

Aim of the application

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## How it works

Features

## Support Tools

ASD

Assistance

How to obtain the software

- Cables

- Sized according to the ABB “XLPE Cable Systems Users Guide”

## XLPE Cable Systems

User's guide



rev.2

# Product managed



- Other Products

- Introduction**

- Aim of the application

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- ASD

- Assistance

- How to obtain the software

- Motors

- M2xxx

- M3xxx

- Transformers

- Oil Distribution Transformers

- RESIBLOC



# DOC

## How it Works



# Features - Professional and Light Profiles



## Introduction

Aim of the application  
Target users  
Product managed

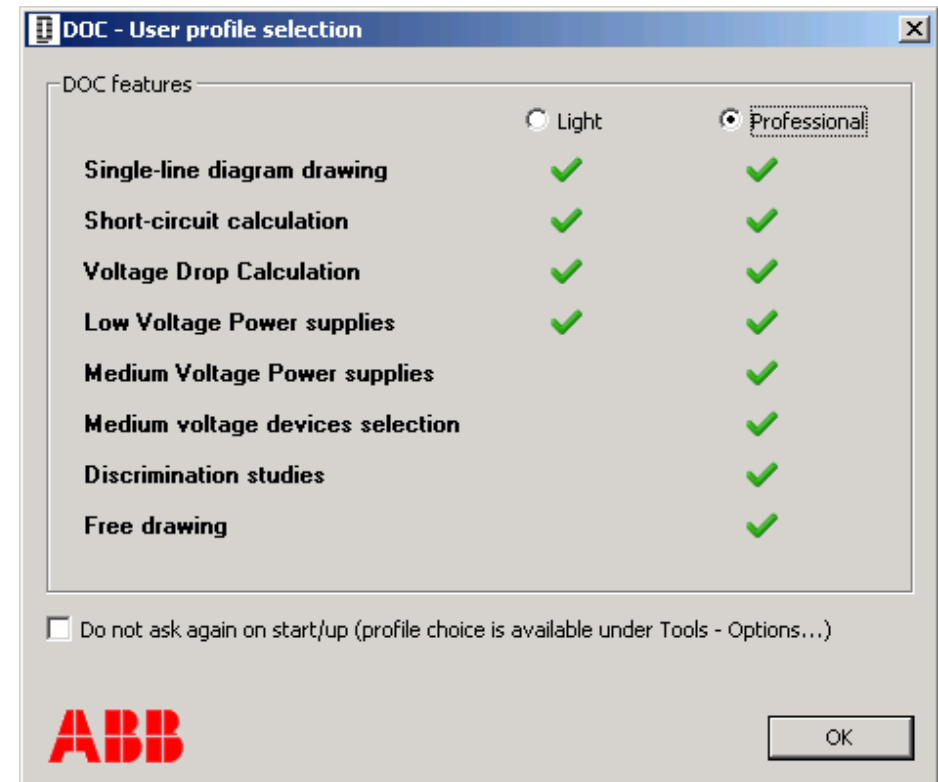
## How it works

### Features

## Support Tools

ASD  
Assistance  
How to obtain the software

- DOC can be used with 2 different profiles
- Depending on the user needs and skills it can be recommended to use the Light Profile which hides the advanced and complex features
- DOC Light is for ...
  - ... first time, unskilled DOC users
  - ... installers – panel builders who need a simple tool to draw and verify small networks
- DOC Professional is for ...
  - ... skilled DOC users
  - ... customers working on industrial applications
  - ... engineering companies – OEM's looking for a powerful calculation and design tool



# Features - Single line diagram drawing

DOC

- Different layout available:
  - Blank Page
    - More flexible
    - Allows representing rings and meshes
    - Main project data available beside the objects
  - Column Page
    - Faster and easier drawing
    - Main project data available in the grid

## Introduction

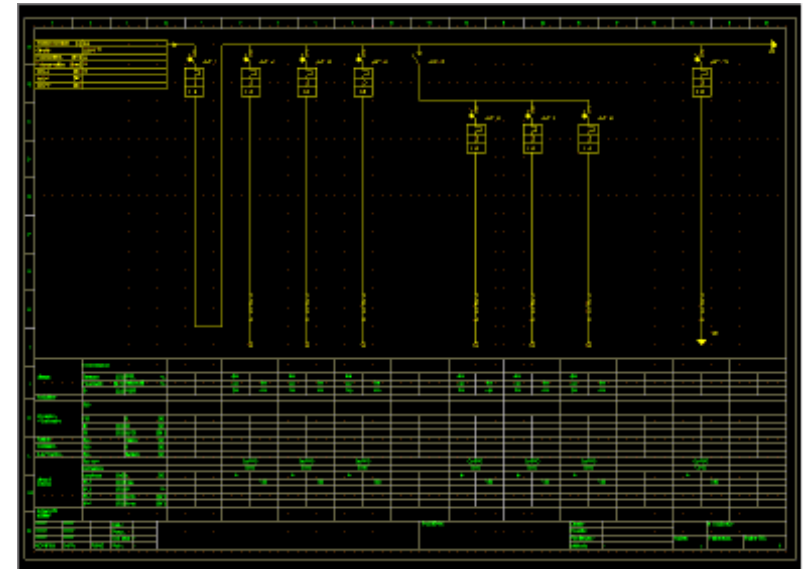
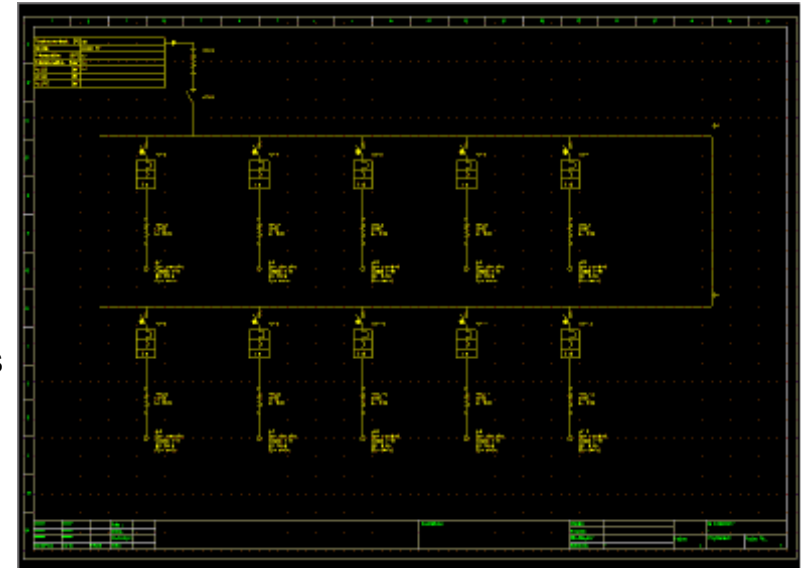
Aim of the application  
Target users  
Product managed

## How it works

Features

## Support Tools

ASD  
Assistance  
How to obtain the software



# Features - Single line diagram drawing

DOC

- Different ways to draw the symbols:

- By Single Objects

- More flexible
    - Allows representing rings and meshes

## Introduction

Aim of the application

Target users

Product managed

## How it works

Features

## Support Tools

ASD

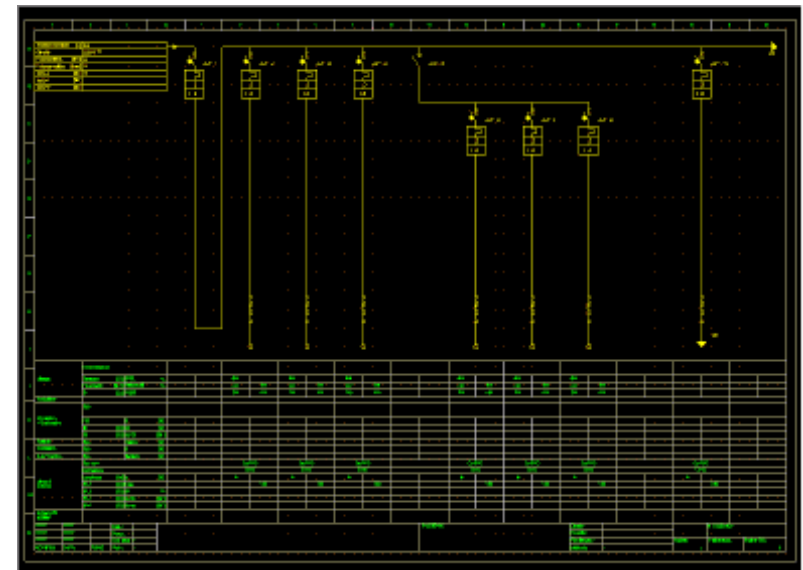
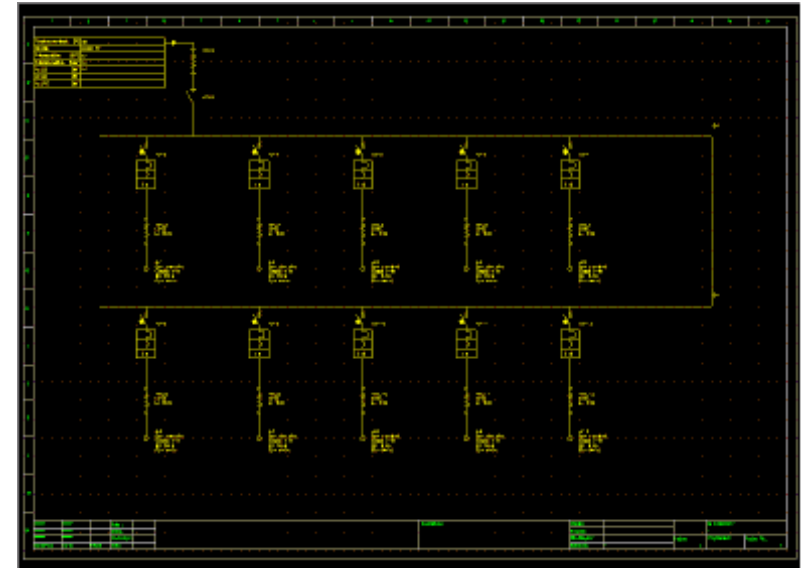
Assistance

How to obtain the software

- By Macros

- Faster and easier drawing

- Note: it is possible to use Single Objects and Macros independently from the layout



# Features - Single line diagram drawing



- When using the Column layout, Objects are numbered by Page & Column

## Introduction

Aim of the application  
Target users  
Product managed

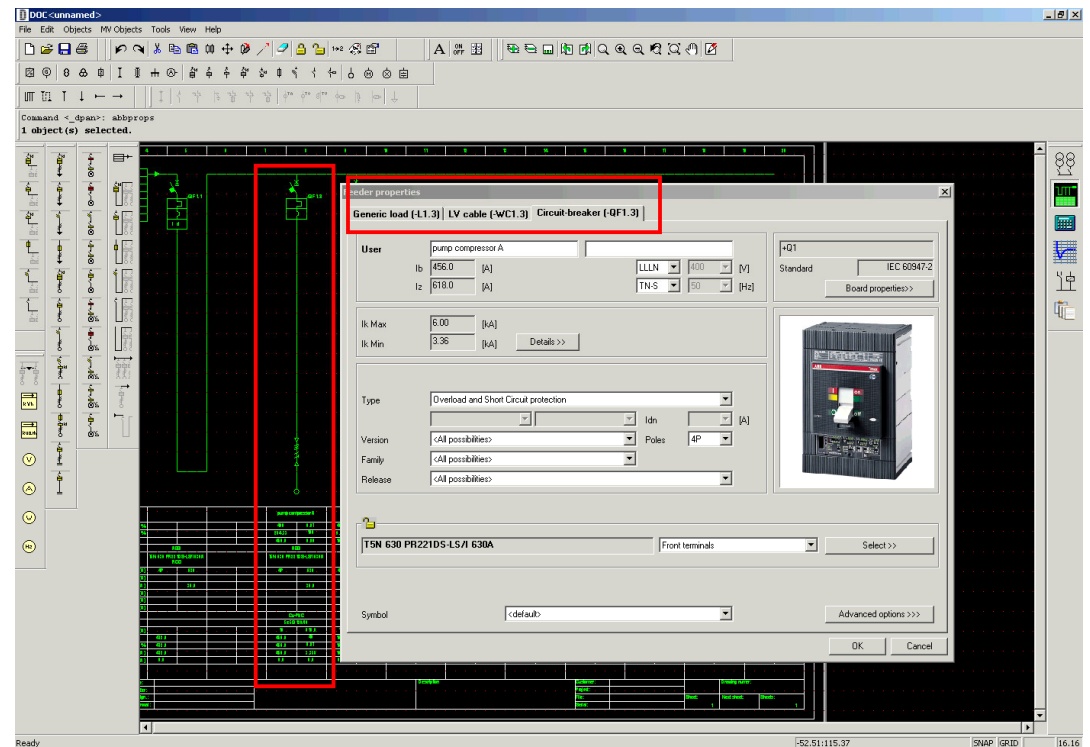
## How it works

Features

- All the object in the same feeder have the same number
- I.e: Page =1, Column=3 leads to QF1.3+ WC1.3 +L1.3

## Support Tools

ASD  
Assistance  
How to obtain the software



# Features - Single line diagram drawing

DOC

- It is possible to draw one scheme on more than one page
  - Use the 'Add Sheet' and 'Change layout' commands to prepare new empty pages
  - Use the Cross References to connect two objects
  - Use the 'Previous/Next Sheet' commands to turn the pages

## Introduction

Aim of the application

Target users

Product managed

## How it works

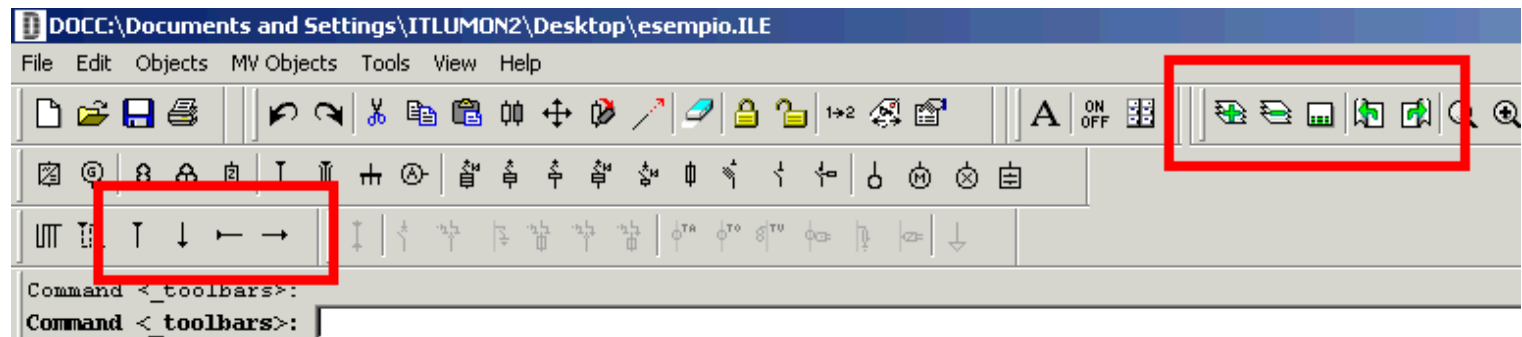
Features

## Support Tools

ASD

Assistance

How to obtain the software



# Features - Plant General Properties Window



- This window is shown when starting a new project. Set all the options carefully to spare time when drawing and calculating the electrical installation

## Introduction

Aim of the application

Target users

Product managed

## How it works

Features

## Support Tools

ASD

Assistance

How to obtain the software

- Main options:

- Power supply definition
- Voltage level
- Default distribution system
- Default number of phases
- Method for SC calculations
- Method for cable sizing
- Options for addressing the device selection

The screenshot shows the 'Plant: general properties' window with the following settings:

- Circuit:** LV Supply (selected), MV-LV Trafo, MV Supply, Generator.
- LV Supply:** V - Icc, bt, Icc: 6 [kA].
- MV-LV Trafo:** An - Vcc - V, 1 Trafo, An: 400 [kVA], Vcc: 4 [%].
- MV Supply:** V - Icc, MT, V: 15000 [V], Icc: 12.5 [kA], 3Io: 50 [A], Neutral balanced.
- Generator:** V, V: 400 [V].
- Symbol:** <default>
- LV section parameters:** 400 [V], LLLN, TT, 50 [Hz].
- Plant loads:** P, I, Q, cosp.
- Calculations according to standard-method:** IEC 60909-1.
- Cable dimensioning according to standard:** CEI 64-8.
- Temperature:** Ambient, for overtemperature in enclosures: 30 [°C]; Used for derating of electrical devices: 40 [°C].
- Protection of people:** Max contact voltage: 50 [V]; Max tripping time: 0.4 [s]; Rt: 1 [Ω].
- Choose automatically:** Miniature CB for Ib up to: 63 [A]; Moulded case CB for Ib up to: 800 [A].
- Neutral section = 50% of Phase (when allowed by standards):**
- Buttons:** Close options <<<, Choose layout, Options..., OK, Cancel.

# Features - Suggested Workflow

# DOC

- A toolbar on the right side of the working area suggests the preferred way to develop a project with DOC

## Introduction

Aim of the application

Target users

Product managed

## How it works


Features

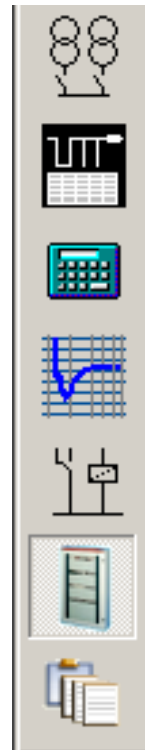
## Support Tools

ASD

Assistance

How to obtain the software

- MV diagram drawing
- LV diagram drawing
- Calculation and automatic project dimensioning
- Protection and discrimination verification thru the curves
- Auxiliaries scheme drawing
- Switchboard configuration 
- Printouts



# Features - MV Diagram Drawing

DOC

## Introduction

Aim of the application

Target users

Product managed

## How it works

Features

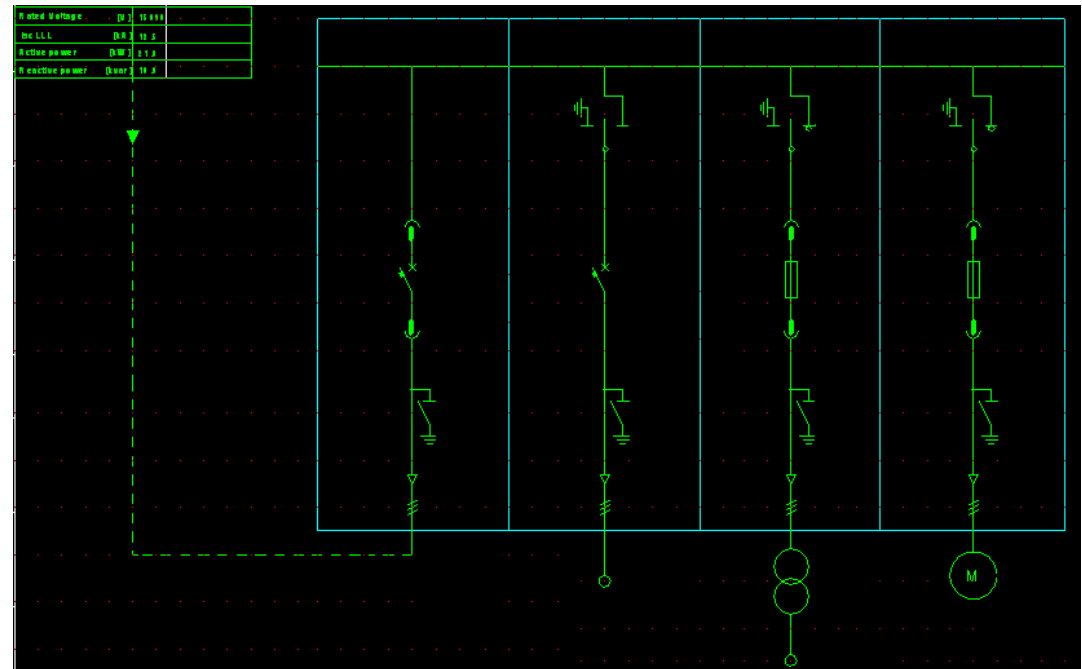
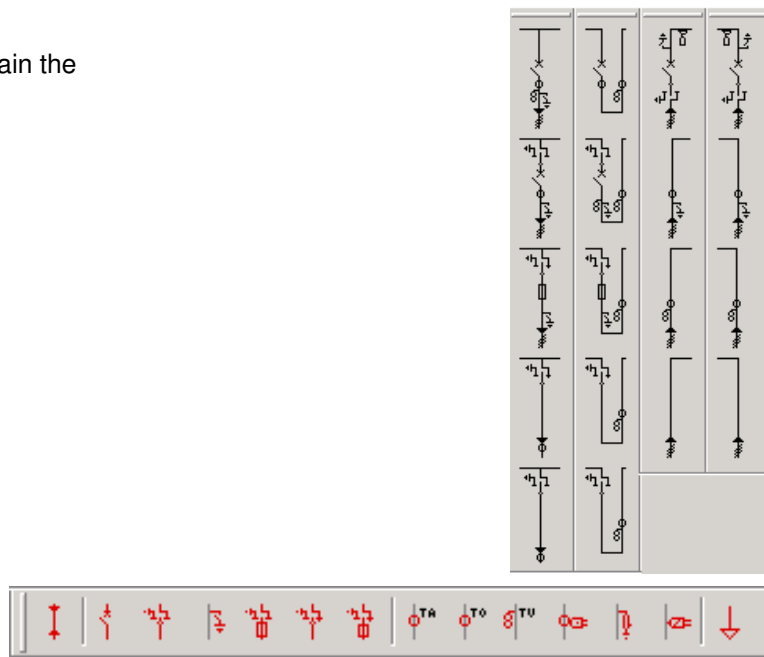
## Support Tools

ASD

Assistance

How to obtain the software

- The Medium Voltage section of the project can be drawn by the Macros of the typical units of the Unimix switchboard or by Objects for more flexibility
- To pass to the Low Voltage section it is necessary to use the transformers (when a low voltage section is not needed, the drawing can be completed with MV Loads or Motors)





# Features - Lv Diagram Drawing



## Introduction

Aim of the application  
Target users  
Product managed

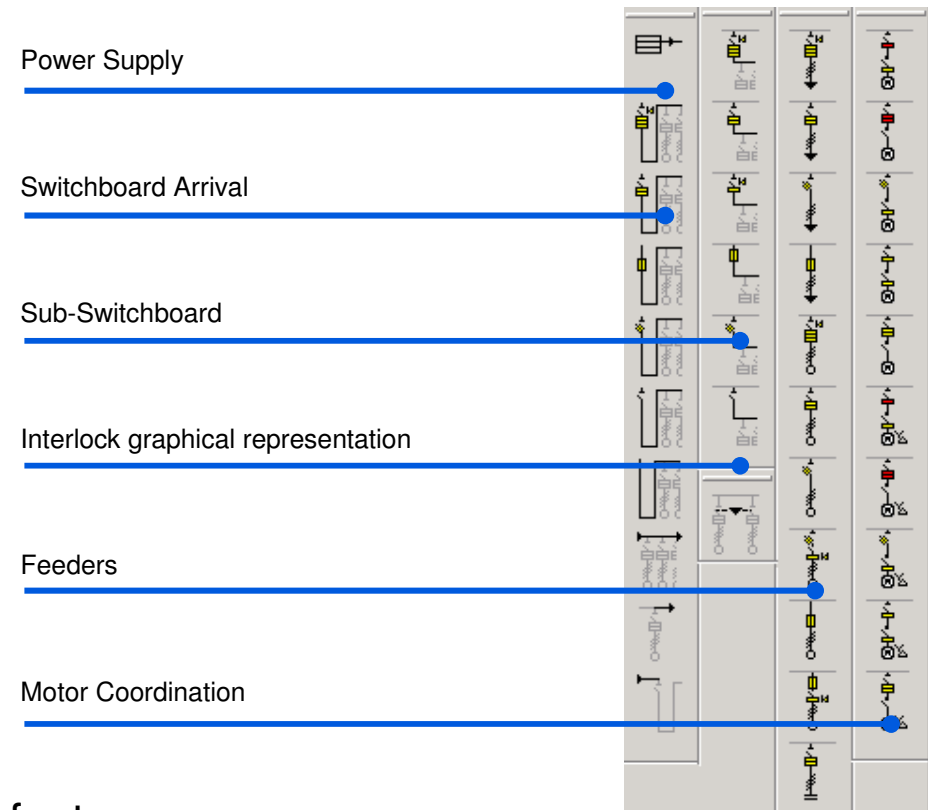
## How it works

### Features

## Support Tools

ASD  
Assistance  
How to obtain the software

- The Low Voltage section of the project can be drawn by the Macros or by Objects for more flexibility
- The Macros available represents the most common Objects combinations; not available combinations can be realized using the Objects
  - 1 Macro = 1 Feeder = Many single objects
    - I.e.: CB+Cable+Load
    - I.e.: Fuse+Cable+Load
  - Faster drawing
- Pop-up window
  - When drawing a feeder it is possible to insert the main data making the drawing phase faster



# Features - Calculation and automatic dimensioning

**DOC**

## ▪ Load-Flow

### Introduction

Aim of the application

Target users

Product managed

### How it works

Features

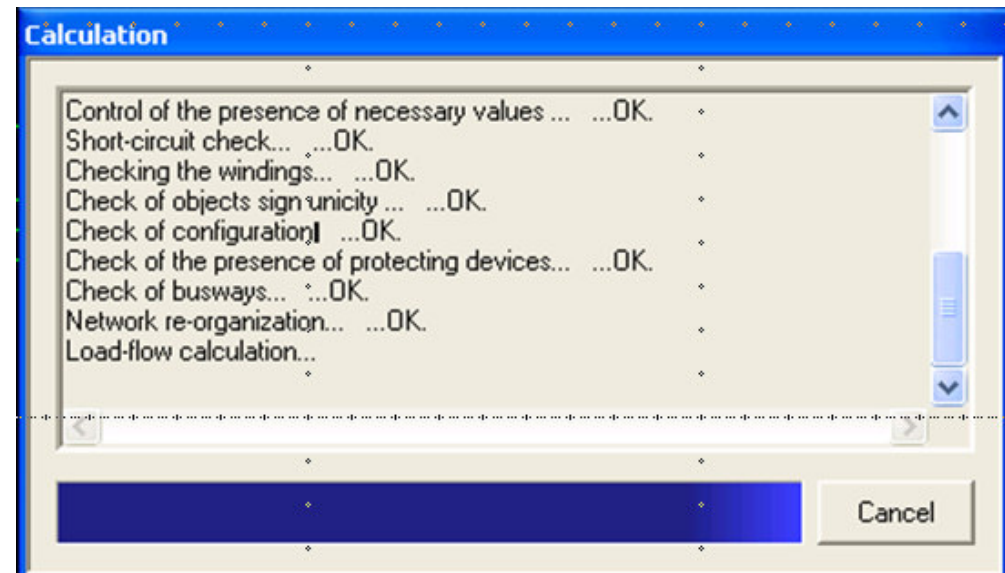
### Support Tools

ASD

Assistance

How to obtain the software

- DOC can calculate the current distribution, the voltage profile and the voltage drop profile in load condition considering:
  - Section with different number of phases
  - Unbalanced loads (automatic balance is optional)
  - Transformer Voltage Regulator
  - Cable dimensioning
  - Presence of meshes
  - More distribution systems



# Features - Calculation and automatic dimensioning



## ■ Cable dimensioning

- Given the power required by the loads and the motors, DOC is able to size the cables in an iterative process bringing to the section optimization and the current profile calculation
- DOC implements several calculation methods
  - IEC 60364
  - CEI 64-8
  - VDE 298
  - NFC 15-100
  - UNE 20460
  - IEC 60092

### **Introduction**

Aim of the application

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# Features - Calculation and automatic dimensioning



## ▪ Short Circuit

### **Introduction**

Aim of the application

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### **How it works**

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ASD

Assistance

How to obtain the software

- DOC can calculate the maximum and minimum short circuit currents, with or without the motor contribution, for symmetrical and not symmetrical faults, for different times
- DOC implements several calculation methods
  - IEC 60909
  - IEC 60363
  - NFC 15-100
  - Symmetrical components method

# Features - Calculation and automatic dimensioning

**DOC**

## ■ Configuration Management

### Introduction

Aim of the application  
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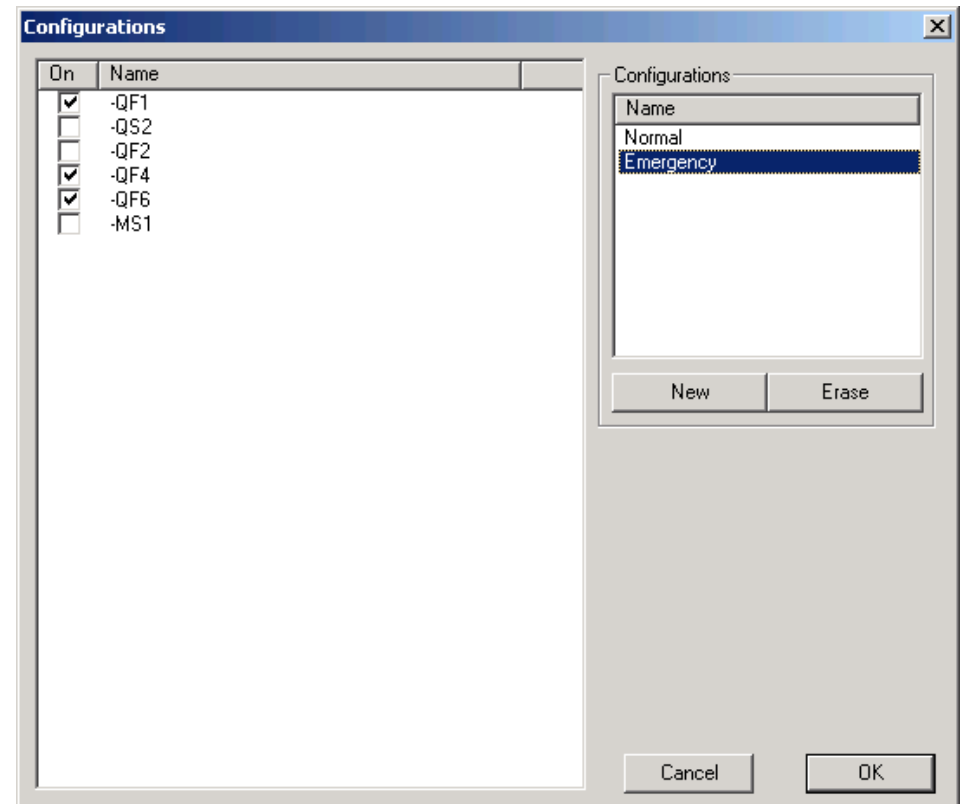
### How it works

Features

### Support Tools

ASD  
Assistance  
How to obtain the software

- In DOC it is possible to simulate different scenarios for the electrical installation defining the open/closed position for the switching and protecting devices
- The calculation are performed in the worst condition



# Features - Calculation and automatic dimensioning



## ▪ Devices Selection

- The calculation leads to an automatic proposal for all the devices drawn in the scheme
- When more than one product is technically suitable, DOC proposes the cheapest one
- It is possible to change the solution proposed by DOC and to lock the user choice thanks to the padlocks present in all the selection windows

### Introduction

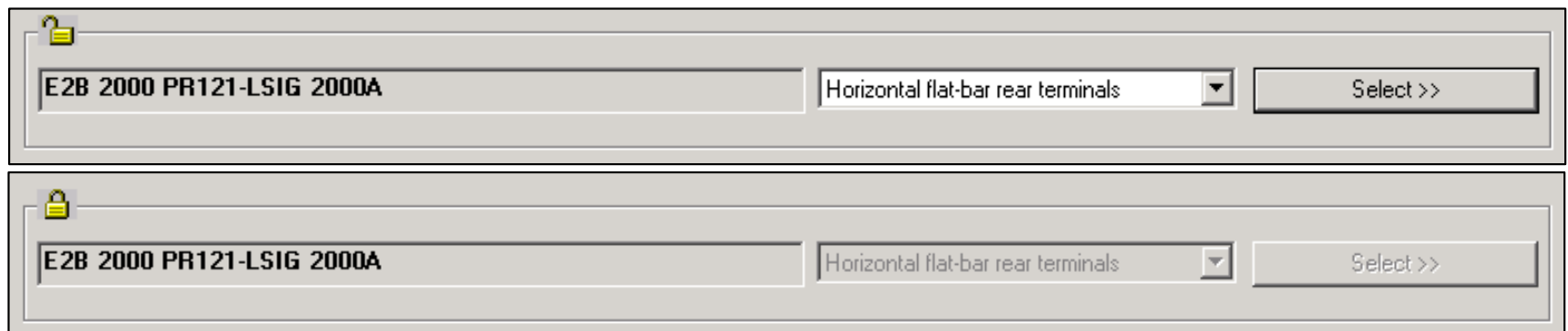
Aim of the application  
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### How it works

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# Features - Calculation and automatic dimensioning



- DOC gives the possibility to perform the temperature rise-assessment according to IEC 60890 in a early stage of the installation design

## Introduction

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New project - Temperature-rise assessment according to IEC 60890

File Help

Cooling system

- Natural ventilation
- Forced ventilation (\*)
- Air-Conditioning (\*)

(\*) Method not contemplated by the reference standard


Target of calculation

- Temperature profile
- Losable power

Ventilation grid's area: 0.00 [cm<sup>2</sup>]

Disposition

- Separate enclosure, detached on all sides
- Separate enclosure for wall-mounting
- First or last enclosure, detached type
- First or last enclosure, wall-mounting type
- Central enclosure, detached type
- Central enclosure, wall-mounting type
- Covered on 2 sides and top surface, for wall mountir



Dimensions [mm]

Height: 2000  
Width: 600  
Depth: 600

Horizontal frames: 2

Effective cooling area (Ae)

		Ao [m <sup>2</sup> ]	b	Ao x b [m <sup>2</sup> ]
Top surface	Exposed	0.36	1.40	0.50
	Covered			
Front surface	Exposed	1.20	0.90	1.08
	Covered			
Back surface	Covered	1.20	0.50	0.60
	Exposed			
Side surface	Exposed	1.20	0.90	1.08
	Exposed	1.20	0.90	1.08
Ae				4.34

Ae < 11.5 m<sup>2</sup> and Width < 1.5 m, so temperature-rise will be calculated on the whole enclosure.

Dimension used for calculation [mm]

Height: 2000  
Width: 600  
Depth: 600

Cancel Next >

New project - Temperature-rise assessment according to IEC 60890

File Help

Selected method: Natural ventilation -> Temperature profile

Power losses

Devices rated power losses: 360.0 [W]  
Demand factor: 1.00 <sup>2</sup>  
Conductors power losses: 100.0 [W]  
Extra power losses: 0.0 [W]

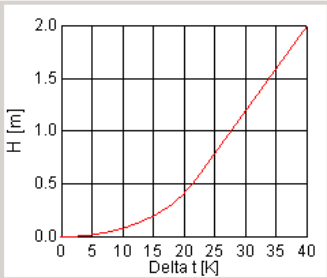
Ambient temperature: 30.0 [°C]

Results

Power [W]

Devices rated power losses: 360.0 ×  
Demand factor: 1.00 <sup>2</sup> =  
Devices power losses: 360.0 +  
Conductors power losses: 100.0 +  
Extra power losses: 0.0 =

Total power losses: 460.0



Ambient temperature: 30.0 [°C]  
Temperature at maximum height: 70.0 [°C]

Δt<sub>1,0</sub>: 40.0 [K]  
Δt<sub>0,5</sub>: 27.5 [K]

< Back OK

# Features - Curves



- With DOC it is possible to manage
  - Time-current diagrams for the devices present in the scheme
  - Set the thermomagnetic and electronic trip units
  - Realize discrimination studies involving MV and LV devices
  - Verify the cable protection

## Introduction

Aim of the application

Target users

Product managed

## How it works

Features

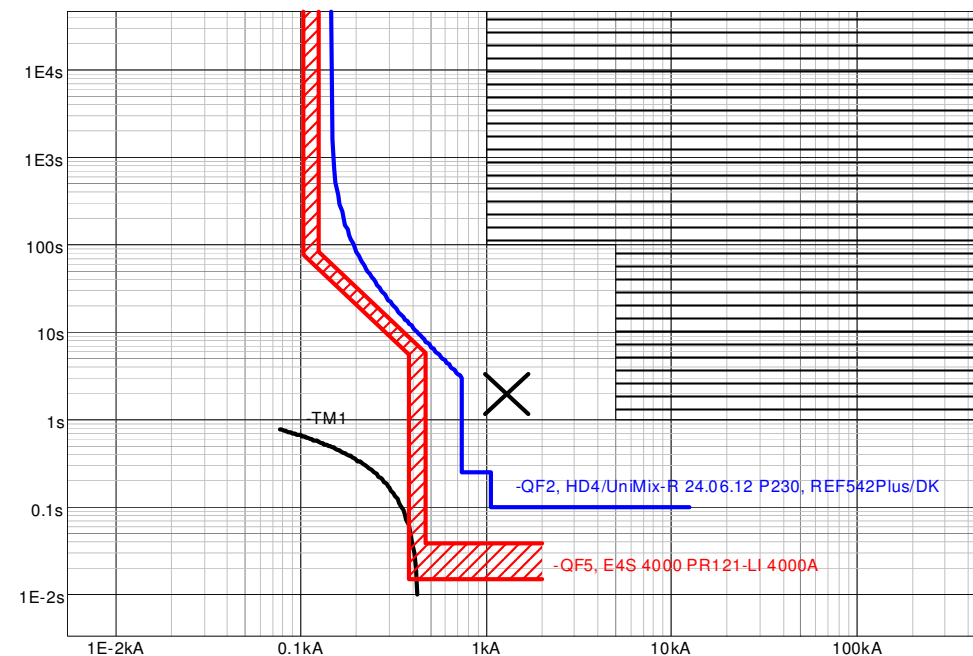
## Support Tools

ASD

Assistance

How to obtain the software

Time-Current curve LLL





# Features – Switchboard configuration



- With DOC it is now possible to configure switchboard:
  - By using a Wizar configuration: three steps guide procedure to create a switchboard.

- By using a toolbar on the left side of working area:

- Insert and move column, Kit and device



- Tracking busbar system and temperature rise assessment



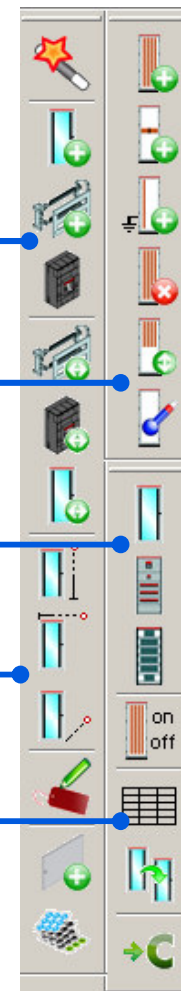
- Layer management (door, panel and plate layer, show hide busbars)



- Modify switchboard dimension



- Smart commands (switchboard table, labels, accessories)



# Features - Project documentation

**DOC**

- Different reports sections allows the creation of a unique file documenting the project
  - The report sections can be added/removed according to the needs
    - Calculation hypothesis
    - Short circuit calculations
    - Cable Protections
    - MV / Iv devices list and settings
  - Export in MS Excel is available
  - The report language can be different from the current language

## **Introduction**

Aim of the application

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## **Support Tools**

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How to obtain the software

# How to obtain the software

- DOC & CAT collection is available ONLINE
  - You can download DOC & CAT from Business On Line portal, in technical area / work tools.  
<http://bol.it.abb.com/>
  - To download the software it is necessary to specify the UserId and the password received after the sign up procedure to Business On Line site.
  - Here below you can find “DOC & CAT” FAQ:



FAQ DOC&CAT

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