



**Mitsubishi Electric Selection software (MELSELECT)
for Mitsubishi Electric low-voltage circuit breaker
User manual**

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1. Introduction

This user manual explains how to use Mitsubishi Electric Selection software, MELSELECT (Ver.1.5.2) for low-voltage circuit breaker.

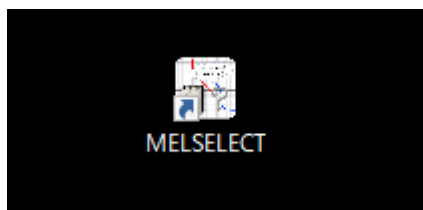
1.1 System requirements

Item	Recommended requirements
Operating system (OS)	Microsoft Windows10 (32/64 bit) Pro
Software execution environment	Microsoft .NET Framework 4.6
Report output software	Microsoft Word 2016

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1.2 Start MELSELECT

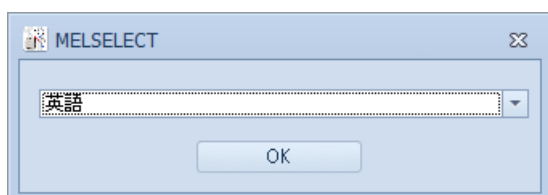
- (1) Download MELSELECT and unzip the compressed folder.
- (2) Install MELSELECT by [MeselectSetup.msi] in the decompressed folder.
- (3) Open MELSELECT from a created below shortcut on a desktop.



When installing MELSELECT Ver1.5.2,
uninstall the old one before installing.
There is no influence on the created project.

- (4) For the first time of starting up MELSELECT, a screen of language selection is displayed. Select language (English/Chinese/Japanese/Portuguese) and click OK.

※The language selection is not displayed at the second and subsequent startups.

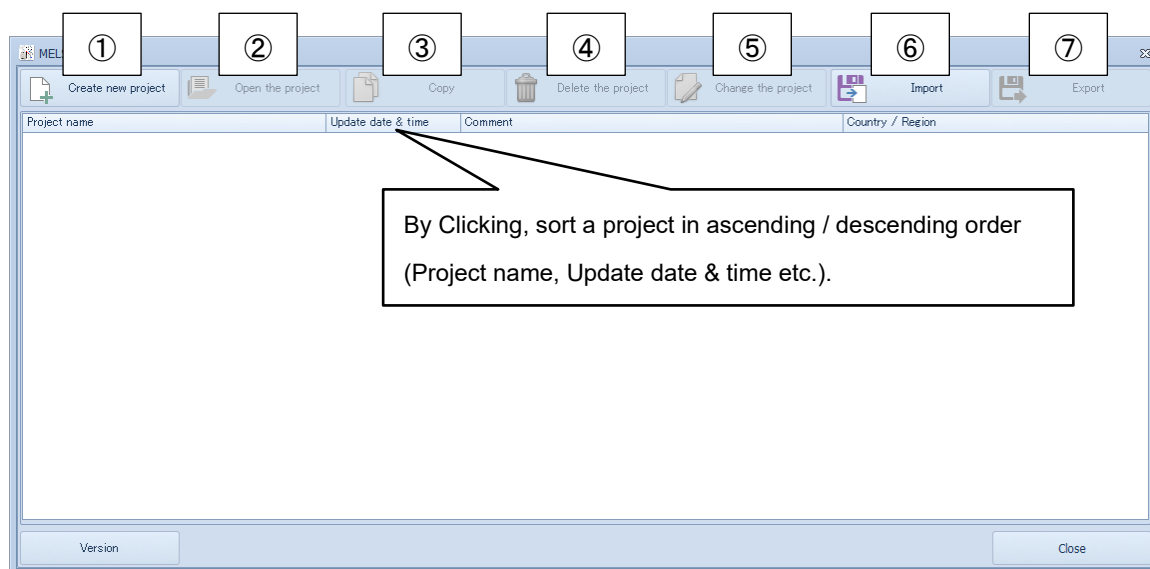


2. Project management

At the project management window which displayed in startup of MELSELECT, following operations are available.

Table1. Project management function list

No	Item	Function
①	Create new project	Create new project
②	Open the project	Open the selected project
③	Copy	Copy selected project and create a project of new name
④	Delete the project	Delete selected project
⑤	Change the project	Change the project information of selected project
⑥	Import	Import project file from arbitrary folder
⑦	Export	Export selected project to arbitrary folder as project file



The project is listed by a created order and they can sort in ascending / descending order by clicking a tabs such as Project name/Update date & time etc.

2.1 Create new project

- (1) Click [Create new project] button, create the new project.
- (2) Enter "Project name" (Required), "Comment" and select "Country/Region" (Required) in the project setting.
- (3) Enter each parameter of "Project information" and "Report information" tabs.

① Click [Create new project].

② Enter Project name, Comment, Country/Region.

③ Enter Project information
System, Model selection, LV cable, Busbar, Busduct, Margin.

Table 2. The tab setting items for Project information

Group	Setting item	Range	Contents
System	Frequency [Hz]	50/60	Select frequency of system
	Maximum allowable voltage drop [%]	0-10 (Integer)	Enter allowable voltage drop in the whole of systems
Model selection	Priority of model selection	Adjustable type/Fixed type	Select a type which is preferentially displayed when selecting models (Adjustable type can be selected even if fixed type is selected)
LV cable	Maximum permissible cable cross section [mm ²]	95/120/150/185/240/300/400/500/630/800/1000 ※	Select a maximum permissible cable cross-section area when selecting a cross section
	Cable ambient temperature [°C]	10/15/20/25/30/35/40/45/50/55/60	Select ambient temperature
	Cable maximum permissible voltage drop default value [%]	0-10 (Integer)	Specify the maximum permissible voltage drop of cable
Busbar	Busbar ambient temperature [°C]	10/15/20/25/30/35/40/45/50/55/60	Select ambient temperature of busbar
	Busbar max. voltage drop [%]	0-10 (Integer)	Specify the maximum allowable voltage drop of busbar
Busduct	Busduct ambient temperature [°C]	10/15/20/25/30/35/40	Select ambient temperature of busduct
	Busduct max. voltage drop [%]	0-10 (Integer)	Specify the maximum allowable voltage drop of busduct
Margin	Breaker rated current margin of load current [%]	100/105/110/115/120/125	Specify added margin when selecting rated current of the breaker

※ Cross-section area 800mm² and 1000mm² cables are not specified in IEC60364-5-52.

(4) Information which is entered at [Report information] tab is listed on output report. (Entry is optional)

The screenshot shows the MELSELECT Project Setting dialog box. The 'Project information' tab is selected, and the 'Report information' sub-tab is active. The dialog box contains several sections: 'Project setting' (Project name: Sample project, Comment, Country / Region: Singapore), 'Project information' (Report information), 'Company' (Company Name: Mitsubishi Electric Corporation, Phone Number, Street: 1-8 Midori-machi, City: Fukuyama, Postal Code: 720-8647, State: Hiroshima, Country: Japan, Web Site), and 'Project' (Project name: Sample project, Place: Singapore, Customer name, Revision). Annotations include: ④ Click [Report information] pointing to the 'Report information' sub-tab; ⑤ Enter Report information. pointing to the 'Report information' section; and ⑥ Click [OK]. pointing to the 'OK' button at the bottom.

④ Click [Report information]

⑤ Enter Report information.

⑥ Click [OK].

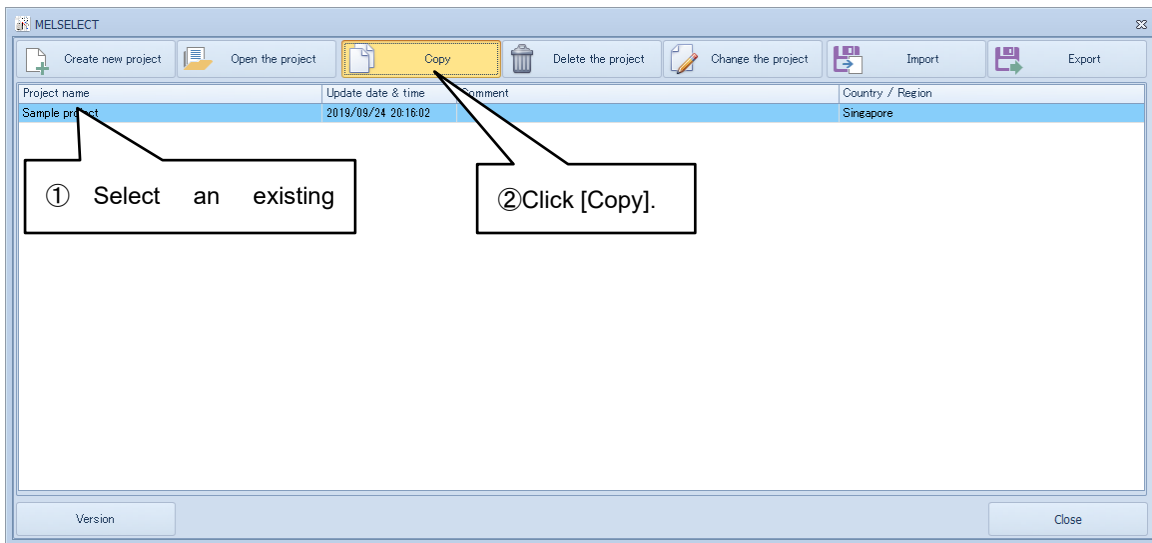
(5) After clicking [OK] button, the project of setup contents is created.

※All of contents except [Project name] can change after creating the project (After clicking [OK] button)

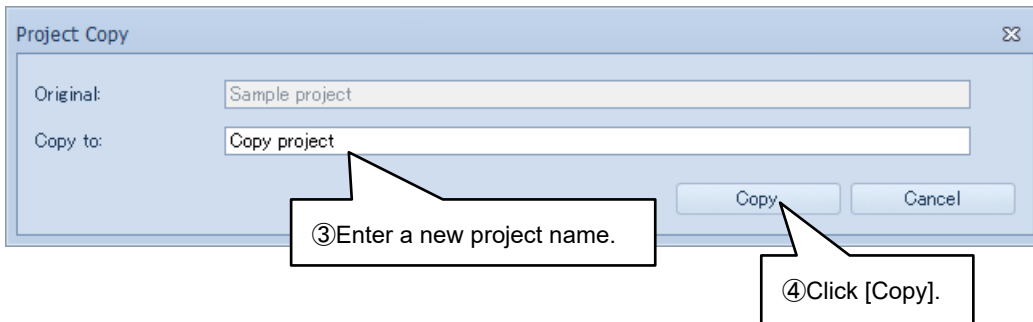
[Project name] cannot change after creating the project. (After clicking [OK] button)

2.2 Divert existing project and create project

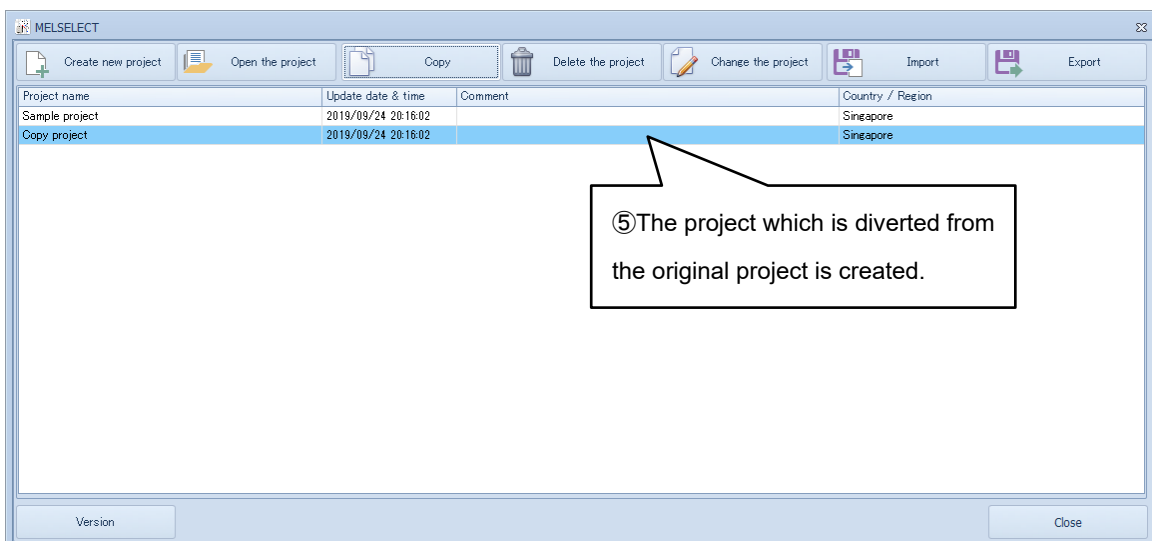
(1) Select an existing project in the project management window, click [Copy] button.



(2) Enter a new project name to [Copy to], click [Copy].



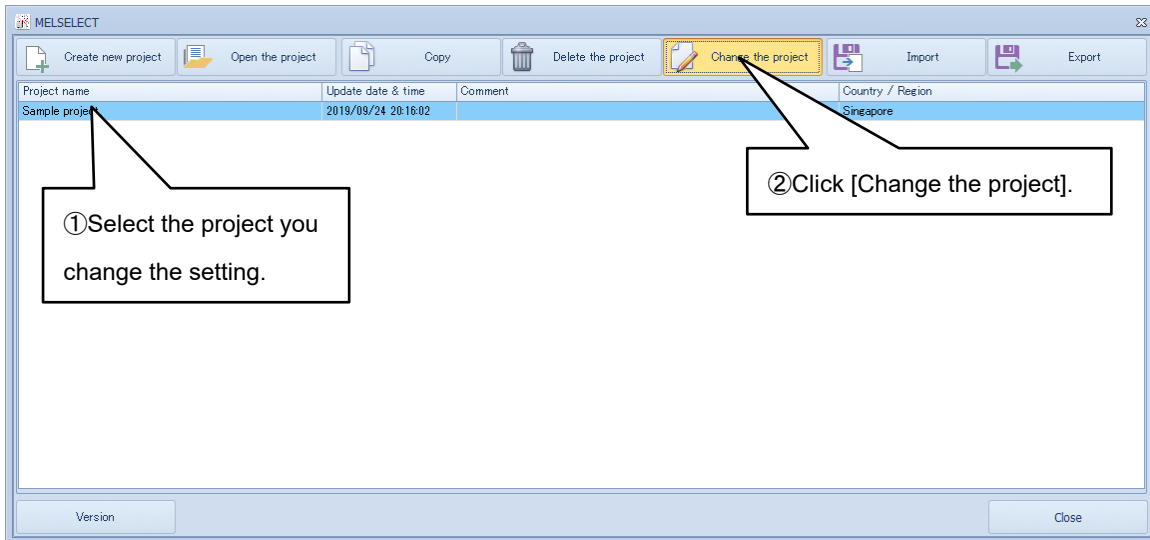
(3) The original project is copied, then the diversion project is created with the set project name.



※At the time of copy, the update date and time retain the original value.

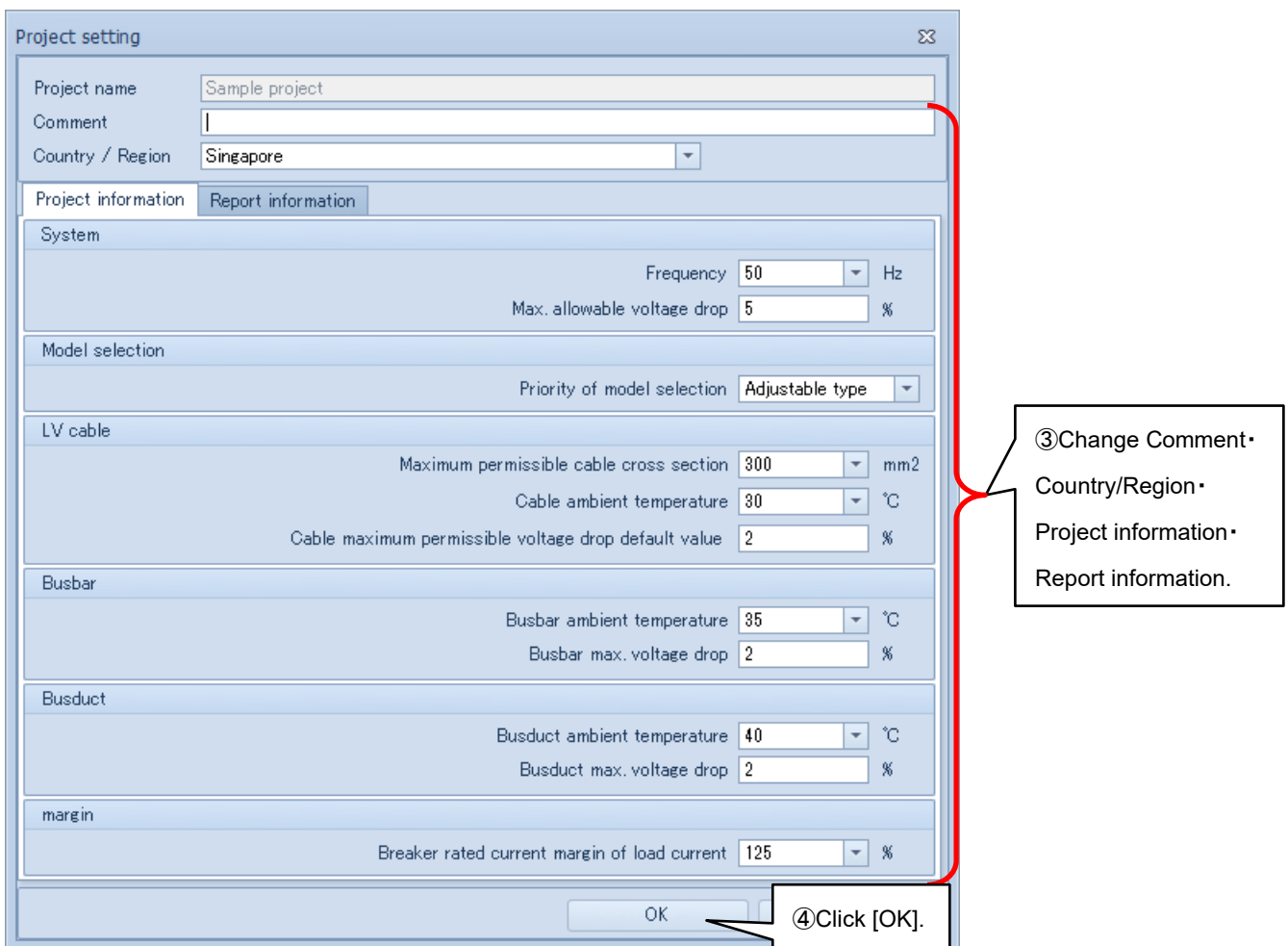
2.3 Change project setting

(1) Click the project which you change of setting in the project management window, click [Change the project] button.



(2) All information except the project name is changeable.

(3) Click [OK] button, the project of changed contents are updated.

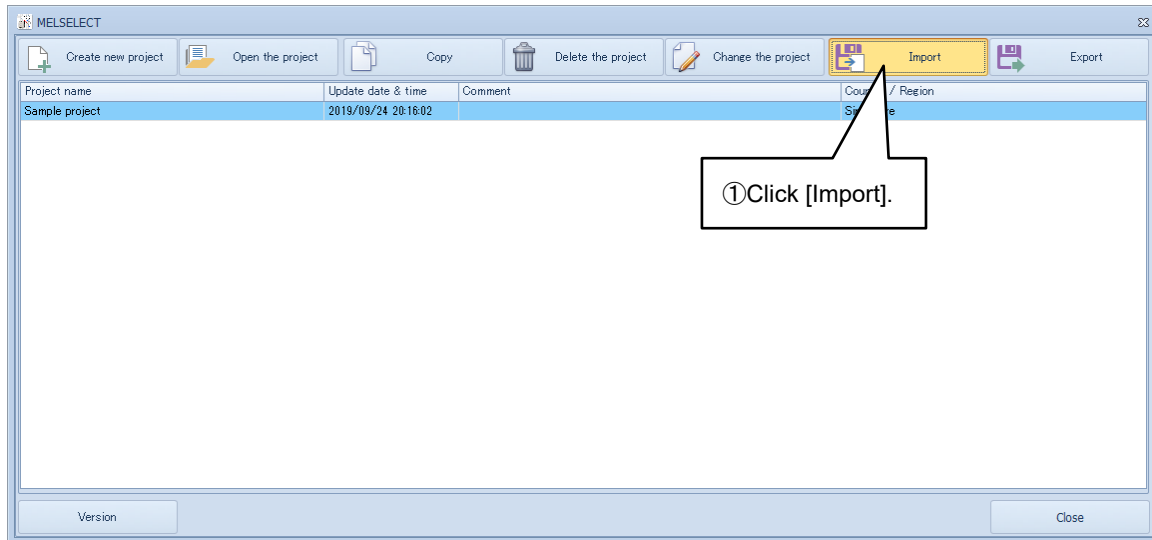


※The updated date and time are updated by the clock time of completed change of setting.

2.4 Import project

MELSELECT can import the project file of extension .mel.

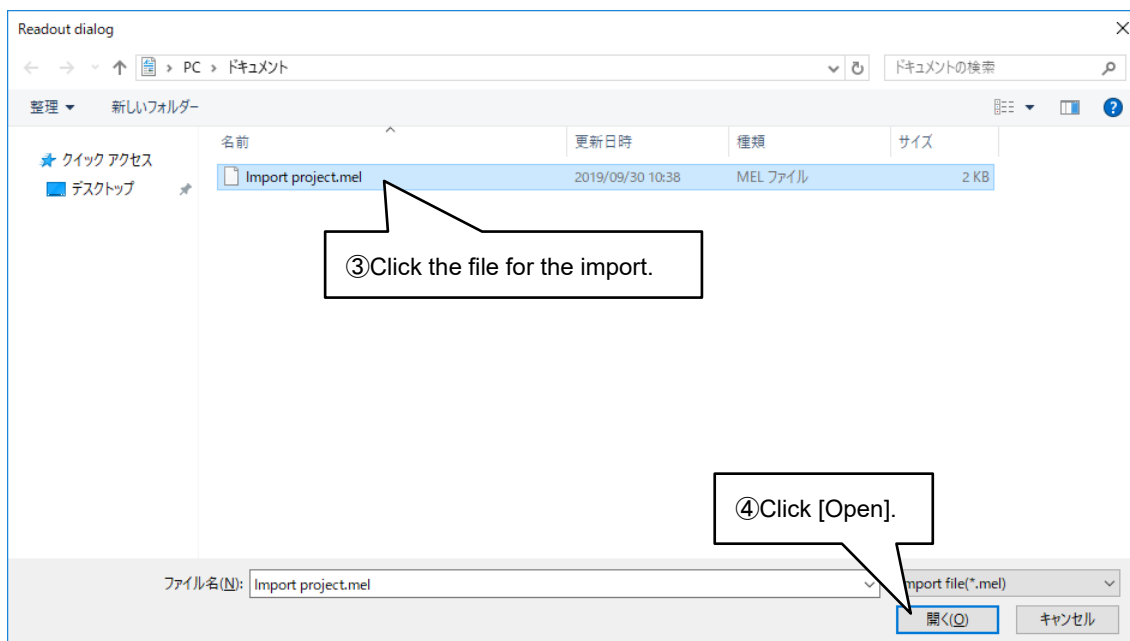
(1) Click [Import] in the screen of the project management window.



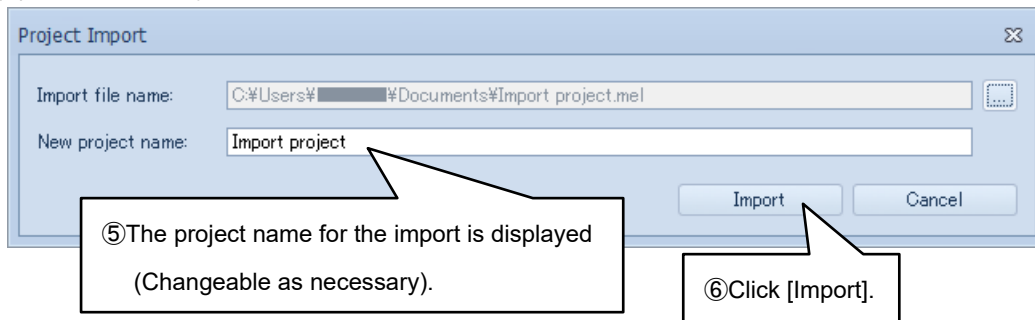
(2) Click [...] button



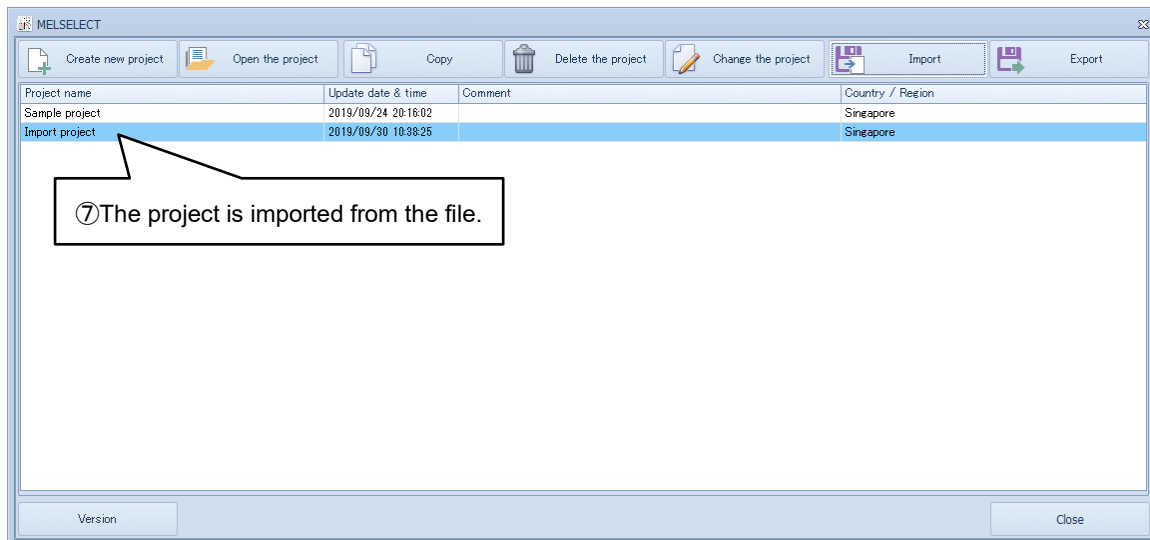
(3) Select the file of .mel for the import, click [Open]



(4) Enter the project name, click [Import] button.



(5) The project is imported.

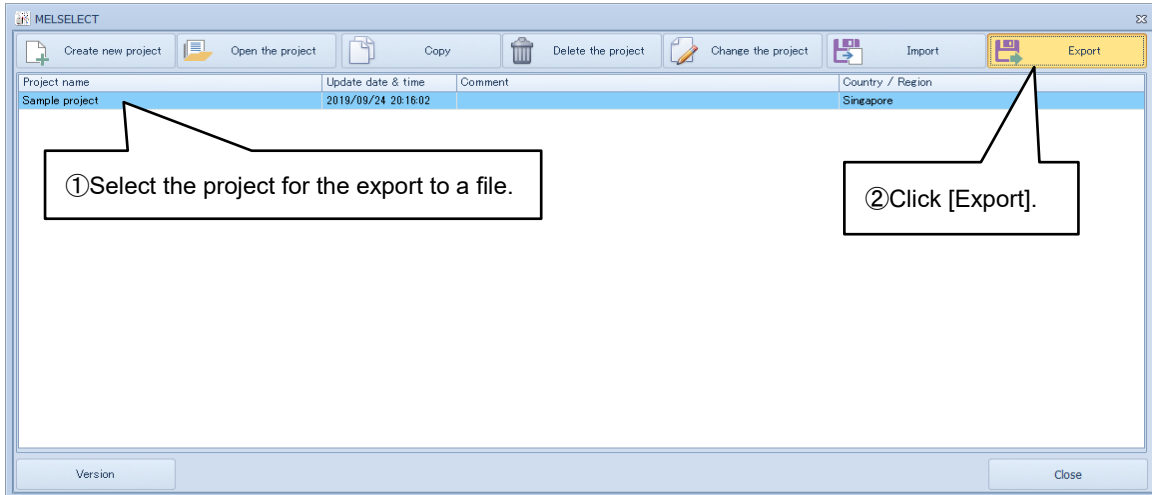


※At the time of the import, the updated date and time retain the value of the import file.

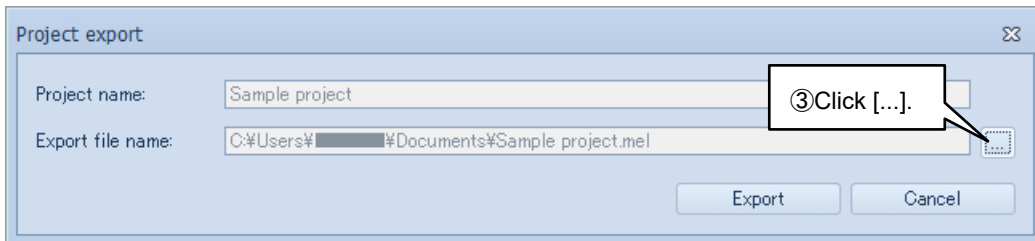
2.5 Export project

MELSELECT can export the project as a project file of extension .mel.

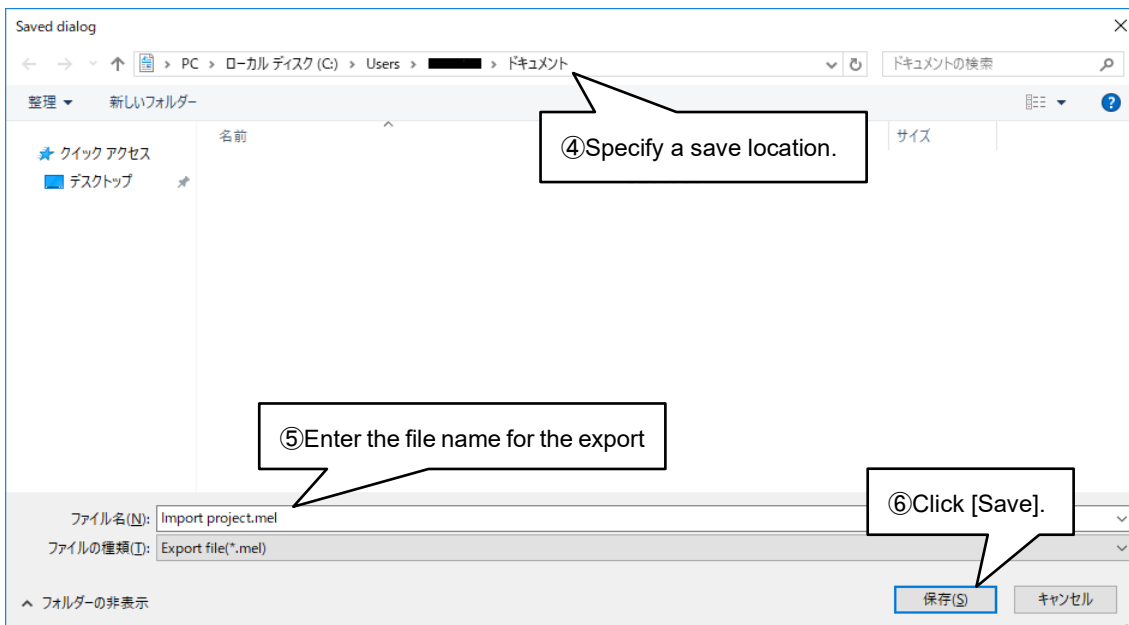
(1) In the project management window, select the project which you export to a file, and click [Export].



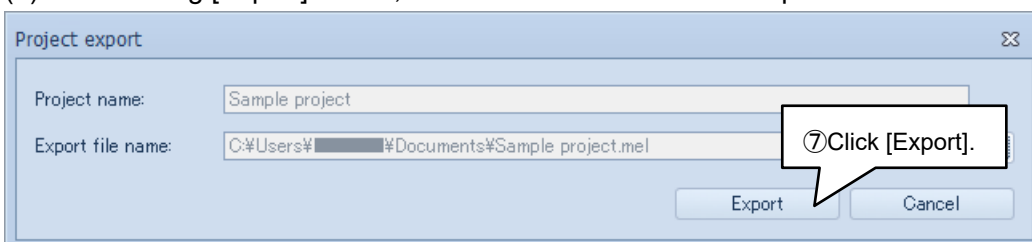
(2) Click [...] button.



(3) Specify a save location and the file name for the export of the project, click [Save] button.



(4) After clicking [Export] button, the .mel file is created to the specified save location.



3. Create single-line diagram

3.1 Draw single-line diagram

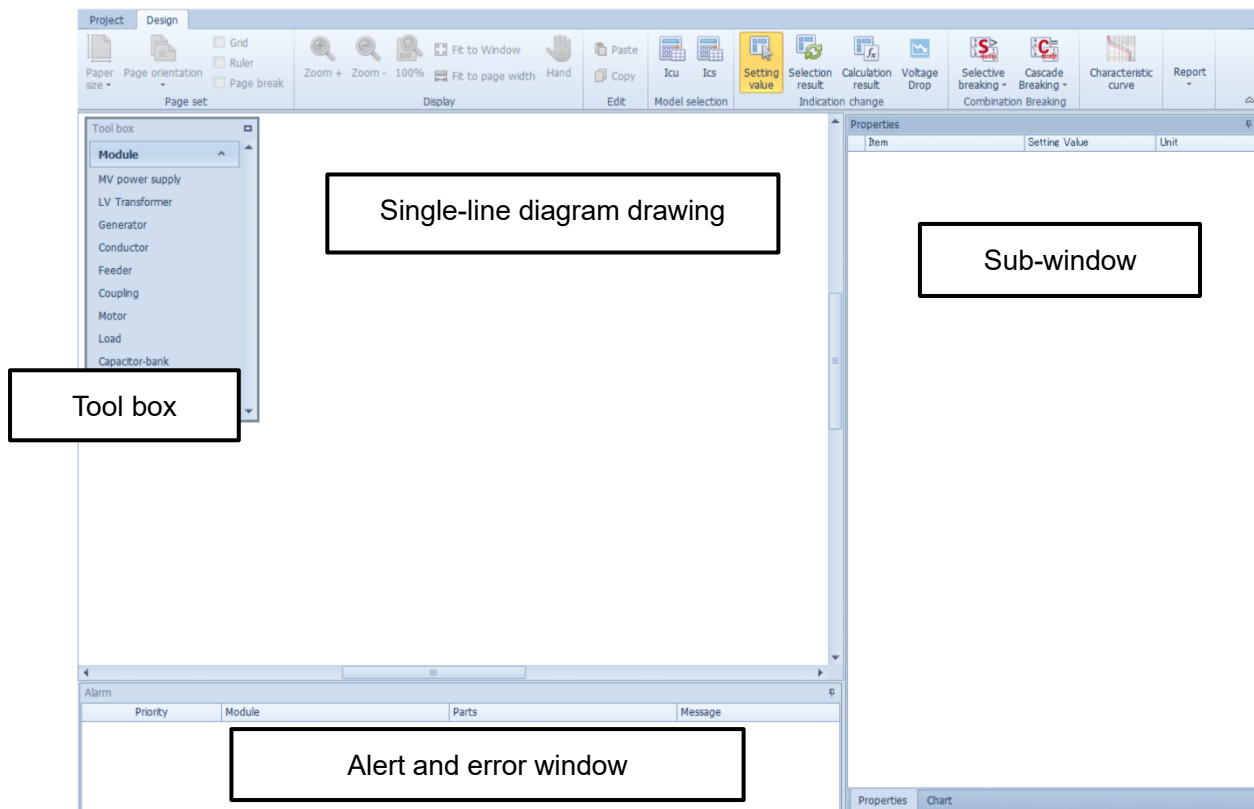
(1) Open the project which edits single-line diagram in the project management window.

It is consisted four screens.

- Single-line diagram drawing area Main screen. Put module, display information of each element
- Tool box Select the module for put
- Sub-window Enter information of element, display breaker characteristic curve
- Display alert, error window Alert, error are displayed

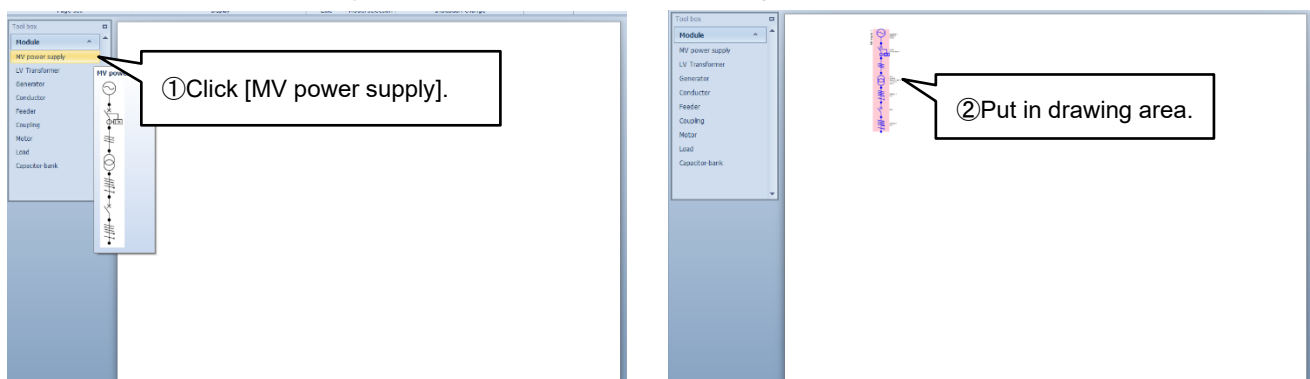
(2) Select module from Tool box on left side and put them to draw single-line diagram.

It can put up to 200 modules in single-line diagram drawing area.

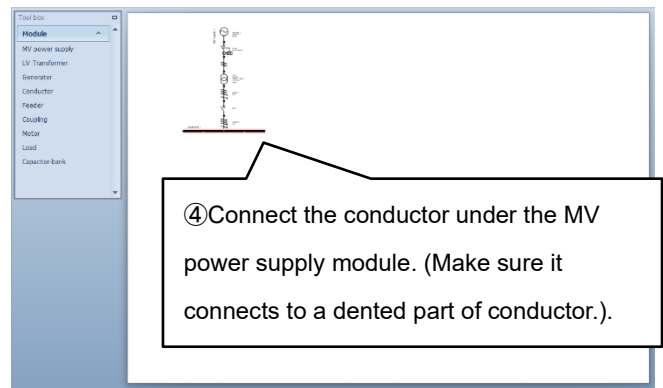
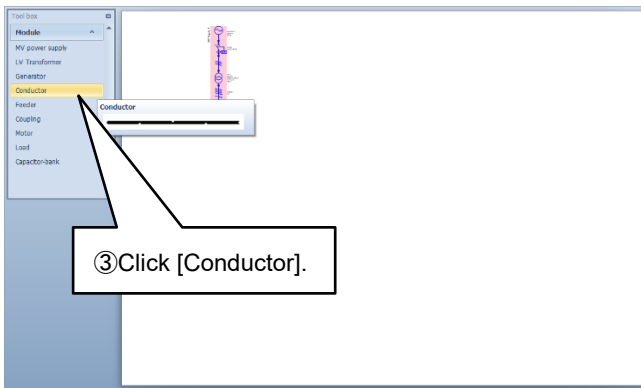


(ex: The drawing in the case of creating single-line diagram including general load and motor load)

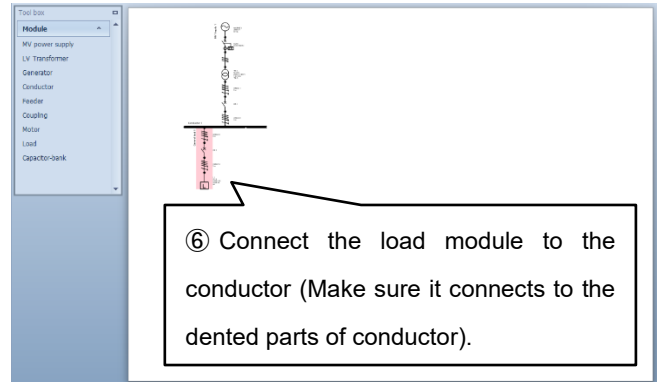
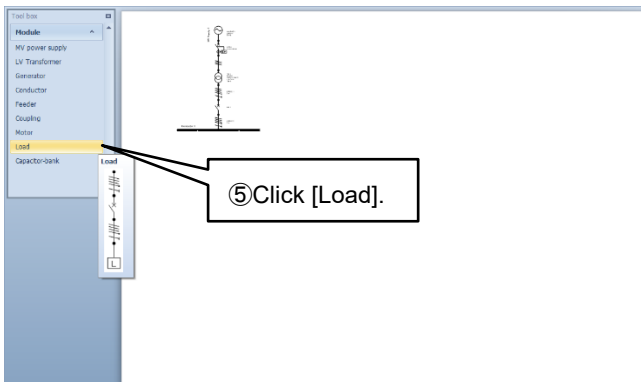
[1] Click [MV power supply] in Tool box and put it in drawing area.



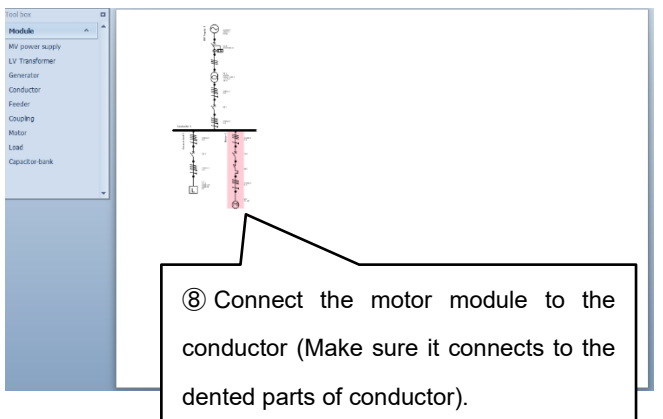
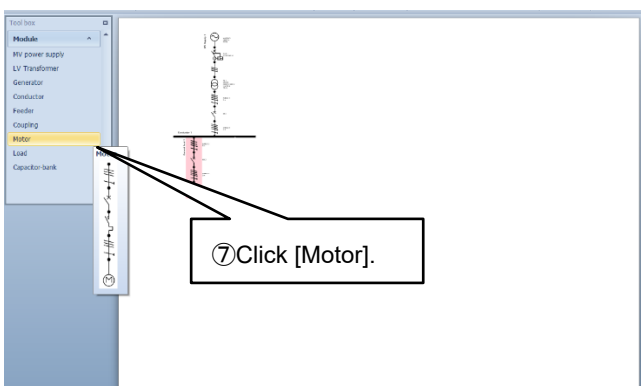
[2] Click [Conductor] in the tool box and put it under the [MV power supply].



[3] Click [Load] in the tool box and put it under [Conductor].

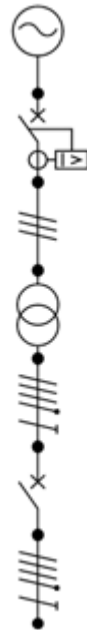




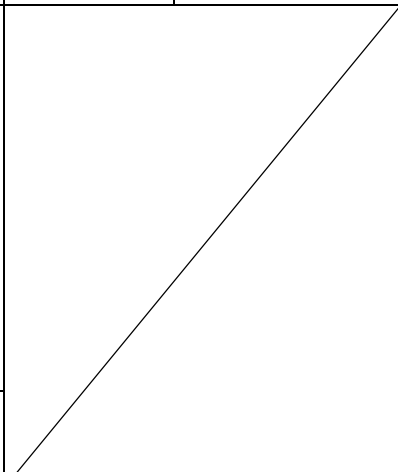







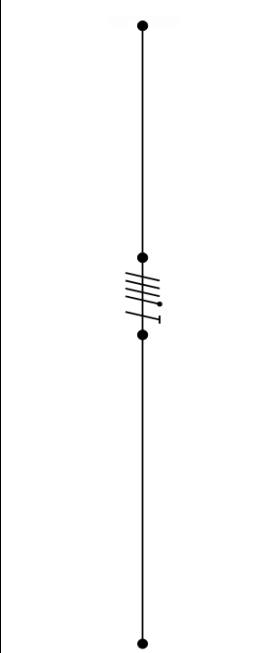
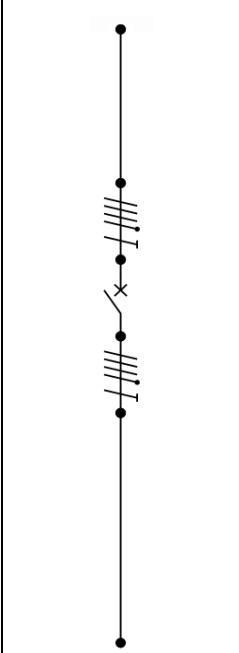
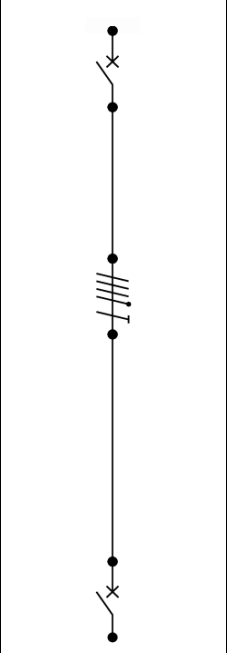
[4] Click [Motor] in the tool box and put it under [Conductor].



[5] After creating single-line diagram, click [Project] tab on the upper left and click [Save].

Table 3. Usable Module list

Item	Module		Item	Module	Item	Module
MV power supply			LV Transformer		Generator	
Feeder			Coupling			
Conductor						
Motor	Direct Start Star-Delta Start 	Inverter Start 	Load		Capacitor-bank	

Item	Module	Item	Module	Item	Module
Vertical conductor		Feeder L		Feeder V	

3.2 Set each element parameter

- (1) The parameters of each element which were put in the drawing area are changeable. Set them before the short-circuit calculation.
- (2) Click each element and set parameter in [Properties] window on the right side according to a condition and a purpose. Main changeable parameters are as follows.

Table 4. Main Changeable parameters

Elements	Changeable parameters
Power	Voltage/Short-circuit capacity/[X/R]
Protection relay	Type/MV protection device
Transformer	Secondary voltage/Earthing system/Transformer capacity/%Z/[X/R]
Generator	Voltage/Power distribution system/Capacity/Transient reactance/Sub-transient reactance /DC time constant/Sub-transient time constant
Cable	Length/Conductor material (Phase) (N) (PE)/Insulating material/Cable arrangement /Resistance/Reactance/Cross section area rate
Busbar	Length/Conductor material (Phase) (N) (PE)/Horizontal installation factor /Proximity effect factor/Resistance/Reactance/Cross section area rate
Busduct	Length/Number of poles/Conductor material (Phase) (N) (PE) /Resistance /Reactance/Cross section area rate
Breaker	Type of circuit breakers/Number of poles/Residual current protection/Electronic trip relay (ACB only)
Capacitor-bank	Installed capacity/Reactor
Load	Load current/Power factor/Capacity/Output
Motor	Starting method/Output
Inverter	AC reactor/DC reactor/Type

(ex: In the case of changing the parameters of single-line diagram created at 3.1.).

[1] Click Power in the single-line diagram and change [Voltage].

①Click Power (SOURCE1).

②Change power setting on sub-window.
Voltage: 22000V

Item	Setting Value	Unit
Voltage	22000	V
Short-circuit capacity	3000	IVA
X/R	6000	
% Z	6600	
Resistance (R)	10000	
Reactance (X)	11000	

[2] Click Protection relay to select protection relay (OCR) model

① Click protection Relay (OCR)

② Change OCR model on the sub-window

Item	Setting Value	Unit
Type	MELPRO-S (5A)	
MV Protection Device	COC4-A02S1	

[3] Click Transformer in the single-line diagram and change “Secondary voltage” and “Transformer capacity”.

① Click Transformer (TR1).

② Change transformer setting on the sub-window.

- Secondary voltage: 400V
- Transformer capacity: 250kVA

Item	Setting Value	Unit
Primary voltage	22000	V
Secondary voltage	400	V
Earthing system	TN-S	
Transformer capacity	50	kVA
Current	20	A
%Z	50	%
X/R	75	
Resistance (R)	100	
Reactance (X)	150	

[4] Click Breaker (CB1) in the single-line diagram and change “Type of circuit breakers”, “Electronic trip relay” and “Residual current protection” etc.

① Click Breaker (CB1).

Properties

Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	ACB	
Number of poles	4P(3P+N)	
Residual current protection	No	
Electronic trip relay	for General use(WS)	
Model	for General use(WS)	
Selective breaking main ...	for Generator protection use(W)	
Cascade breaking main b...	for Special use(WB)	
	for Coordination use(WF)	

Properties

Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	ACB	
Number of poles	4P(3P+N)	
Residual current protection	No	
Electronic trip relay	for General use(WS)	
Model	for General use(WS)	
Selective breaking main ...	for Generator protection use(W)	
Cascade breaking main b...	for Special use(WB)	
	for Coordination use(WF)	

② Change breaker setting in the sub-window.

- Type of circuit breakers: ACB
- Residual current protection: No
- Electronic trip relay: for General use (WS)

③ Click Breaker (CB2).

Properties

Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	MCCB	
Number of poles	4P(3P+N)	
Residual current protection	No	
Model	Yes	
Selective breaking main ...	No	
Cascade breaking main b...		

Properties

Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	MCCB	
Number of poles	4P(3P+N)	
Residual current protection	No	
Model	Yes	
Selective breaking main ...	No	
Cascade breaking main b...		

④ Change breaker setting on the sub-window.

- Type of circuit breakers: MCCB
- Residual current protection: No

⑤ Click Breaker (CB3).

⑥ Change breaker setting on the sub-window.

- Type of circuit breakers: MCCB
- Residual current protection: Yes

Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	MCCB	
Number of poles	3P	
Residual current protection	No	
Model	Yes	
Selective breaking main	No	
Cascade breaking main	No	

[5] Click Load in the single-line diagram and change “Load current” and “Power factor”.

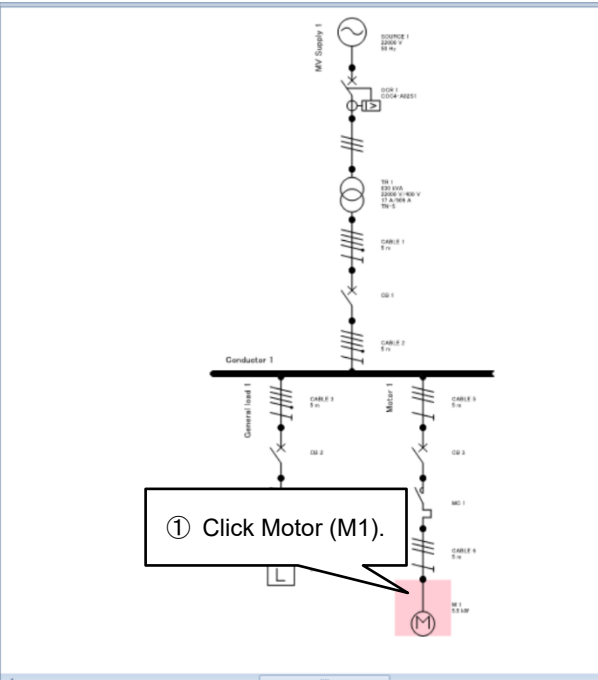
① Click Load (L1).

② Change load setting on the sub-window.

- Load current: 80A
- Power factor: 0.9

Item	Setting Value	Unit
Load current	80	A
Power factor	0.9	
Capacity	55.426	kVA
Output	49.883	kW

[6] Click Motor in the single-line diagram and change “Starting method” and “Output”.



① Click Motor (M1).

② Change motor setting

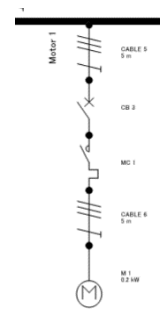
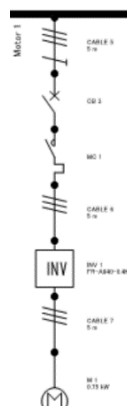
- Starting method: INV starting
- Output: :5.5kW

③ Change motor setting on the sub-window.

- Starting method: Star-Delta start
- Output: :5.5kW

Item	Setting Value	Unit
Starting method	Star-Delta start	
Output	5.5	kW
Load current	5.5 7.5 11 45 55 75 90 110 132 160 200 ---	

[6-1] When INV start is selected
When you change “Starting method”, symbol and setting value (output and Load current) will be changed.

Symbol	Setting value												
<div><div>Direct start, Star-Delta start</div><div>Inverter start</div></div>	<table><tr><th>To</th><th>Output (kW)</th><th>Load current (A)</th></tr><tr><td>Direct start</td><td>0.2</td><td>0.6</td></tr><tr><td>Star-Delta start</td><td>5.5</td><td>11</td></tr><tr><td>Inverter start</td><td>0.75</td><td>1.6</td></tr></table> <p>※1 This case is the voltage is 400V. ※2 Even if the voltage is changed, Output and Load current will automatically return to the initial values.</p>	To	Output (kW)	Load current (A)	Direct start	0.2	0.6	Star-Delta start	5.5	11	Inverter start	0.75	1.6
To	Output (kW)	Load current (A)											
Direct start	0.2	0.6											
Star-Delta start	5.5	11											
Inverter start	0.75	1.6											

[7] Cable setting is also changeable. In this example is the initial setting.

①Click Cable (CABLE1).

②Cable setting

- Cable/Busbar/Busduct
- Length
- Conductor material
- Insulating material
- Resistance
- Reactance
- Cross section area rate

Item	Setting Value	Unit
Cable / Busbar / Bus...	Cable	
Length		
Conductor material (P...	Busbar	
Conductor material (P...	Busduct	
Conductor material (P...	Cu	
Insulating material	PVC	
Cable arrangement	31F	
Cross sectional area		
Number of wires		
Resistance		
Resistance X Length		
Reactance		
Reactance X Length		
[Neutral conductor se...		
Cross section area ra...		
Cable/Busbar		
Conductor material		
Cross sectional area		
Number of the cables		
Resistance		
Resistance X Length		
Reactance		
Reactance X Length		

Conductor material (P...	Cu
Insulating material	PVC
Cable arrangement	31F
Cross sectional area	
Number of wires	

③Click [Cable arrangement]

④It is possible to add a cable installation condition. (Cable only).

- Core configuration
- Wiring systems
- Installation conditions
- Arrangement conditions
- Cable installation method

Cable installation

Core configuration
Single core

Select wiring systems
Cable channel
Surface mounted
Free in air
Building voids

Ambient temperature 30 °C

Installation conditions
Cable ladder / Cable tray / Cable bracket
On unperforated tray
On perforated tray
On brackets or on a wire mesh tray
Spaced more than 0.3 times cable diameter from a wall
On Ladder

Arrangement condition
Flat type (touching)
Trefoil formation
Horizontal
Vertical
Number of trays 1
Number of circuits 1

Cables installation method
31/F

OK Cancel

The setting before short-circuit current calculation is completed.

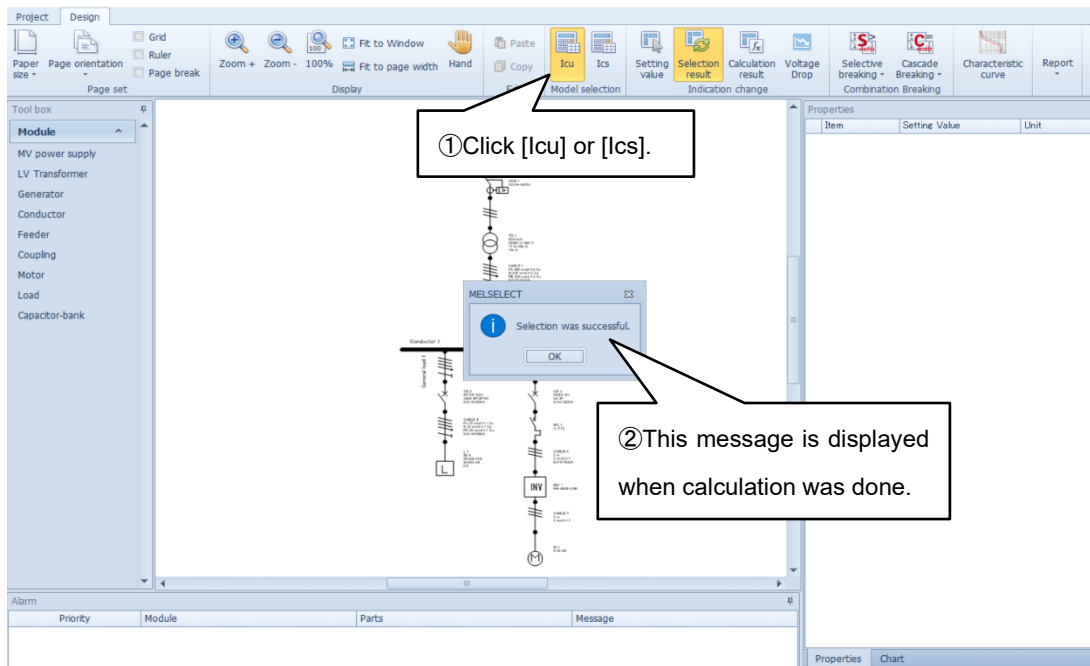
4. Calculate short-circuit current and select model

4.1 Calculate short-circuit current

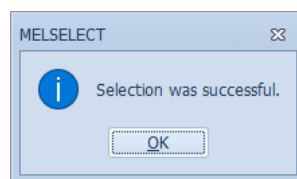
- (1) MELSELECT calculates a short-circuit current of the created single-line diagram at Chapter 3 and selects the suitable model of breaker to protect from the short-circuit current. And, the voltage drop of the system and each conductor is also calculated at the same time.
- (2) The short-circuit current calculation can be based on either [Icu] or [Ics] that are selected according to the conditions and the purpose.

Icu: Rated ultimate short-circuit breaking capacity (IEC60947-2)

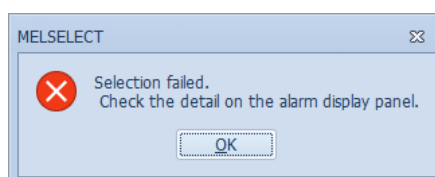
Ics: Rated service short-circuit breaking capacity (IEC60947-2)



- (3) When short-circuit current calculation was normally completed, “Selection was successful” is displayed in the middle.



- (4) When the short-circuit current calculation has some problems, “Selection failed. Check the detail on the alarm display panel.” is displayed in the middle and error message is displayed at the bottom. According to the error message, change each parameter setting and the calculation conditions and then perform the short-circuit current calculation again.



(5) “Indication change”

After calculating the short-circuit current, the display on the single-line diagram will be switched according to the selection of the display switching.

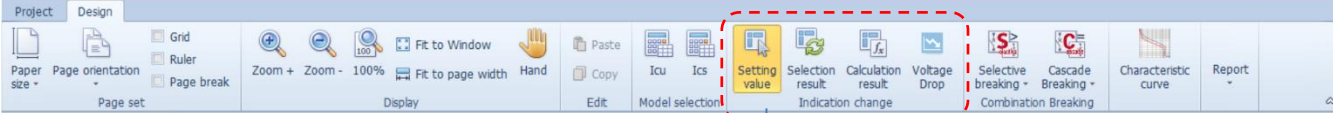
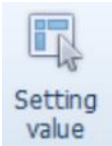





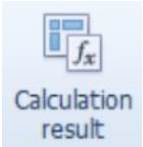


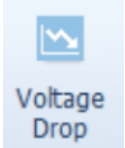


Note that [Selection result] is selected first after the short-circuit calculation is completed.

By clicking [Setting value], the setting contents of the parameter is displayed on the single-line diagram.

By clicking [Selection result], the result of model selection is displayed on the single-line diagram.

By clicking [Calculation result], the result of short-circuit current calculation is displayed on the single-line diagram.

By clicking [Voltage drop], the result of the voltage drop calculation is displayed on the single-line diagram.

			
	<p>[Setting value]</p> <p>Setting contents of the parameter is displayed.</p>	<p>Cable</p>  <p>CABLE 1 5 m</p>	<p>Circuit Breaker</p>  <p>CB 1</p>
	<p>[Selection result]</p> <p>The result of the model selection is displayed.</p>	<p>Cable</p>  <p>CABLE 1 Ph 240 mm² × 2 Cu N 240 mm² × 2 Cu PE 240 mm² × 2 Cu Ik3=20.907kA</p>	<p>Circuit Breaker</p>  <p>CB 1 AE1600-SW with MCR WS 960A 4P(3P+N) Ik3=20.907kA</p>
	<p>[Calculation result]</p> <p>The result of the short-circuit calculation is displayed.</p>	<p>Cable</p>  <p>CABLE 1 Ik3=20.907kA Ik1=20.369kA Ik1(PE)=20.369kA</p>	<p>Circuit Breaker</p>  <p>CB 1 Ik3=20.907kA Ik1=20.369kA Ik1(PE)=20.369kA</p>
	<p>[Voltage drop]</p> <p>The result of the voltage drop calculation is displayed.</p>	<p>Cable</p>  <p>CABLE 1 379.690 V (99.918 %)</p>	<p>Circuit Breaker</p>  <p>CB 1</p>

The following table shows the items displayed on the single-line diagram for each element according to the display switching selection.

Table 5. The list of the items which are displayed on the single-line diagram

Elements	Setting value	Selection result	Calculation result	Voltage drop
Source	Part name	Part name	Part name	Part name
	Voltage	Voltage	Voltage	
	Source capacity	Source capacity	Source capacity	
	Frequency	Frequency	Frequency	
Protection relay	Part name model	Part name model	Part name	Part name
Transformer	Part name	Part name	Part name	Part name
	Transformer capacity	Transformer capacity	Transformer capacity	
	Primary voltage	Primary voltage	Primary voltage	
	/Secondary voltage	/Secondary voltage	/ Secondary voltage	
	Primary current	Primary current	Primary current	
	/Secondary current	/ Secondary current	/ Secondary current	
	Earthing system	Earthing system	Earthing system	
Generator	Part name	Part name	Part name	Part name
	Capacity	Capacity	Capacity	
	Voltage	Voltage	Voltage	
	Frequency	Frequency	Frequency	
	Power distribution system	Power distribution system	Power distribution system	

Table 5. The list of the items which are displayed on the single-line diagram (Continued on previous page)

Elements		Setting value	Selection result	Calculation result	Voltage drop
Cable	4P/3P+N	Part name Length	Part name Conductor (Phase) sectional area·Number Material Conductor (N) sectional area·Number Material Conductor (PE) sectional area·Number Material Short-circuit current Ik3	Part name Short-circuit current Ik3 Short-circuit current Ik1 Ground fault current Ik1 (PE)	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)
	3P	Part name Length	Part name Conductor (Phase) sectional area·Number Material Conductor (N) sectional area·Number Material Conductor (PE) sectional area·Number Material Short-circuit current Ik3	Part name Short-circuit current Ik3 Ground fault current Ik1 (PE)	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)
	2P	Part name Length	Part name Conductor (Phase) sectional area·Number Material Conductor (N) sectional area·Number Material Conductor (PE) sectional area·Number Material	Part name Line short-circuit current Ik2 Ground fault current Ik1 (PE)	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)
	1P+N	Part name Length	Part name Conductor (Phase) sectional area· Number Material Conductor (N) sectional area·Number Material Conductor (PE) sectional area·Number Material	Part name Phase to Neutral short-circuit current Ik1 Ground fault current Ik1 (PE)	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)
Busbar		Part name Length	Part name Conductor (Phase) size Number Conductor (N) size Number Conductor (PE) size Number	Part name Conductor (phase) size Number Conductor (N) size Number Conductor (PE) size Number	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)
Busduct		Part name Length	Part name Rated current Busduct size Number	Part name Rated current Busduct size Number	Part name Voltage drop (Voltage) Voltage drop (Percentage of retention)

Table 5. The list of the items which are displayed on the single-line diagram (Continued on previous page)

Elements		Setting value	Selection result	Calculation result	Voltage drop
Breaker	4P/3P+N	Part name	Part name Model Rated current Pole number Short-circuit current Ik3	Part name Short-circuit current Ik3 Phase to Neutral short-circuit current Ik1 Ground fault current Ik1 (PE)	Part name
	3P	Part name	Part name Model rated current Pole number Short-circuit current Ik3	Part name Short-circuit current Ik3 Ground fault current Ik1 (PE)	Part name
	2P	Part name	Part name Model Rated current Pole number	Part name Line short-circuit current Ik2 Ground fault current Ik1 (PE)	Part name
	1P+N	Part name	Part name Model Rated current Pole number	Part name Phase to Neutral short-circuit current Ik1 Ground fault current k1 (PE)	Part name
Capacitor-bank		Part name Installed capacity	Part name Installed capacity	Part name Installed capacity	Part name
Load		Part name Load current Capacity Output Power factor	Part name Load current Capacity Output Power factor	Part name Load current Capacity Output Power factor	Part name
Motor		Part name Output	Part name Output	Part name Output	Part name
Contactor		Part name	Part name Model Thermal relay type Rated current	Part name	Part name
Inverter		Part name Model	Part name Model	Part name	Part name

※The voltage drop (Percentage of retention) value from the elements of the low-voltage transformer down to the bottom are recalculated an electric potential of low-voltage transformer as the basis (100%).

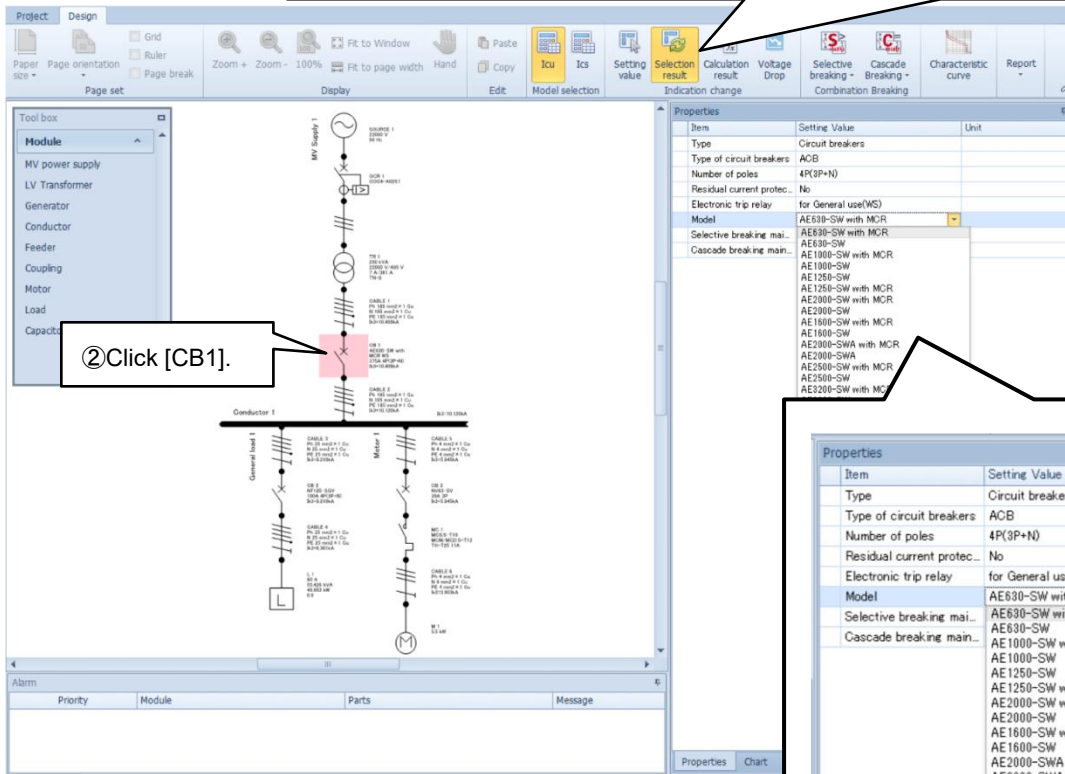
(6) When you change each parameter setting after the short-circuit current calculation, the calculation results and the selection results is cleared. Calculate by [Icu] or [Ics] again.

4.2 Select model

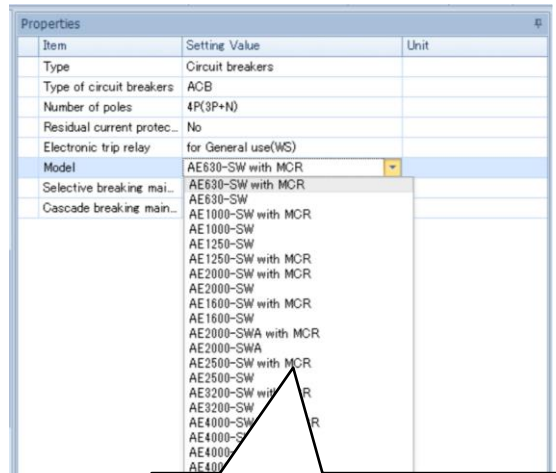
(1) After short-circuit current calculation (Chapter 4.1), click [Selection result] to show the results of the model selection for each circuit breaker.

(2) Depending on a calculation results, some models can be selected. Click a breaker (ex: CB1) and select a suitable breaker from “Model” of properties on the right sub-window.

①Click [Selection result] to display the result of a model selection.



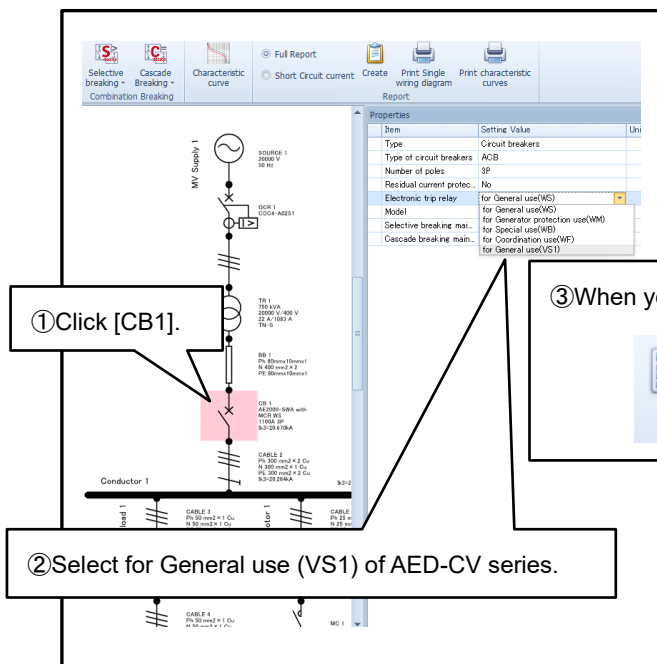
②Click [CB1].



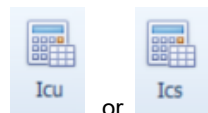
(3) If you would like to select AED-CV series ACB.

Trip relay “VS1” is selected, then AED-CV series can be selected.

③Suitable breakers are displayed.

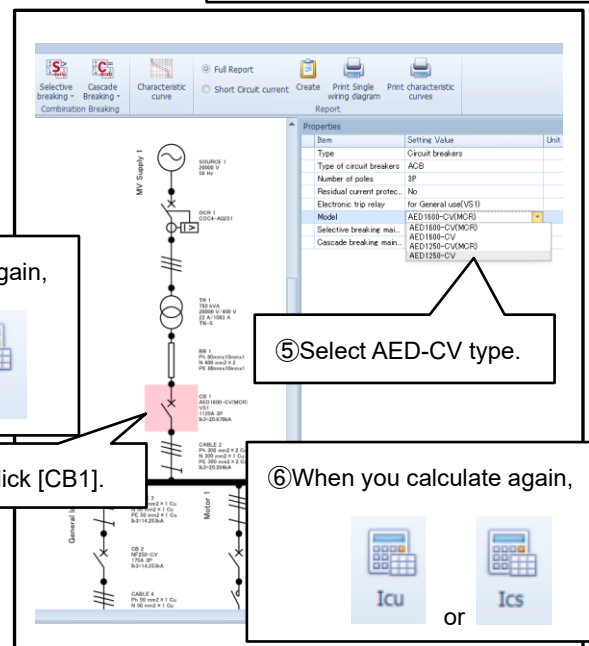


③When you calculate again,



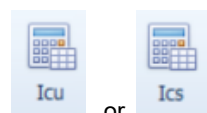
or

④Click [CB1].



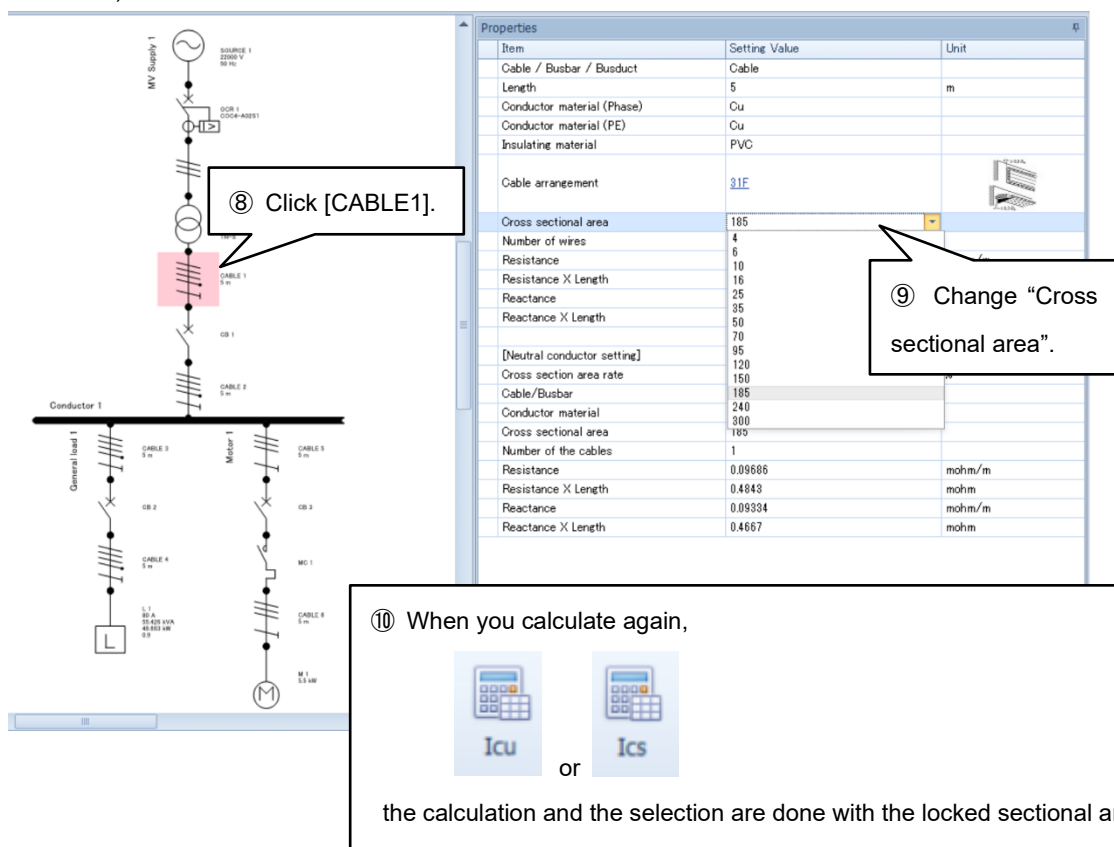
⑤Select AED-CV type.

⑥When you calculate again,



or

(4) As with breakers, Cable/Busbar/Busduct can be selected and fixed with a lock mark.



⑧ Click [CABLE1].

⑨ Change “Cross sectional area”.

⑩ When you calculate again,

Icu or Ics

the calculation and the selection are done with the locked sectional area.

Item	Setting Value	Unit
Cable / Busbar / Busduct	Cable	
Length	5	m
Conductor material (Phase)	Cu	
Conductor material (PE)	Cu	
Insulating material	PVC	
Cable arrangement	31F	
Cross sectional area	185	
Number of wires	4	
Resistance	10	
Resistance X Length	16	
Reactance	25	
Reactance X Length	35	
	50	
	70	
[Neutral conductor setting]	95	
Cross section area rate	120	
Cable/Busbar	150	
Cable/Busbar	185	
Conductor material	240	
Cross sectional area	300	
Number of the cables	180	
	1	
Resistance	0.09686	mohm/m
Resistance X Length	0.4843	mohm
Reactance	0.09334	mohm/m
Reactance X Length	0.4667	mohm

※The sizes of Cable/Busbar/Busduct are selected based on the capacity of power distribution.

As for the connecting method of actual breaker, confirm by a catalog and/or a technical documents.

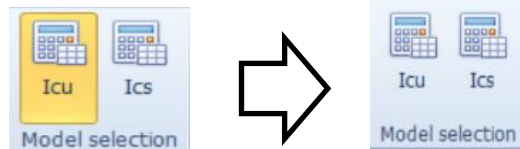
(5) Besides, when you change parameter such as “Residual current protection (Yes/No)”, “ACB/MCCB/MCB” or of other elements, recalculate by [Icu] or [Ics] and reselect models.

The screenshot shows the software interface with a circuit diagram on the left and a properties table on the right. The properties table has the following data:

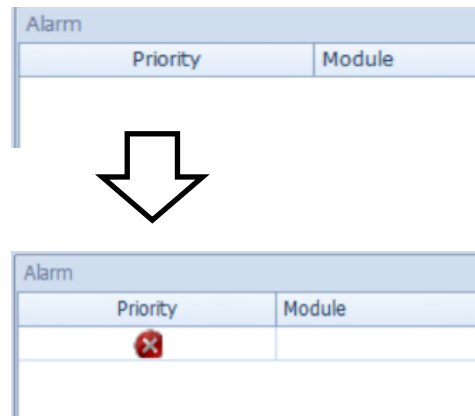
Item	Setting Value	Unit
Type	Circuit breakers	
Type of circuit breakers	ACB	
Number of poles	4P(3P+N)	
Residual current protection	No	
Electronic trip relay	for General use(WS)	
Model	AE1000-SW with MCR	
Selective breaking	breaker	
Cascade breaking	breaker	

The circuit diagram shows a power supply connected to a circuit breaker (CB 1) and a motor (Motor 1). The properties table is highlighted with a red dashed box, and an arrow points from it to the text box below.

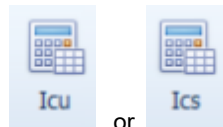
When you change parameters;
[Icu] and [Ics] turn off.



An alert mark is displayed in “Alert and error window”.



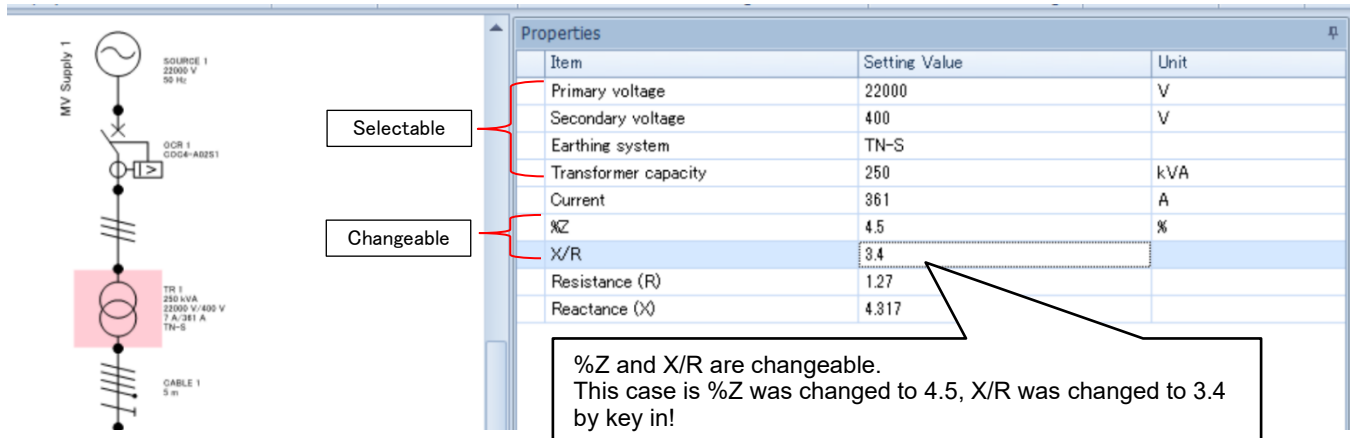
⑪ If you change parameters, recalculate by [Icu] or {Ics}



4.3 Manual parameter change

Source (Transformer, Generator) and Wire (Cables, Busbars, Busduct) parameters can be changed manually.

(1) Transformer parameter change



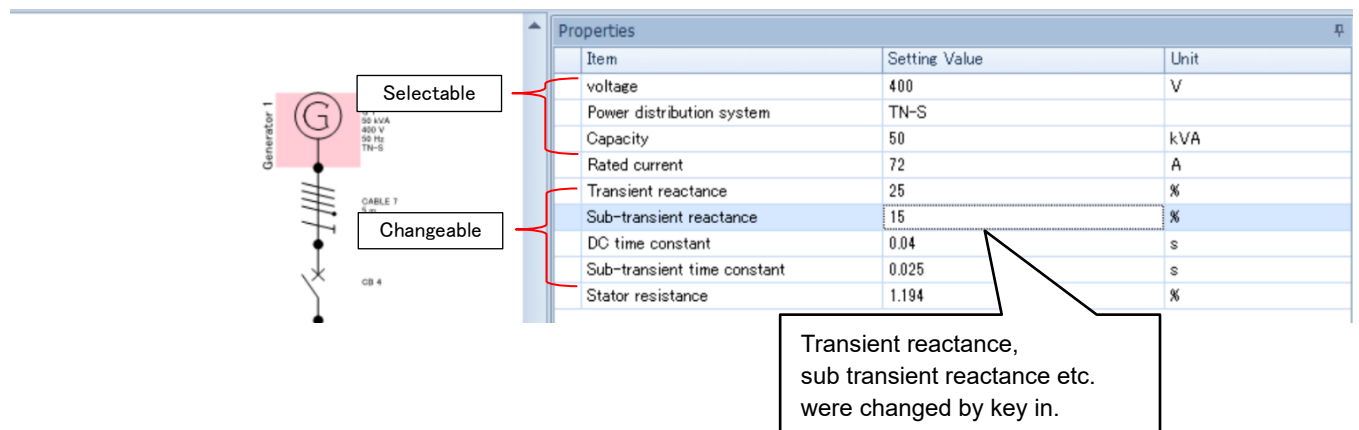
The diagram shows a circuit with an MV Supply 1 connected to a transformer (TR 1) via a cable (CABLE 1). The transformer is labeled with 250 kVA, 22000 V/400 V, 7 A/261 A, and TN-S. The properties table for the transformer is as follows:

Item	Setting Value	Unit
Primary voltage	22000	V
Secondary voltage	400	V
Earthing system	TN-S	
Transformer capacity	250	kVA
Current	361	A
%Z	4.5	%
X/R	3.4	
Resistance (R)	1.27	
Reactance (X)	4.317	

Annotations: "Selectable" points to the primary voltage, secondary voltage, earthing system, and transformer capacity. "Changeable" points to %Z, X/R, Resistance (R), and Reactance (X). A callout box states: "%Z and X/R are changeable. This case is %Z was changed to 4.5, X/R was changed to 3.4 by key in!"

Current, Resistance(R) and Reactance (X) are auto change. (Automatic calculation)

(2) Generator parameter change



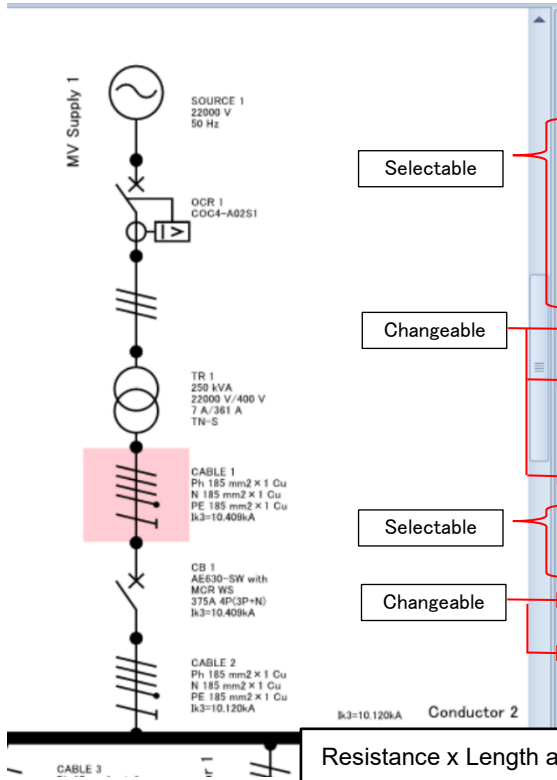
The diagram shows a circuit with a generator (Generator 1) connected to a busbar (CB 4) via a cable (CABLE 7). The generator is labeled with 55 kVA, 400 V, 50 Hz, and TN-S. The properties table for the generator is as follows:

Item	Setting Value	Unit
voltage	400	V
Power distribution system	TN-S	
Capacity	50	kVA
Rated current	72	A
Transient reactance	25	%
Sub-transient reactance	15	%
DC time constant	0.04	s
Sub-transient time constant	0.025	s
Stator resistance	1.194	%

Annotations: "Selectable" points to the voltage, power distribution system, capacity, and rated current. "Changeable" points to transient reactance, sub-transient reactance, DC time constant, sub-transient time constant, and stator resistance. A callout box states: "Transient reactance, sub transient reactance etc. were changed by key in."

Rated current and Stator resistance are auto change. (Automatic calculation)

(3) Cable parameter change



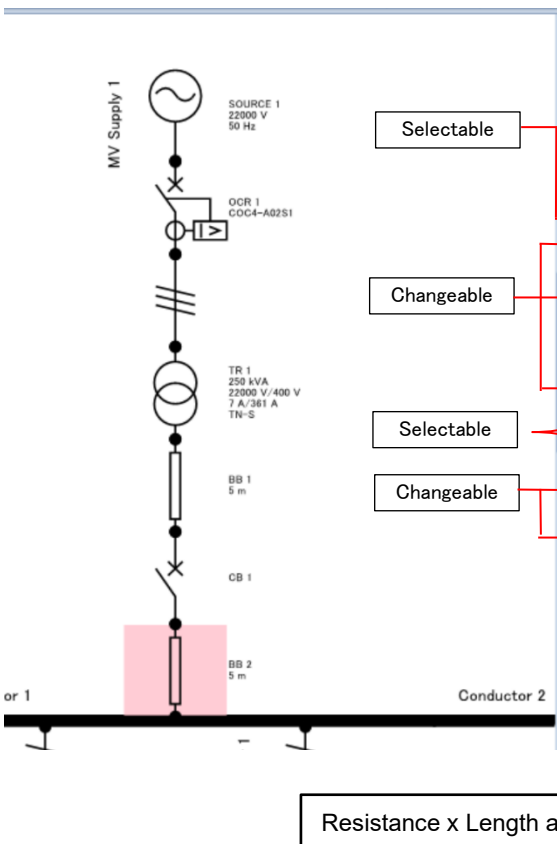
Properties

Item	Setting Value	Unit
Cable / Busbar / Busduct	Cable	
Length	5	m
Conductor material (Phase)	Cu	
Conductor material (PE)	Cu	
Insulating material	PVC	
Cable arrangement	31F	
Cross sectional area	185	
Number of wires	1	
Resistance	0.09686	mohm/m
Resistance X Length	0.4843	mohm
Reactance	0.09334	mohm/m
Reactance X Length	0.4667	mohm
[Neutral conductor setting]		
Cross section area rate	100	
Cable/Busbar	Cable	
Conductor material	Cu	
Cross sectional area	185	
Number of the cables	1	
Resistance	0.09686	mohm/m
Resistance X Length	0.4843	mohm
Reactance	0.09334	mohm/m
Reactance X Length	0.4667	mohm

Resistance and Reactance were changed by key in.

Resistance x Length and Reactance x Length are auto change. (Automatic calculation)

(4) Busbar parameter change



Properties

Item	Setting Value	Unit
Cable / Busbar / Busduct	Busbar	
Length	5	m
Conductor material (Phase)	Cu	
Conductor material (PE)	Cu	
Horizontal installation factor	1	
Proximity effect factor	1	
Busbar size WxDxN	50mmx5mmx2	
Resistance	0.39	mohm/m
Resistance X Length	1.95	mohm
Reactance	0.18	mohm/m
Reactance X Length	0.9	mohm
[Neutral conductor setting]		
Cross section area rate	50	%
Cable/Busbar	Busbar	
Conductor material	Cu	
Busbar size WxTxPcs.	30mmx5mmx2	
Resistance	0.5	mohm/m
Resistance X Length	2.5	mohm
Reactance	0.25	mohm/m
Reactance X Length	1.25	mohm

Neutral conductor's cross section rate is changeable. Resistance and Reactance were changed by key in.

Resistance x Length and Reactance x Length are auto change. (Automatic calculation)

(5) Busduct parameter change

Item	Setting Value	Unit
Cable / Busbar / Busduct	Busduct	
Length	5	m
Number of poles	4P(3P+N)	
Conductor material (Phase)	Cu	
Conductor material (PE)	Cu	
Busduct size WxDxN	50mmx6mmx1	
Resistance	0.0766	mohm/m
Resistance X Length	0.383	mohm
Reactance	0.025	mohm/m
Reactance X Length	0.125	mohm
[Neutral conductor setting]		
Cross section area rate	50	
Cable/Busbar	Busbar	
Conductor material	Cu	
Busbar size WXTxPcs.	30mmx5mmx1	
Resistance	0.1273	mohm/m
Resistance X Length	0.6365	mohm
Reactance	0.2181	mohm/m
Reactance X Length	1.0905	mohm

Selectable

Changeable

Selectable

Changeable

Resistance and Reactance were changed by key in.

Resistance x Length and Reactance x Length are auto change. (Automatic calculation)

If you change parameters, recalculate by [Icu] or [Ics].

or

4.4 Cascade breaking (Select downstream breaker)

Cascade breaking coordination can be considered to select economic breaker when especially upstream breaker is high performance class.

(1) Select breakers as usual. And set cascade selection.

MELSELECT(Sample project1-2)

① Select upstream breaker with [Ctrl] key.

② Select downstream breaker with [Ctrl] key.

③ Click [Cascade breaking] icon. And click [Set] icon.

Properties

Item	Setting Value

(2) Set → Cascade breakers set is ready. Click Icu or Ics button.

MELSELECT(Sample project1-2)

① Click [Icu] or [Ics] to calculate again!

② Click [Icu] or [Ics] to calculate again!

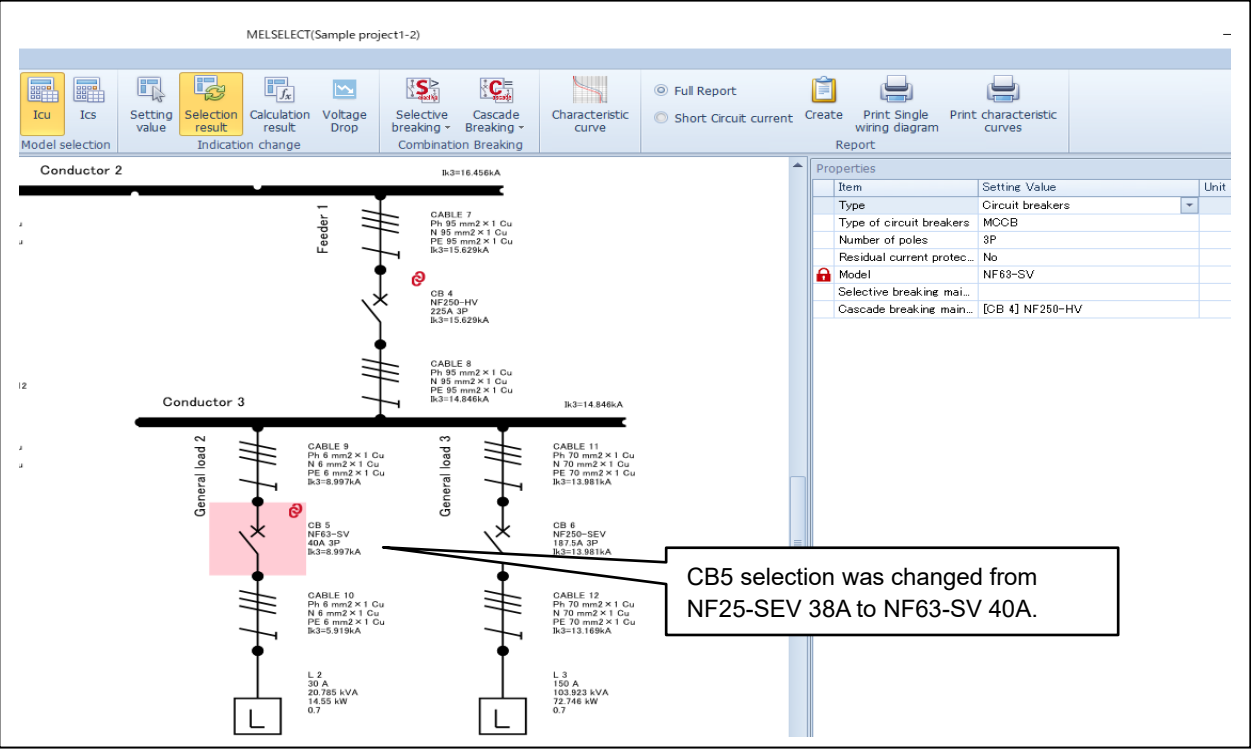
③ Click [Set] icon. And click [Cancel] icon.

④ Click [Cancel] icon.

Properties

Item	Setting Value

(3) Downstream breaker by cascading was changed.



4.5 Selective breaking (Selective breaking value on the report)

Selective breaking capacity can be reported on the report.

(1) Select breakers as usual. And set selective breaking coordination.

① Select upstream breaker with [Ctrl] key.

② Select downstream breaker with [Ctrl] key.

③ Click [Selective breaking] icon. And click [Set] icon.

(2) Set → Selective breakers set is ready. Click Icu or Ics button.

CB1 and CB4 selective coordination set is ready.
※This set can be also cancelled
Click selective breaking button → Click cancel.

Click [Icu] or [Ics] to calculate again!

Icu or Ics

(3) Reported selective breaking capacity between CB1 and CB4.

3. Switchgear information.

3.1 Numerical Protection Relay.

Ref No.	Name	Type
1	OCR 1	OC04-A02ST

3.2 Low Voltage Circuit Breakers.

Ref No.	Name	Breaker type	Rated current	Breaking capacity	Poles	Fixed / Adjustable	Earthleakage Protection	Selective Breaking		Cascade Breaking		Breaking capacity
								Main breaker Name	Type	Main breaker Name	Type	
1	CB 1	AE1000-SW	750A	65kA	4P(3P+N)	Adjustable type	No					
2	CB 2	NF125-SGV	100A	36kA	4P(3P+N)	Adjustable type	No					
3	CB 3	NM63-HV	40A	10kA	3P		Yes					
4	CB 4	NF250-HV	225A	75kA	3P	Fixed type	No	CB 1	AE1000-SW	15kA		
5	CB 5	NF125-SEV	38A	36kA	3P	Adjustable type	No					
6	CB 6	NF250-SEV	187.5A	36kA	3P	Adjustable type	No					

Created report example

Selective breaking value 15kA is reported.
between CB1:AE1000-SW 750A and CB4:NF250-HV 225A.

(4) Selective and cascade breaking can be set on the same breakers.

3. Switchgear information.

3.1 Numerical Protection Relay.

Ref No.	Name	Type
1	OCR 1	OC04-A02ST

3.2 Low Voltage Circuit Breakers.

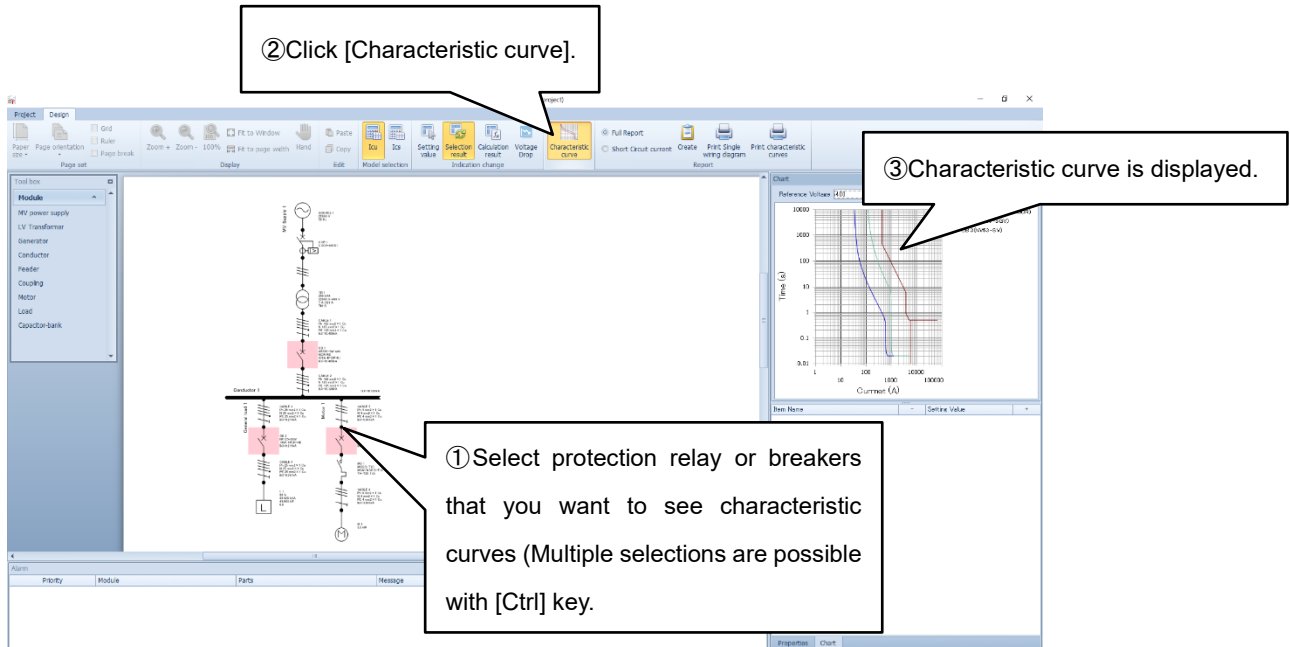
Ref No.	Name	Breaker type	Rated current	Breaking capacity	Poles	Fixed / Adjustable	Earthleakage Protection	Selective Breaking		Cascade Breaking		Breaking capacity
								Main breaker Name	Type	Main breaker Name	Type	
1	CB 1	AE1000-SW	750A	65kA	4P(3P+N)	Adjustable type	No					
2	CB 2	NF125-SGV	100A	36kA	4P(3P+N)	Adjustable type	No					
3	CB 3	NM63-HV	40A	10kA	3P		Yes					
4	CB 4	NF250-HV	225A	75kA	3P	Fixed type	No	CB 1	AE1000-SW	15kA	CB 3	NM63-HV
5	CB 5	NF125-SEV	38A	36kA	3P	Adjustable type	No					
6	CB 6	NF250-SEV	187.5A	36kA	3P	Adjustable type	No					

Selective breaking value 15kA is reported.
between CB1:AE1000-SW 750A and CB4:NF250-HV 225A.

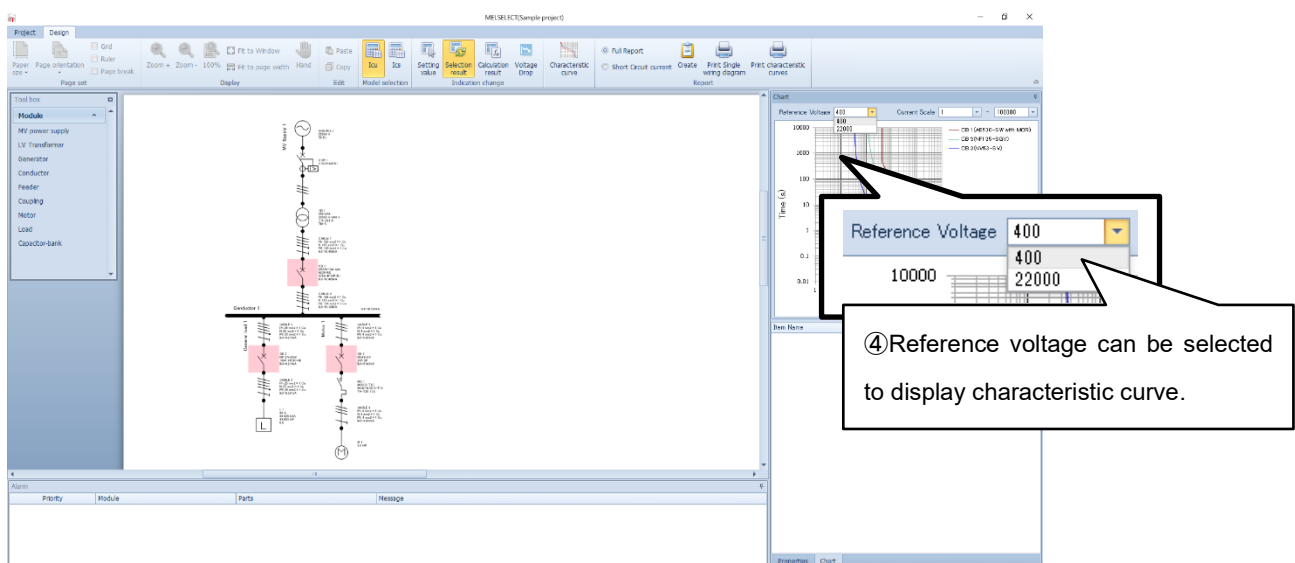
Cascade breaking value 10kA is reported.
between CB4:NF250-HV 225A and CB5:NF63-CV 40A.

4.6 Display characteristic curve

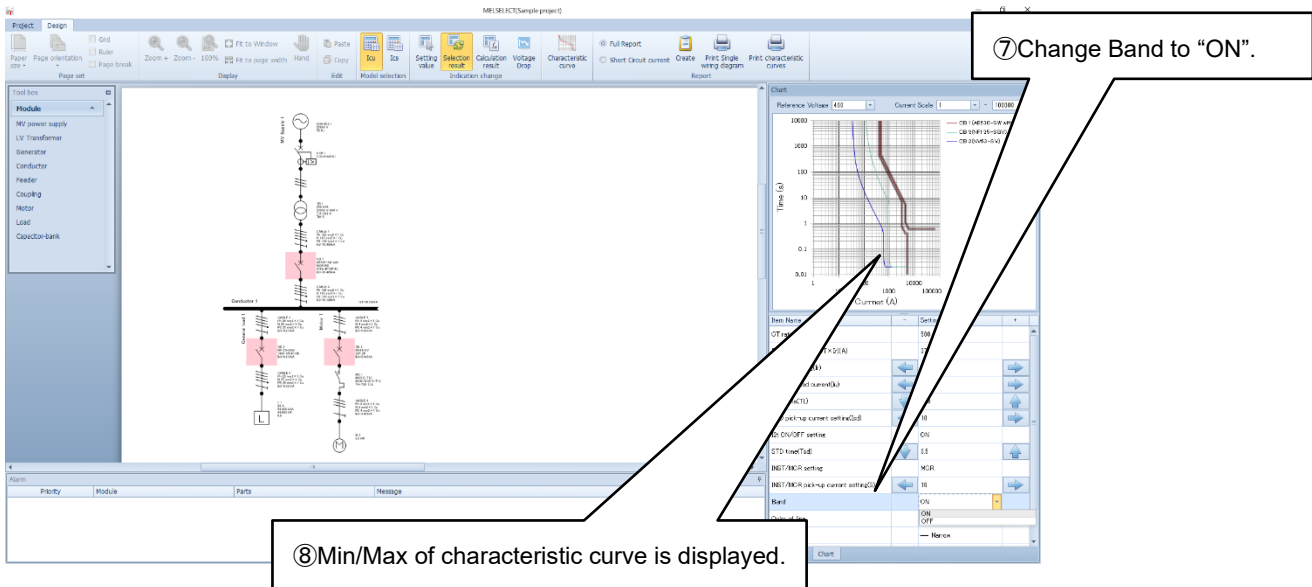
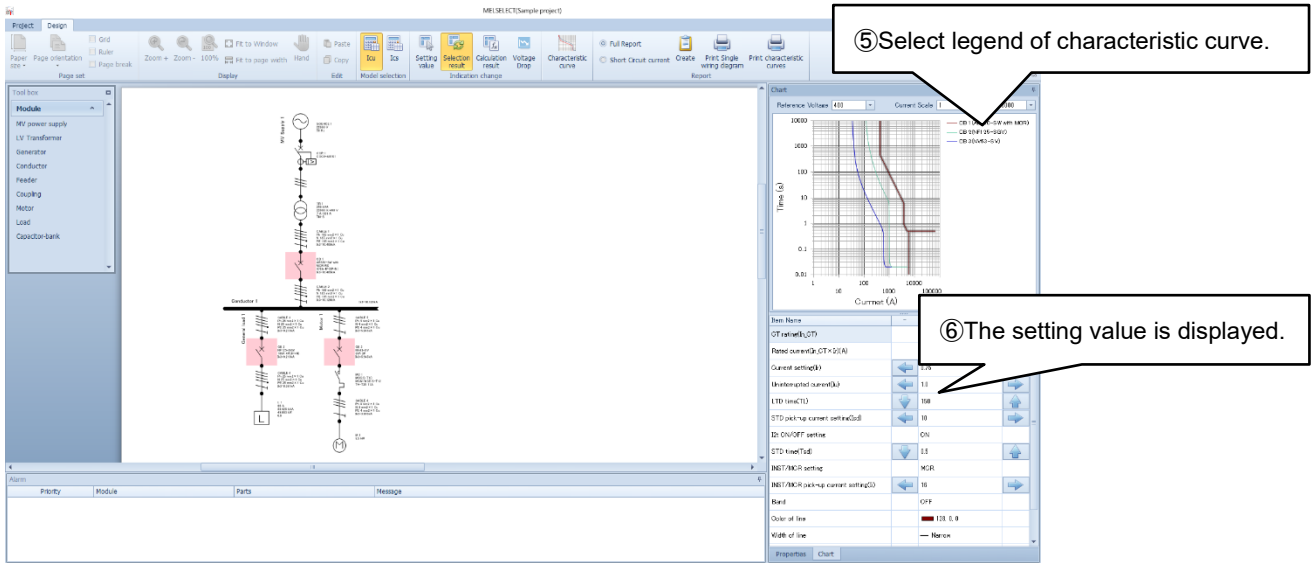
- (1) MELSELECT enables to display characteristic curve of selected breakers and the set protection relays. Then you can check a coordination between breakers and protection relays.
- (2) For the selection results, select a breaker and a protection relay that you display characteristic curves by pressing [Ctrl] key and click [Characteristic curve]. Then the characteristic curves of each device are displayed on the right side. It is possible to show up to 10 characteristic curves.



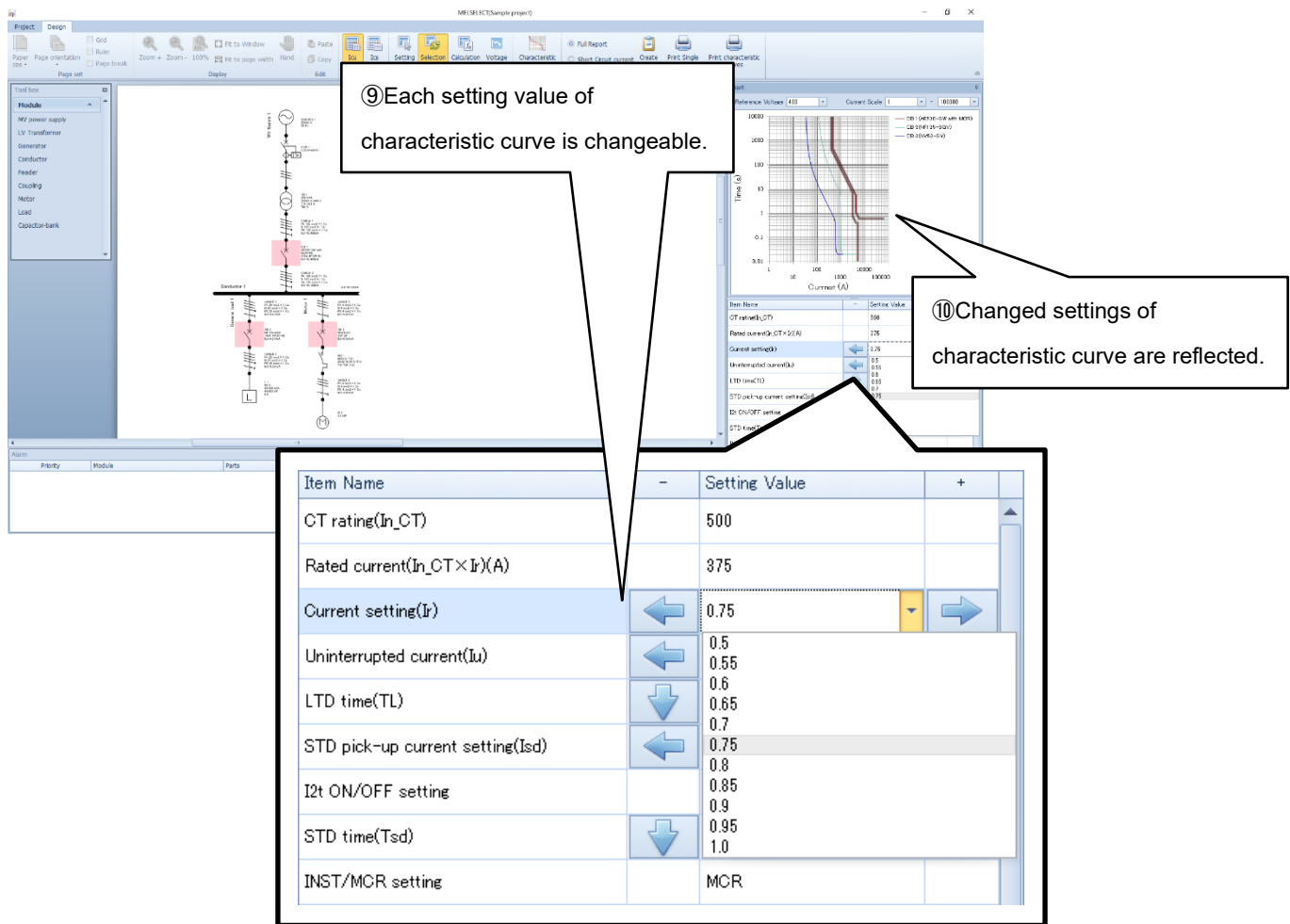
A reference voltage which display characteristic curve can be selected from the primary voltage/ the secondary voltage of each transformer included in the single-line diagram. Select it from [Reference voltage] in the top of the displayed characteristic curve.



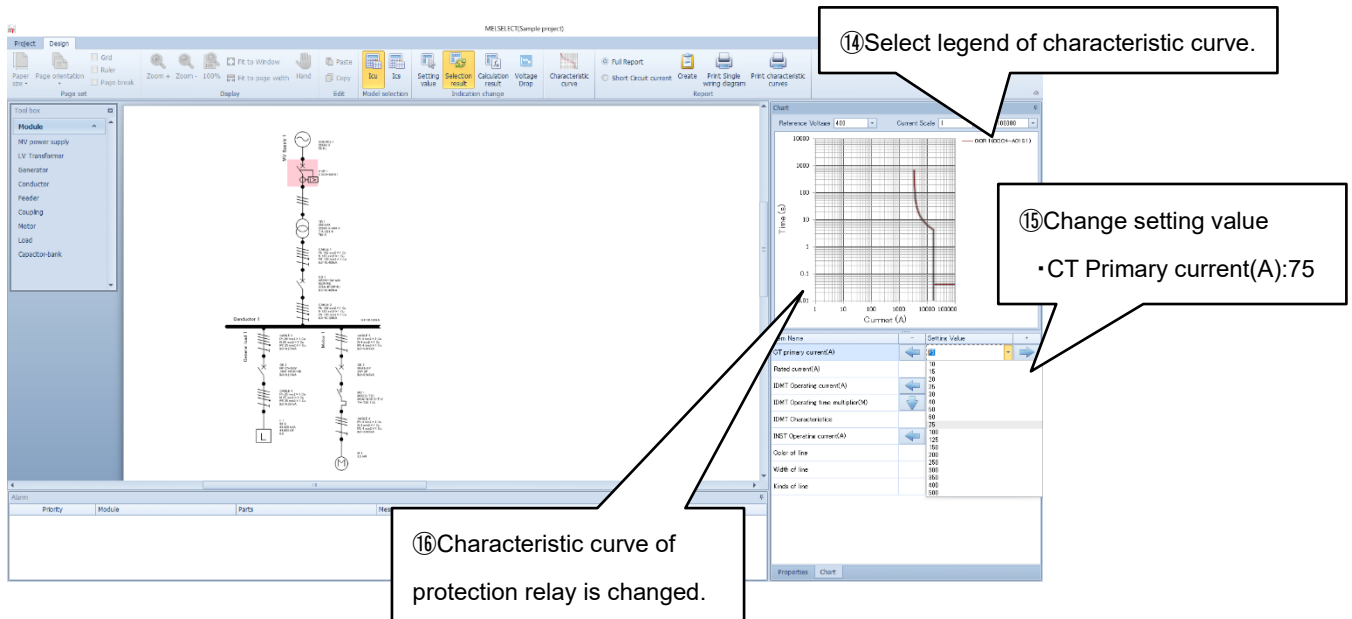
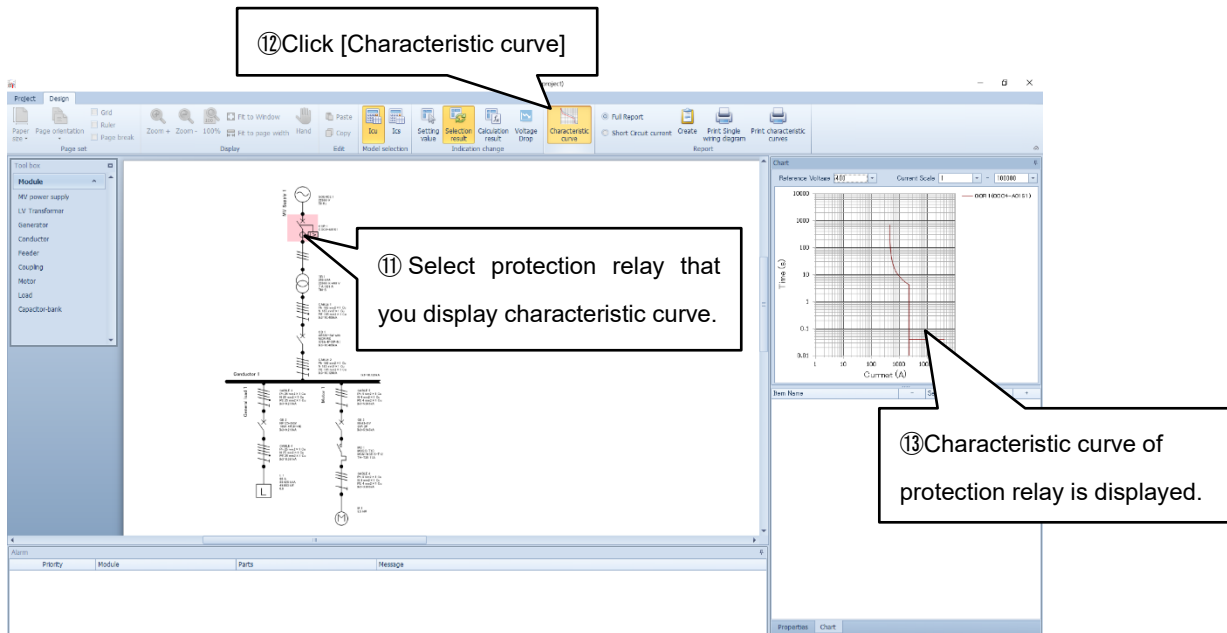
(3) The default of characteristic curve is central value. If you change the characteristic curve to Max or Min, select the legend of characteristic curve, change Band to “ON” and change the value.



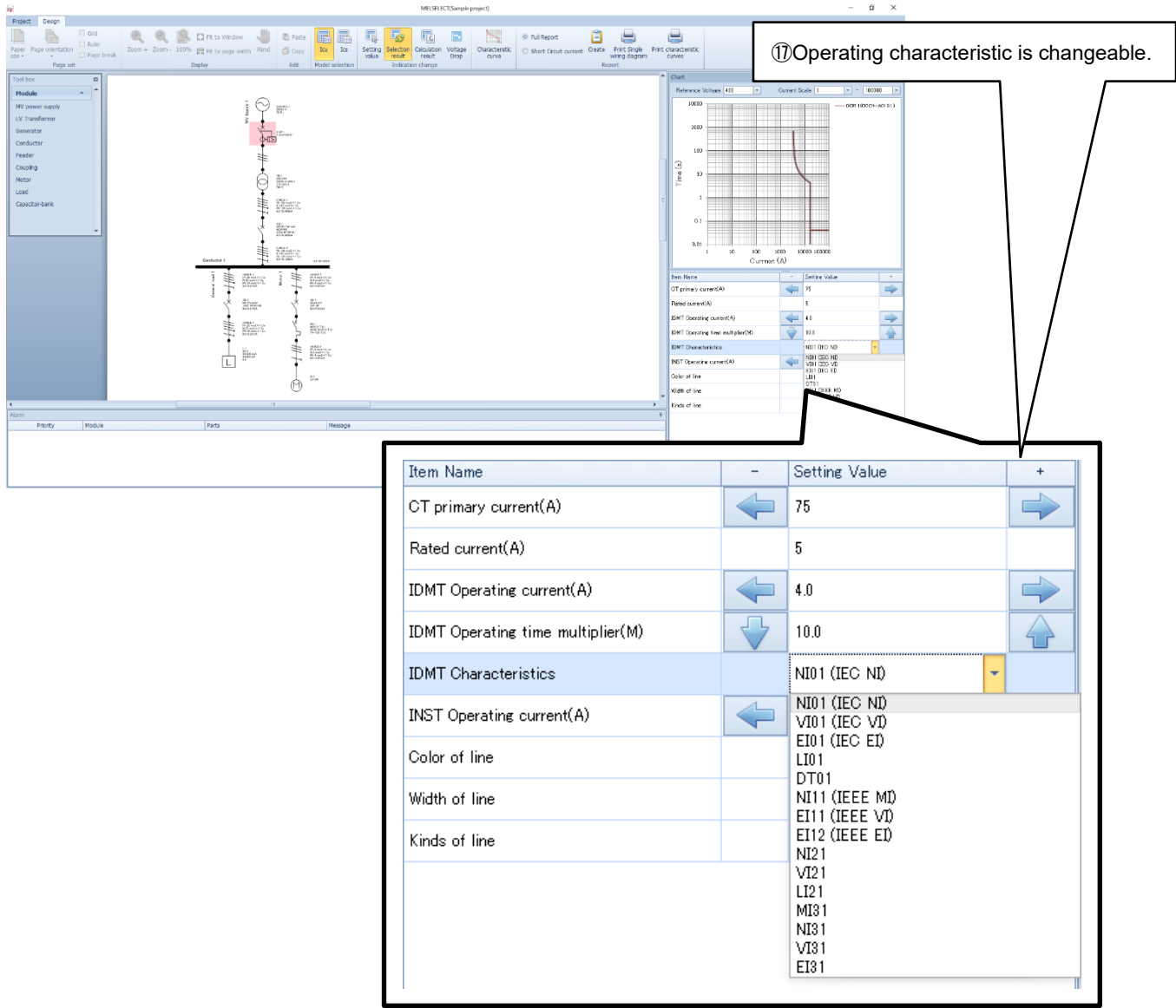
(4) When selected breaker is adjustable-type, it is possible to change each setting value of characteristic curve. Change the setting value and it will be reflected to the characteristic curve.



(5) The characteristic curve of the protection relay is determined only by the setting value regardless of the short-circuit current calculation. As the same as the breaker, each setting value is able to display and change by selecting the protection relays.



(6) The protection relay can also change the operating characteristic corresponding to the set model.

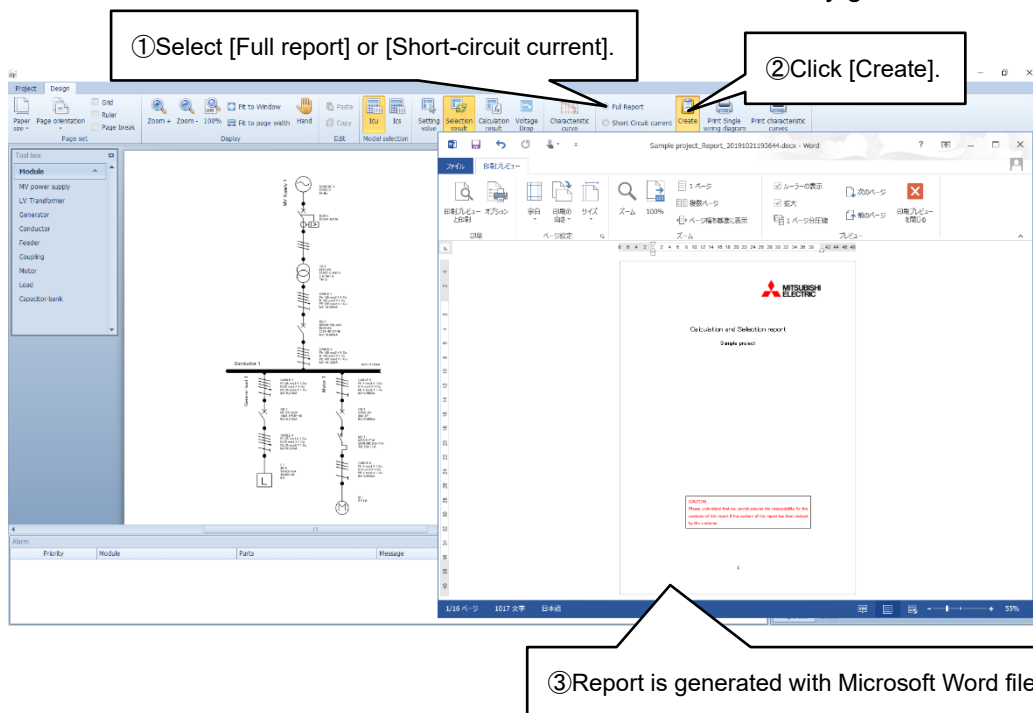


5. Generate report

5.1 Generating report of short-circuit current calculation and result of model selection

(1) MELSELECT can create a report of [Full report] or [Short-circuit current], click a suitable form.

Click [Create] in report section on the upper side of the screen, and the report of short-circuit current calculation results and the results of model selection are automatically generated.



(2) Report is created as a file name as below, it is automatically saved to a folder of [Document] or [My document].

Table6. File name of reports

Form	File name
Full report	[Project name]_Report_yyyyMMddHHmmss.docx
Short-circuit current	[Project name]_ShortCircuit_yyyyMMddHHmmss.docx

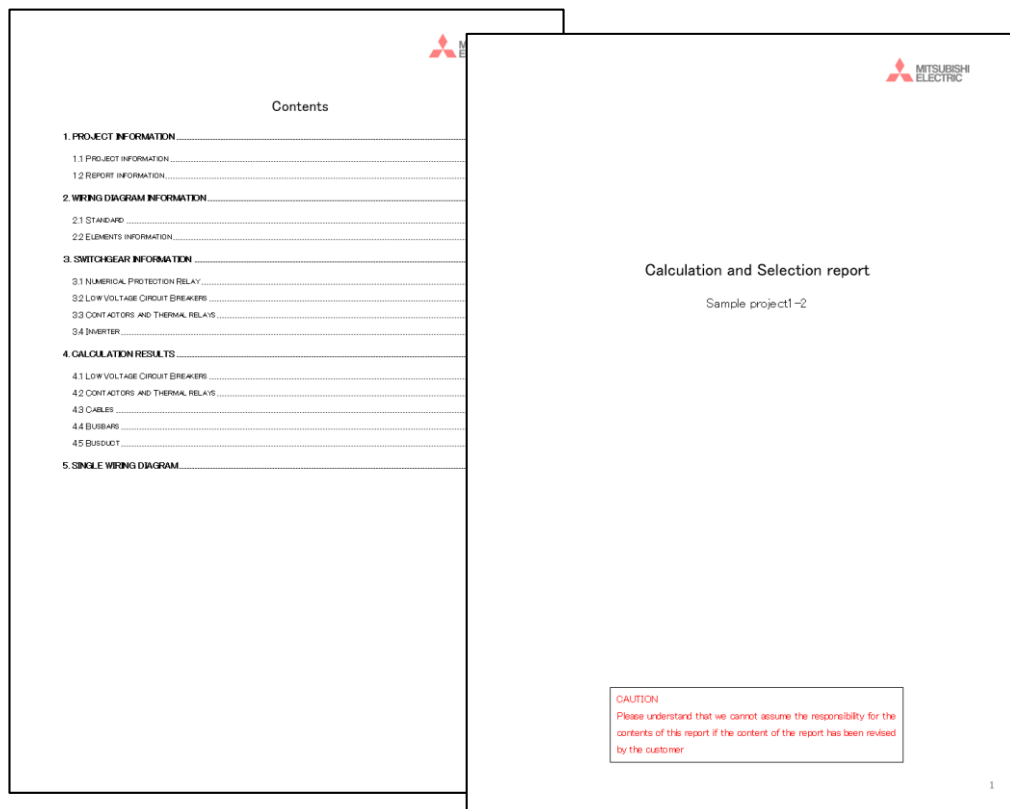
(3) Sections included in the generated report are as following.

Table 7. Items of the report

Section	Full report	Short-circuit current
Cover and TOC	✓	—
1. Project information	✓	—
2. Wiring diagram information	✓	✓
3. Switchgear information	✓	—
4. Calculation Results	✓	✓
5. Single wiring diagram	✓	—

Cover and TOC(Table of Contents)

Report title and your project name are printed in the Cover, and TOC follows.



1. Project information

General information and basic calculation conditions are printed in Project information section, which are set in project setting window.

1. Project information

1.1 Project information

Item name	Setting Value
Power Distribution system	Frequency
	50Hz
Priority to select Breakers	Default capable voltage drop
	5%
LV cables	Breaker type
	Fixed type
	Maximum capable cable cross section
	400mm ²
	Ambient Temperature
	30°C
	Default Max. capable cable voltage drop
	2%
Busbars	Ambient Temperature
	35°C
	Max. capable busbar voltage drop
	2%
Busducts	Ambient Temperature
	40°C
	Max. capable busduct voltage drop
	2%
Margin	Breaker rated current margin of load current
	115%
Region	China
Remarks	

1.2 Report information

Item name	Setting Value
Company	Company name
	Tel
	Address
	City
	Post code
	States/Prefecture
	Country
	Web site
Project	Project name
	Place
	End user
	Revision

2. Wiring diagram information

Listed IEC standards which MELSELECT is based on and settings list for each element for calculation are printed in Wiring diagram information section.

2.2 Elements information

(1) Source

RefNo.	Name	Voltage	Capacity	N2	X/R
1	SOURCE 1	22000V	1000MVA	01N	25

(2) MV/LV Transformer

RefNo.	Name	Primary voltage	Secondary voltage	Network system	Tr capacity	Secondary
1	TR 1	22000V	400V	TN-S	250kVA	361 A

(3) Generator

RefNo.	Name	Voltage	Network system	Gen capacity	Rated current	Transient res
--------	------	---------	----------------	--------------	---------------	---------------

(4) LV/LV Transformer

RefNo.	Name	Primary voltage	Secondary voltage	Network system	Tr capacity	Secondary
--------	------	-----------------	-------------------	----------------	-------------	-----------

(5) General Load

RefNo.	Name	Load current	Capacity	Output	Power factor
1	L 1	80A	55.425kVA	49.883kW	0.9

(6) Motor

RefNo.	Name	Voltage	Starting method	Output	Load current
1	M 1	400V	Star-Delta start	55kW	96A

(7) Capacitor bank

RefNo.	Name	Voltage	Capacity	Reactor
--------	------	---------	----------	---------

2. Wiring diagram information

2.1 Standard

(1) Standard of Cable, Busbars and installation

IEC 60227-1

Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V

– Part 1: General requirements

IEC 60228/2004

Conductors of insulated cables

IEC 60364-1

Low-voltage electrical installations

– Part 1: Fundamental principles, assessment of general characteristics, definitions

IEC 60364-5-51

Electrical installations of buildings

– Part 5-51: Selection and erection of electrical equipment – Common rules

IEC 60364-5-52 (※1)

Low-voltage electrical installations

– Part 5-52: Selection and erection of electrical equipment – Wiring systems

IEC 60364-5-53

Low-voltage electrical installations

– Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring

IEC 61439-2

Low-voltage switchgear and controlgear assemblies

– Part 2: Power switchgear and controlgear assemblies

(2) Standard of Low Voltage Circuit Breakers

IEC 60947-1

Low-voltage switchgear and controlgear

– Part 1: General rules

IEC 60947-2

Low-voltage switchgear and controlgear


– Part 2: Circuit-breakers

※1 Note

When cross-sectional area 800 mm² and 1000 mm² cables are selected, these cables are not specified in IEC 60364-5-52.

3. Switchgear information

The model list of switchgears selected by MELSELECT are printed in Switchgear information section.


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3. Switchgear information

3.1 Numerical Protection Relay

RefNo.	Name	Type
1	QCB 1	QCB4-A02S1

3.2 Low Voltage Circuit Breakers

RefNo.	Name	Breaker type	Rated current	Breaking capacity	Poles	Fixed / Adjustable	Earthleakage Protection	Selective Breaking		Breaking capacity	Cascade Breaking		Breaking capacity
								Main breaker	Type		Main breaker	Type	
1	CB 1	AE1000-SW	750A	65kA	4P(3P+N)	Adjustable type	No						
2	CB 2	NF12P-SGV	100A	38kA	4P(3P+N)	Adjustable type	No						
3	CB 3	NV63-HV	30A	10kA	3P		Yes						
4	CB 4	NF250-HV	225A	17.5kA	3P	Fixed type	No	CB 1	AE1000-SW	15kA			
5	CB 5	NF63-SV	40A	7.5kA	3P	Fixed type	No				CB 4	NF250-HV	10kA
6	CB 6	NF250-SEV	187.5A	38kA	3P	Adjustable type	No						

3.3 Contactors and Thermal relays

RefNo.	Name	Contactor type	Thermal relay type
1	MC 1	MOS-S-T10 MCM/MCD-S-T12	TH-T25 11A

3.4 Inverter

RefNo.	Name	Type	AC reactor	DC reactor	Multiple ratings
--------	------	------	------------	------------	------------------

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4. Calculation results

Prospective short circuit current for each element (Cables, Busbars, Busducts, Circuit breakers) is printed in Calculation results section.

4.3.1 Neutral wire

(1) Cables

RefNo.	Name
1	CABLE 1
2	CABLE 2
3	CABLE 3
4	CABLE 4
5	CABLE 5
6	CABLE 6
7	CABLE 7
8	CABLE 8
9	CABLE 9
10	CABLE 10
11	CABLE 11
12	CABLE 12

(2) Busbars

RefNo.	Name
--------	------

4.4 Busbars

4.4.1 Neutral wire

(1) Cables

RefNo.	Name
--------	------

(2) Busbars

RefNo.	Name
--------	------

4.5 Busduct

RefNo.	Name
--------	------

4. Calculation Results

4.1 Low Voltage Circuit Breakers

RefNo.	Name	Type	Poles	Rated current	Voltage	Priority to select	Breaking capacity	3 phase short-circuit current (kA)	Phase - Phase short-circuit current (kA)	Phase - Neutral short-circuit current (kA)	Phase - PE short-circuit current (kA(PE))
1	CB 1	AE1000-SW	4P(3P+N)	750A	400V	Isu	65kA	16.967kA		16.594kA	16.621kA
2	CB 2	NF125-SGV	4P(3P+N)	100A	400V	Isu	36kA	14.519kA		12.269kA	12.279kA
3	CB 3	NV93-HV	3P	30A	400V	Isu	10kA	7.711kA			4.488kA
4	CB 4	NF250-HV	3P	225A	400V	Isu	75kA	13.626kA			14.416kA
5	CB 5	NF63-SV	3P	40A	400V	Isu	7.5kA	8.987kA			5.559kA
6	CB 6	NF250-SEV	3P	187.5A	400V	Isu	36kA	13.951kA			11.662kA

4.2 Contactors and Thermal relays

RefNo.	Name	Contact type	Thermal relay type	Voltage
1	MO 1	MCS-S-T10	TH-T22 11A	400V

4.3 Cables

RefNo.	Name	Conductor material	Insulation material	Core configuration	Installation	Cross section	Permissible current	Length	3 phase short-circuit current (kA)	Phase - Phase short-circuit current (kA)	Phase - Neutral short-circuit current (kA)	Phase - PE short-circuit current (kA(PE))	Operational Voltage	Resistance	Reactance	Voltage drop	Voltage retention rate
1	CABLE 1	Cu	PVC	Single core	21F	185mm ² × 4	1673.84A	5m	15.363kA		15.363kA	15.363kA	400V	0.09686mhm/m	0.06234mhm/m	399.943 V	99.961%
2	CABLE 2	Cu	PVC	Single core	21F	185mm ² × 2	836.92A	5m	15.458kA		15.323kA	15.364kA	400V	0.09686mhm/m	0.06234mhm/m	399.528 V	99.892%
3	CABLE 3	Cu	PVC	Single core	21F	25mm ² × 1	111.72A	5m	14.519kA		12.279kA	12.279kA	400V	0.7167mhm/m	0.1026mhm/m	398.967 V	99.727%
4	CABLE 4	Cu	PVC	Single core	21F	25mm ² × 1	111.72A	5m	12.214kA		3.468kA	3.468kA	400V	0.7167mhm/m	0.1026mhm/m	398.297 V	99.572%
5	CABLE 5	Cu	PVC	Single core	21F	4mm ² × 1	33.32A	5m	7.711kA		4.488kA	4.488kA	400V	4.488mhm/m	0.1181mhm/m	398.364 V	99.591%
6	CABLE 6	Cu	PVC	Single core	21F	4mm ² × 1	33.32A	5m	4.558kA		2.401kA	2.401kA	400V	4.488mhm/m	0.1181mhm/m	397.200 V	99.300%
7	CABLE 7	Cu	PVC	Single core	21F	95mm ² × 1	299.5A	5m	15.458kA		14.416kA	14.416kA	400V	0.1886mhm/m	0.04405mhm/m	399.161 V	99.790%
8	CABLE 8	Cu	PVC	Single core	21F	95mm ² × 1	299.5A	5m	14.448kA		13.063kA	13.063kA	400V	0.1886mhm/m	0.04405mhm/m	398.793 V	99.695%
9	CABLE 9	Cu	PVC	Single core	21F	6mm ² × 1	44.1A	5m	5.919kA		5.919kA	5.919kA	400V	2.995mhm/m	0.1117mhm/m	397.759 V	99.440%
10	CABLE 10	Cu	PVC	Single core	21F	6mm ² × 1	44.1A	5m	5.919kA		3.268kA	3.268kA	400V	2.995mhm/m	0.1117mhm/m	396.724 V	99.181%
11	CABLE 11	Cu	PVC	Single core	21F	70mm ² × 1	220.5A	5m	13.951kA		11.983kA	11.983kA	400V	0.256mhm/m	0.06613mhm/m	398.377 V	99.594%
12	CABLE 12	Cu	PVC	Single core	21F	70mm ² × 1	220.5A	5m	13.188kA		10.408kA	10.408kA	400V	0.256mhm/m	0.06613mhm/m	397.862 V	99.491%

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5. Single wiring diagram

Single wiring diagram section is printed with just the section header. To complete the report, print a single-line diagram (see chapter 5.2) and attach to this section.

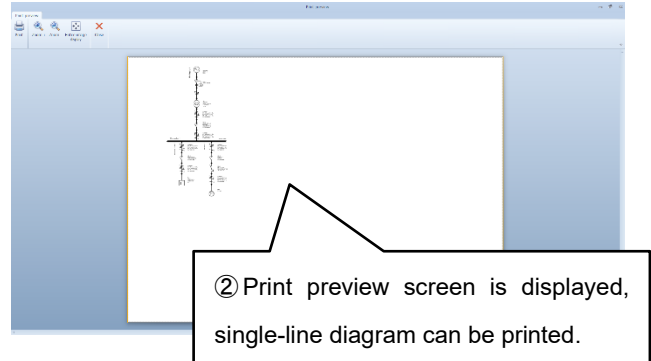
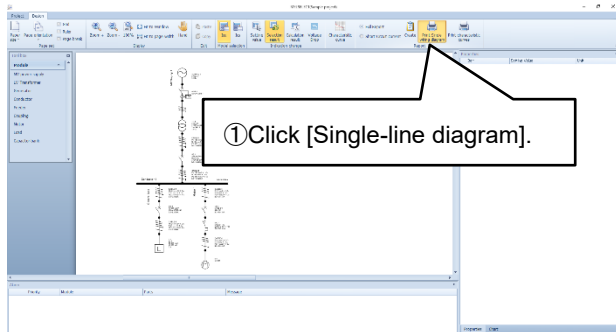
5. Single wiring diagram

Please print the single wiring diagram separately.

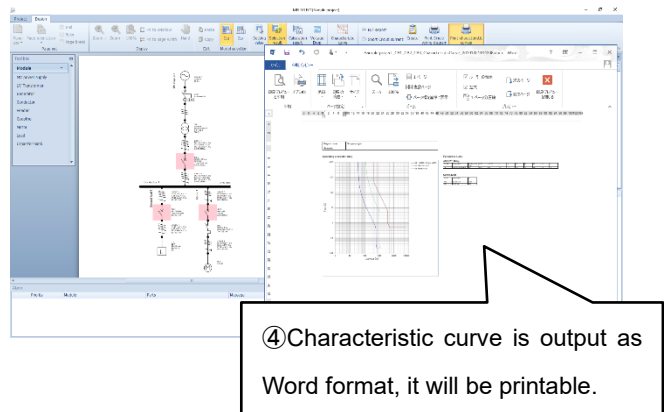
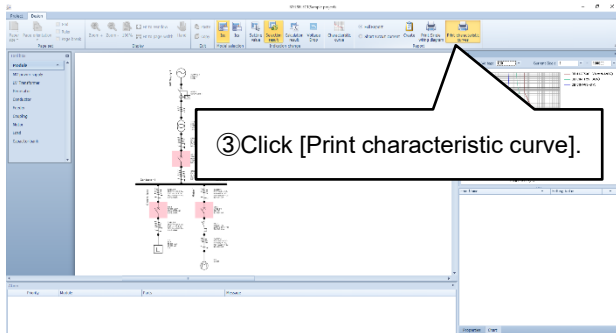
10

5.2 Print single-line diagram and characteristic curve

- (1) MELSELECT enables to print single-line diagram and characteristic curve as related materials.
- (2) Click [Print single-line diagram] in Report section to print the created single-line diagram which was created at drawing area.



- (3) By Clicking [Print Characteristic curves] in the report section, the created characteristic curves is output as Word format and it will be printable.



- (4) The created operating characteristic curve is created as below file name, they are automatically saved to [Document] or [My document] folder.

[Project name][Selected part name]_CharacteristicCurve_yyyyMMddHHmmss.docx

6. Appendix

6.1 Troubleshooting

Table 8. The contents of the trouble, the causes and solutions

No	Contents	Cause and solution
1	MELSELECT does not work	Check if OS is Windows10.
2		Check if it is Microsoft.NET Framework4.6.
3		Your OS language may be incompatible. Change the language setting to English/Chinese/Japanese and try again
4		The download may have failed. Download it again.
5	When calculating short-circuit current, error occurs	Change the setting condition referring to the error message.
6		Make sure each element is correctly arranged and connected.
7		There might be no suitable model. Reconsider the calculation conditions.

6.2 The list of setting parameters for the elements

Table 9. The list of setting parameters for the elements

Elements	Setting parameters
Power	Voltage [V] 3000/3300/6000/6600/10000/11000/13800/15000/20000/22000/24000/25000/30000/33000/35000
	Source capacity [MVA] 1000(Default), 1-9999 (Arbitrary input)
	X/R 0-99 (Arbitrary input)
Protection relay	Type No/ MELPRO-D (1A)/ MELPRO-D (5A)/ MELPRO-S (5A)
	MV protection device CFP1-A41D1-E**1/CAC1-A41D1-E**1 (In case of MELPRO-D(1A)) CFP1-A41D1-E**5/CAC1-A41D1-E**5 (In case of MELPRO-D(5A)) COC4-A01S1 (In case of MELPRO-S(5A)) COC4-A02S1 (In case of MELPRO-S(5A) MODBUS-RTU)
Transformer	Secondary voltage [V] 100/110/220/230/240/380/400/415/440/480/500/525/660/690
	Earthing system TN-S/ TN-C/ TT/ IT
	Transformer capacity [kVA] 20/30/50/75/100/150/160/200/250/300/315/400/500/630/750/800/1000/1250/1500/1600/2000/2500/ 3150/3750/4000/5000/6000
	%Z [%] 0.1-10 (Arbitrary input)
	X/R 0-99 (Arbitrary input)
Generator	Voltage [V] 100/110/220/230/240/380/400/415/440/480/500/525/660/690
	Power distribution system TN-S/ TN-C/ TT/ IT
	Capacity [kVA] 20/30/50/75/100/150/160/200/250/300/400/500/630/750/800/1000/1250/1500/1600/2000/2500/3150
	Transient reactance [%] 0-100 (Arbitrary input)
	Sub- transient reactance [%] 0-100 (Arbitrary input)
	DC time constant [s] 0.01-100 (Arbitrary input)
	Sub-transient time constant [s] 0.001-100 (Arbitrary input)

Table 9. The list of setting parameters for the elements (Continued on previous page)

Element	Setting parameter
Cable	Length [m] 0.1-999 (Arbitrary input)
	Conductor material (Phase) Cu/Al
	Conductor material (N) (PE) (PEN) Cu/Al
	Insulating material PVC/ XLPE
	Cable arrangement (Select it in the setting window)
	Cross sectional area [mm ²] 1.5/2.5/4/6/10/16/25/30/50/70/95/120/150/185/240/300/400/500/630/800/1000 (Depending on a capacity of power distribution)
	Number of wires 1/2/3/4/5/6/7/8/9/10/11/12 (Depending on a capacity of power distribution)
	Resistance [mohm/m] 0.0-15 (Arbitrary input)
	Reactance [mohm/m] 0.0-0.5 (Arbitrary input)
	Cross section area rate [%] 50-200 (Arbitrary input)
Busduct	Length [m] 0.-999 (Arbitrary input)
	Number of poles 4P(3P+N)/3P (Depending on an earthing system)
	Conductor material (Phase) Cu/Al
	Conductor material (N) (PE) Cu/Al
	Busduct size WxDxN 75mmx6mmx1/100mmx6mmx1/125mmx6mmx1/175mmx6mmx1/230mmx6mmx1/280mmx6mmx1 /200mmx6mmx1/280mmx6mmx2 (Depending on the capacity of power distribution) (In case of the conductor material (Phase) is Cu) 100mmx6mmx1/100mmx10mmx1/125mmx10mmx1/175mmx10mmx1/230mmx10mmx1 /280mmx10mmx1/200mmx10mmx2/280mmx10mmx2 (Depending on the capacity of power distribution) (In case of the conductor material (Phase) is Al)
	Resistance [mohm/m] 0.0-15 (Arbitrary input)
	Reactance [mohm/m] 0.0-0.5 (Arbitrary input)
	Cross section area rate [%] 50-200 (Arbitrary input)

Table 9.The list of setting parameters for the elements (Continued on previous page)

Elements	Setting parameters
Busbar	Length [m] 0.1-999 (Arbitrary input)
	Conductor material (Phase) Cu/Al
	Conductor material (N) (PE) (PEN) Cu/Al
	Horizontal installation factor 0.1-2 (Arbitrary input)
	Proximity effect factor 0.1-2 (Arbitrary input)
	Busbar size WxDxN 12mmx2mmx1/15mmx2mmx1/15mmx3mmx1/20mmx2mmx1/12mmx2mmx2/20mmx3mmx1/ 15mmx2mmx2/25mmx3mmx1/20mmx5mmx1/30mmx3mmx1/15mmx3mmx2/20mmx2mmx2/ 25mmx5mmx1/30mmx5mmx1/20mmx3mmx2/40mmx3mmx1/25mmx3mmx2/40mmx5mmx1/ 20mmx5mmx2/30mmx3mmx2/50mmx5mmx1/25mmx5mmx2/40mmx3mmx2/30mmx5mmx2/ 60mmx5mmx1/40mmx10mmx1/50mmx10mmx1/40mmx5mmx2/80mmx5mmx1/60mmx10mmx1/ 100mmx5mmx1/50mmx5mmx2/60mmx5mmx2/80mmx10mmx1/40mmx10mmx2/100mmx10mmx1/ 50mmx5mmx3/50mmx10mmx2/80mmx5mmx2/120mmx10mmx1/60mmx5mmx3/60mmx10mmx2/ 40mmx10mmx3/100mmx5mmx2/50mmx5mmx4/50mmx10mmx3/80mmx10mmx2/80mmx5mmx3/ 160mmx10mmx1/60mmx5mmx4/40mmx10mmx4/60mmx10mmx3/100mmx10mmx2/100mmx5mmx3/ 80mmx5mmx4/50mmx10mmx4/80mmx10mmx3/120mmx10mmx2/60mmx10mmx4/100mmx5mmx4/ 100mmx10mmx3/160mmx10mmx2/80mmx10mmx4/120mmx10mmx3/100mmx10mmx4/ 160mmx10mmx3/150mmx10mmx4/200mmx10mmx4 (Depending on the capacity of power distribution) (In case of the conductor material (Phase) is Cu) 12mmx2mmx1/15mmx2mmx1/15mmx3mmx1/20mmx2mmx1/12mmx2mmx2/20mmx3mmx1/ 15mmx2mmx2/25mmx3mmx1/20mmx5mmx1/30mmx3mmx1/15mmx3mmx2/20mmx2mmx2/ 25mmx5mmx1/30mmx5mmx1/20mmx3mmx2/40mmx3mmx1/25mmx3mmx2/40mmx5mmx1/ 20mmx5mmx2/30mmx3mmx2/50mmx5mmx1/25mmx5mmx2/40mmx3mmx2/30mmx5mmx2/ 60mmx5mmx1/40mmx10mmx1/50mmx10mmx1/40mmx5mmx2/80mmx5mmx1/60mmx10mmx1/ 100mmx5mmx1/50mmx5mmx2/60mmx5mmx2/80mmx10mmx1/40mmx10mmx2/100mmx10mmx1/ 50mmx5mmx3/50mmx10mmx2/80mmx5mmx2/120mmx10mmx1/60mmx5mmx3/60mmx10mmx2/ 40mmx10mmx3/100mmx5mmx2/50mmx5mmx4/50mmx10mmx3/80mmx10mmx2/80mmx5mmx3/ 160mmx10mmx1/60mmx5mmx4/40mmx10mmx4/60mmx10mmx3/100mmx10mmx2/100mmx5mmx3/ 80mmx5mmx4/50mmx10mmx4/80mmx10mmx3/120mmx10mmx2/60mmx10mmx4/100mmx5mmx4/ 100mmx10mmx3/160mmx10mmx2/80mmx10mmx4/120mmx10mmx3/100mmx10mmx4/ 160mmx10mmx3/150mmx10mmx4/200mmx10mmx4 (Depending on the capacity of power distribution) (In case of the conductor material (Phase) is Al)
	Resistance [mohm/m] 0.0-15 (Arbitrary input)
	Reactance [mohm/m] 0.0-0.5 (Arbitrary input)
	Cross section area rate [%] 50-200 (Arbitrary input)

Table 9. The list of setting parameters for the elements (Continued on previous page)

Elements	Setting parameters
Breaker	Type of circuit breakers ACB/ MCCB/ MCB
	Number of poles 4P(3P+N)/ 3P/ 2P/ 2P(1P+N) (Depending on an earthing system)
	Residual current protection (Earth-leakage protection) Yes/ No
	Electronic trip relay (ACB only) AE-SW series: for General use (WS)/for Generator protection use (WM)/ for Special use (WB)/for Coordination use (WF) AED-CV series: for General use (VS1)
Capacitor-bank	Capacitance [kVar] 5/10/15/20/25/30/40/50/60/75/100/150/200/250/300/400/500/600/750
	Reactor [%] 6/ 13
Load	Load current [A] 0.1-8267 (Arbitrary input)
	Power factor 0-1 (Arbitrary input)
	Capacity [kVA] 0.038-3150 (Arbitrary input)
	Output [kW] 0.004-3150 (Arbitrary input)
Motor	Starting method Direct-to-line start/ Star-Delta start/ Inverter start
	Output [kW] 0.1/0.2/0.4/0.75/1.5/2.2/3.7/5.5/7.5/11/15/18.5/22/30/37/45/55/75/90/110/132/160/200/250/300 (In case of the Direct-to-line start) 5.5/7.5/11/15/18.5/22/30/37/45/55/75/90/110/132/160/200/250/300 (In case of the Star-Delta start) 0.2/0.4/0.75/1.5/2.2/3.7/5.5/7.5/11/15/18.5/22/30/37/45/55/75/90/110/132 /160/185/220/250/280/315/355/400/450/500/560 (In case of the Inverter start)
Inverter	AC reactor Yes/ No
	DC reactor Yes/ No

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