Release Information – PSS®SINCAL Platform 20.0

This document describes the most important enhancements and changes in the new program version. See the product manuals for more detailed descriptions of the functionalities.

General Remarks

Licensing

To operate the PSS SINCAL Platform 20.0, new license files are required. These can be requested at the **PSS SINCAL Platform Support** (sincal.support.it@siemens.com).

System Requirements

The following hardware and software requirements include the minimum requirements to operate an application of the PSS SINCAL Platform 20.0.

Hardware Requirements
PC or Notebook
CPU: x64, >= 2 GHz, multicore
RAM: >= 8 GB
Free hard disk space: >= 20 GB
Graphics card: >= 1920 x 1200, True Color
Operating Systems Supported
Windows 10
Windows 11
Windows Server 2012 R2
Windows Server 2016
Windows Server 2019
Database Systems Supported
SQLite 3.x
Microsoft Access
Oracle 9i
Oracle 10g
Oracle 11g
Oracle 12c
Oracle 19c
SQL Server 2008 and 2008 R2
SQL Server 2012
SQL Server 2014
SQL Server 2016
SQL Server 2017
SQL Server 2019

Example Networks

PSS SINCAL

With this product version new and revised example networks are delivered. These illustrate the basic use of the product functions and can be used to test the various calculation modules.

The following extended example networks are available:

Network	Description
Example OC	Adaptations for new protection functions.
Example Prot	Adaptations for new protection functions.
Example PSA	
Example TDA	
Example Imp Excel	The example shows the step-by-step import of a symmetric network model and its update via the Excel import function.

Protection Devices

The library of protection devices has been expanded again in this product version. The new and modified devices are listed below. Comprehensive descriptions of the protective devices are available in the **Protection Coordination** and **Input Data** manuals.

New Protection Devices

The following new protection devices are available:

Protection device	Description
SIBA-HHD-BSSK_6-12kV (63A)	Fuse
SIBA-HHD-BSSK_6-12kV (80A)	Fuse
SIBA-HHD-BSSK_6-12kV (100A)	Fuse
SIBA-HHD-BSSK_6-12kV (125A)	Fuse
SIBA-HHD-BSSK_6-12kV (160A)	Fuse
SIBA-HHD-BSSK_6-12kV (180A)	Fuse
SIBA-HHD-BSSK_10-24kV (63A)	Fuse
SIBA-HHD-BSSK_10-24kV (80A)	Fuse
SIBA-HHD-BSSK_10-24kV (100A)	Fuse
SIBA-HHD-BSSK_10-24kV (125A)	Fuse
SIBA-HHD-BSSK_10-24kV (140A)	Fuse
SIBA-HHD-BSSK_20-36kV (50A)	Fuse
SIBA-HHD-BSSK_20-36kV (63A)	Fuse
SIBA-HHD-BSSK_20-36kV (80A)	Fuse
SIBA-HHD-BSSK_40,5kV (80A)	Fuse

Modified Protection Devices

The following protection devices have been upgraded.

Protection device	Description
SIBA-HHD	Renaming to SIBA-HHD_BU.
All recloser models	The tripping currents are now no longer specified by reference to a rated current Ir, but in secondary values in amperes.

Phase Out of Modules

The following modules are no longer available in PSS SINCAL 20.0.

Module	Annotation
Transfer capacity (TC)	
Protection device management (PDMS)	In the future, the protection device settings will be managed with the new PCDMS module.
Flicker (FLI)	

The following modules have the "deprecated" state, i.e. these will not be available in a future product version.

Module	Annotation
Energy storage (ES)	Phase out in version 20.5.

PSS®SINCAL

User Interface

General Extensions

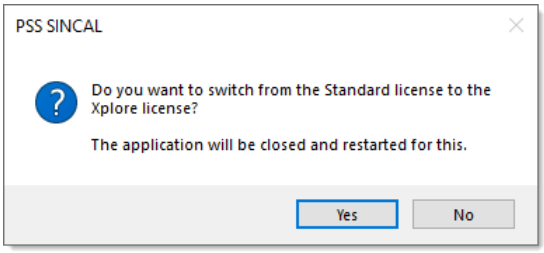
Simplified Change between Standard and Xplore License

The PSS SINCAL Platform is delivered with a special Xplore license, that enables every user to test almost all modules of the product without a commercial license.

The most important features of the Xplore license in overview:

- The license is not bound to a PC or dongle and can therefore be used on any PC.
- The license allows to calculate networks with a size of up to 50 nodes and to create GMB models with up to 10 blocks.
- The license can be used until the release of the next product version plus 2 months.

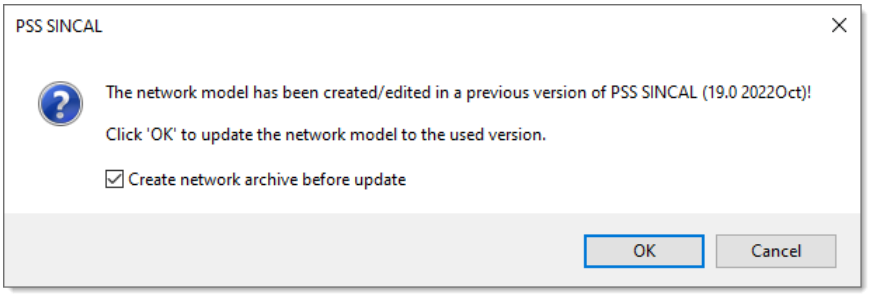
Until now, changing between standard license and Xplore license was possible by manually selecting the license file. Now the switch can be done easily via the menu item **Help** – **Toggle Standard/Xplore License**. Switching the license is possible only if no network model is opened in the user interface. Before switching the license, the following message is displayed:



After confirming the message, PSS SINCAL is terminated and restarted with the Xplore license. Returning to the standard license is possible in the same way.

Creation of a Network Archive when Updating Networks

In PSS SINCAL, a network model from a previous version is automatically updated to the current version when it is opened. To ensure that the network is still available in the old version, a network archive (in the network models' directory) can now be created automatically before the update. For this purpose, a corresponding option is available in the message box that is displayed when opening network models of a previous version:



Color Scheme and Palette

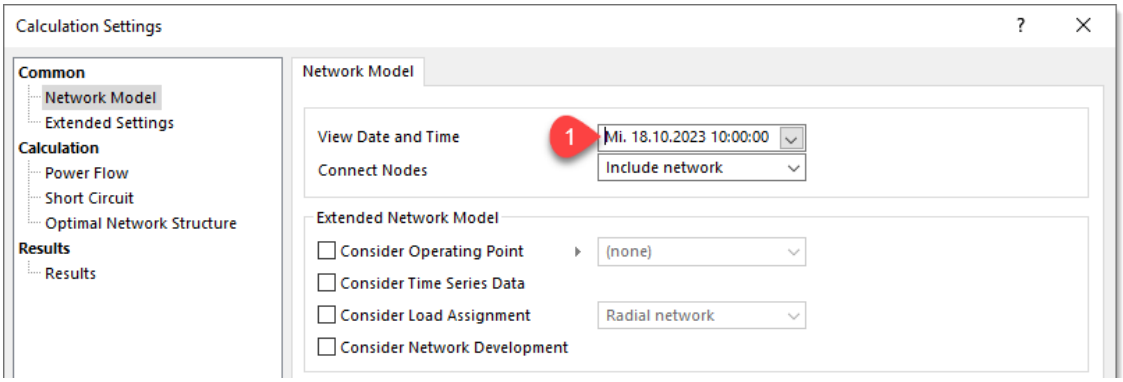
As part of the last product release, the use of colors in the PSS SINCAL Platform was revised. In addition to a new color palette, a clearer separation between the offered colors for feedback, for evaluations and for manual coloring has been introduced.

In this version, further adjustments to the color scheme and color palettes have been implemented:

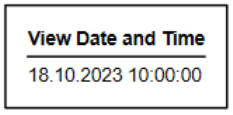
- In the diagrams the document colors are now offered as palette.
- The new default colors are also applied for heat maps.
- The default colors for filter settings have been adapted according to the palette.
- The colors for characteristic curves, profiles and operating points have been adapted to the new palette.

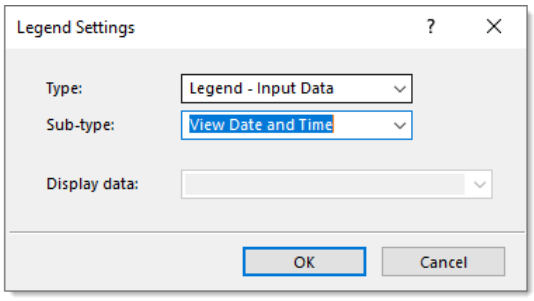
New Legend for View Date and Time

The **View Date and Time** parameter (#1) can be used to specify the time when the network is viewed and calculated. This timestep is considered in all calculation methods. It applies to the establishment (Ti) and shutdown date (Ts) of network elements as well as to time-dependent profile values and, of course, the time series data interface.



The selected view date and time can now also be visualized in the network graphic with the corresponding legend sub-type.

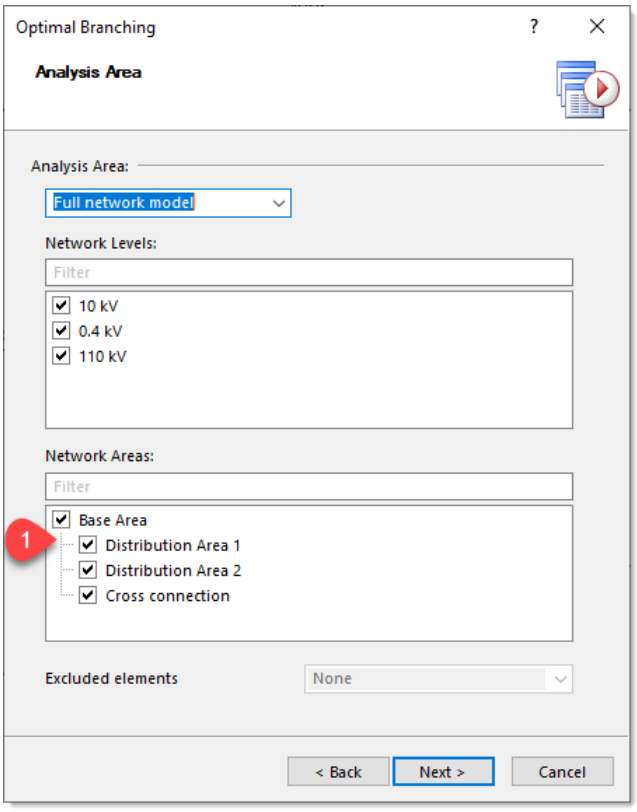




Advanced Wizards for Calculation Modules

In most of the wizards of the calculation modules the analysis and calculation area can be selected. This specifies, on the one hand, which area of the network model is evaluated and, on the other hand, in which area the calculation module perform the respective temporary changes to the network model (e.g., opening and closing of switches in the Optimal Branching module) during the calculation.

Either the entire network model, the part of the network selected in the network graphic, or a network element group represents the base collection of elements. Additionally, this selection can be limited to selected network levels and network areas. The following figure shows, for example, the selection of the analysis area for the Optimal Branching module.



A new feature is that the **Network Areas** (#1) are offered for selection according to their hierarchical structure. This extension is available in all wizards where network areas are offered for selection.

Advanced Keyboard Shortcuts

The processing of shortcuts in PSS SINCAL has been extended.

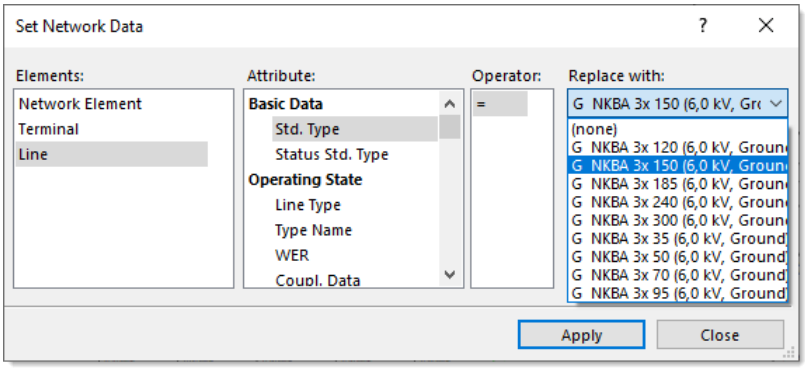
In the graphics editor, analogous to CAD programs, the ESC key is now assigned for returning to the selection function. I.e. if a special mode is active, such as switching, pressing ESC can switch back to the selection mode. If the selection mode is already active, ESC resets the selection.

In the tabular view, pressing the ESC key also resets the selection of cells.

The network browser has also been extended. The shortcut for the **Select in Graphic View** function (Ctrl + G) is now also supported here. This allows the element currently selected in the network browser to be conveniently selected in the graphics editor as well.

Advanced Assignment of Standard Types

The **Set Network Data** function has been extended. Now it is possible to assign the standard types for all the network elements selected in the graphics editor. Setting the standard type is possible for all network elements that support standard types (line, transformer, synchronous machine, asynchronous machine, etc.).



In the selection list those standard types are available, which were preselected in the network model in the data screen forms.

Page Setup

The **Page Setup** function has been extended. This defines the worksheet and, for geographic networks, also the scale. Previously, the scale could only be changed in a completely empty graphics editor, as this change causes each graphical position of the network elements and supplementary graphics objects to be recalculated and stored in the database. Now the scale can be changed at any time to facilitate the selection of the most suitable scale and thus a network model adequate graphic resolution.

Creating Substations

The workflow for the modelling of substations in the network graphic editor has been adapted. In a schematic view, the substation container is captured with a simple rectangle as before, and in the geographic view now per default using a polygon.

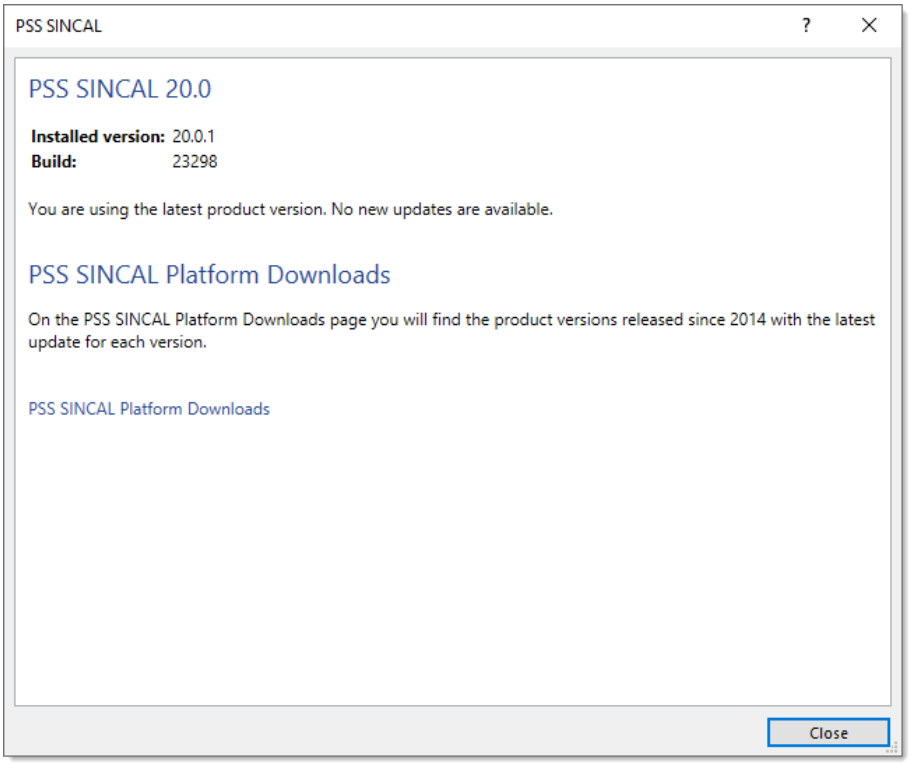
Primary Key in Tabular View

In the tabular view, the primary keys of the records can now also be displayed for external databases, (as offered for the network database as well). The display is activated via the menu item **Table** – **Display Options** – **Show Primary Key**.

Advanced Check for Updates

In PSS SINCAL, the **Help** – **Check for Updates** function can be used to determine whether the product version used is current or whether an update is available for it that has not yet been installed.

The result of the check was previously displayed with a message box. Now a new dialog box is available that clearly displays the installed version, any available updates and also newer product versions. Links to the download page are available in the dialog box, which can be used to open the web browser for the download.



Reconnect for Network Licenses

When using a network license, PSS SINCAL on the client computer continuously communicates with the license server on the server computer (if no CheckOut is activated). If this communication is not possible for a period of 5 minutes, the connection from the server computer is automatically disconnected and PSS SINCAL must then be terminated. This is unlikely to occur, but if the network infrastructure is particularly poor, this might happen.

In case of such connection problems, an extended error message is now displayed. This makes it possible to manually re-establish the connection to the server computer. If this is successful, work with PSS SINCAL can be continued. If a reconnection is not successful, the previous functionality is retained. I.e. PSS SINCAL changes to ReadOnly mode and no more changes to the network model are possible. Only changes can be saved or discarded.

Result View

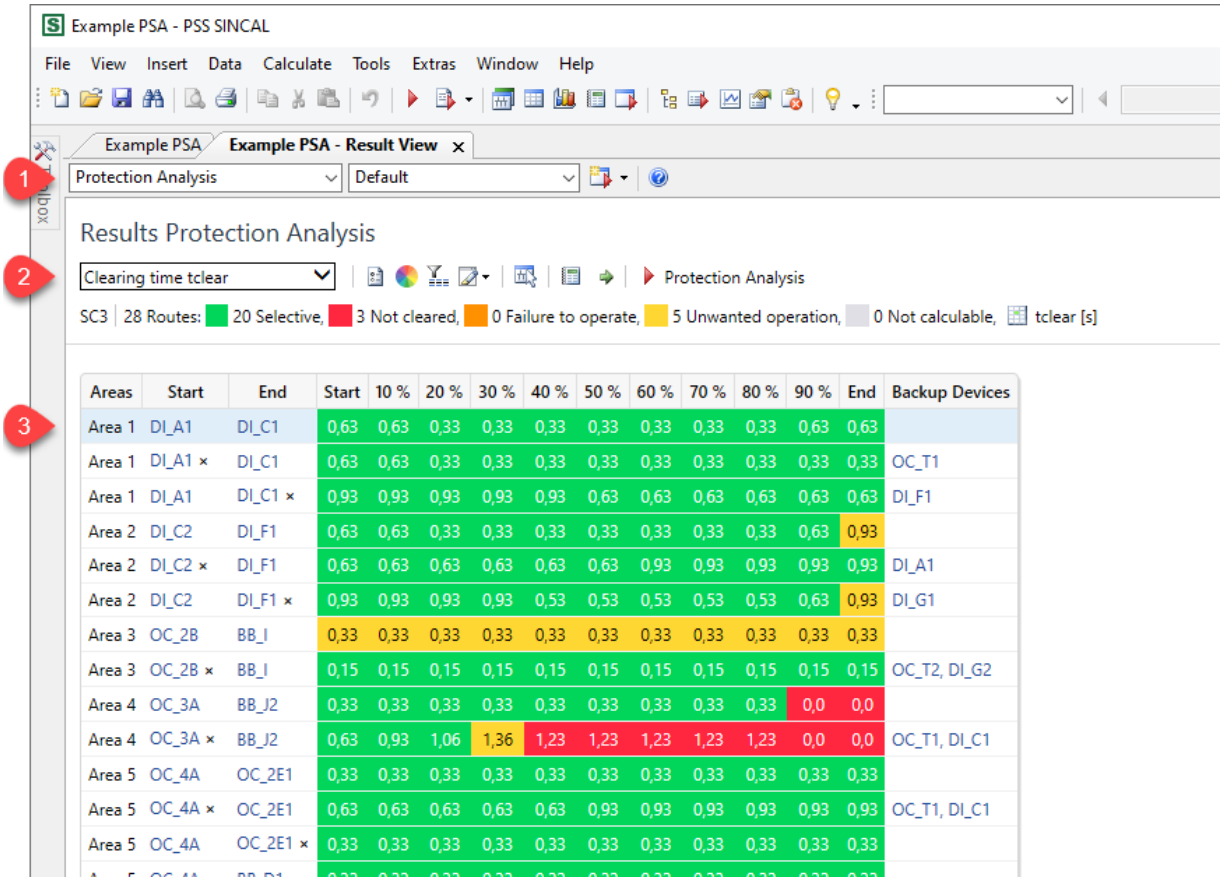
The result view is a central function for result visualization and analysis. With it, extended results of the specific calculation modules are displayed and can be evaluated interactively.

In this product release, the display and presentation of results has been redesigned with a focus on a content centric presentation and an improved user experience. The following result views have been redesigned:

- Calculation Log
- Power Flow Debug Details
- Stationary Debug Details (Pipe Networks)
- Variant Comparison
- Scenario Comparison
- Result Compilation

- Time Series Data Interface
- Contingency Analysis for Electrical Networks
- Contingency Analysis for Pipe Networks
- Connection Conditions
- Hosting Capacity
- Network Stress Test
- Optimal Branching
- Protection Analysis
- Thermal Destruction Analysis
- Check OC Settings
- Determining Fault Locations
- Earth Fault Compensation Data

The following figure shows an example of the adapted result view with results of the Protection Analysis (PSA) module:



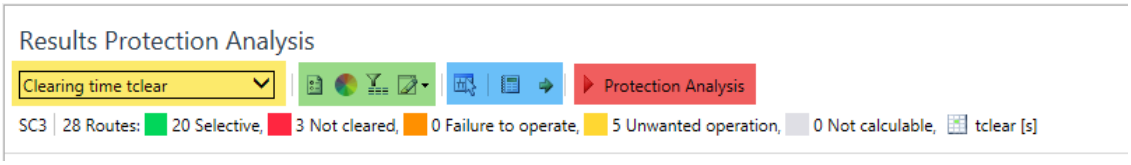
Areas	Start	End	Start	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	End	Backup Devices
Area 1	DI_A1	DI_C1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,63	0,63	
Area 1	DI_A1 ×	DI_C1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	OC_T1
Area 1	DI_A1	DI_C1 ×	0,93	0,93	0,93	0,93	0,93	0,63	0,63	0,63	0,63	0,63	0,63	DI_F1
Area 2	DI_C2	DI_F1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,63	0,93	
Area 2	DI_C2 ×	DI_F1	0,63	0,63	0,63	0,63	0,63	0,63	0,93	0,93	0,93	0,93	0,93	DI_A1
Area 2	DI_C2	DI_F1 ×	0,93	0,93	0,93	0,93	0,53	0,53	0,53	0,53	0,53	0,63	0,93	DI_G1
Area 3	OC_2B	BB_I	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	
Area 3	OC_2B ×	BB_I	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	OC_T2, DI_G2
Area 4	OC_3A	BB_J2	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,0	0,0	
Area 4	OC_3A ×	BB_J2	0,63	0,93	1,06	1,36	1,23	1,23	1,23	1,23	1,23	0,0	0,0	OC_T1, DI_C1
Area 5	OC_4A	OC_2E1	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	
Area 5	OC_4A ×	OC_2E1	0,63	0,63	0,63	0,63	0,63	0,93	0,93	0,93	0,93	0,93	0,93	OC_T1, DI_C1
Area 5	OC_4A	OC_2E1 ×	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	

Primarily, the result view consists of a static window frame with a toolbar and the dynamic display area.

The results to be displayed can be selected via the **toolbar (#1)**. In addition, further functions for managing the results databases and a button for opening the help are available in the toolbar.

The display area consists of a **header (#2)** and the area where the selected data is displayed (#3). The header is fixed and is therefore always available with the most important functions. The functions provided here differ depending on the calculation module to support the workflows in the evaluation of the results as optimally as possible. In general, however, care has been taken to ensure that commonly used functionalities are available in the same way in all modules. This is to ensure that also a comprehensive work with different calculation modules is possible without problems.

The function bar is divided into the following parts (highlighted in color):



- Selection for display mode
- Options, colors, filters and highlighting
- Selection, reports and export functions
- Calculation functions

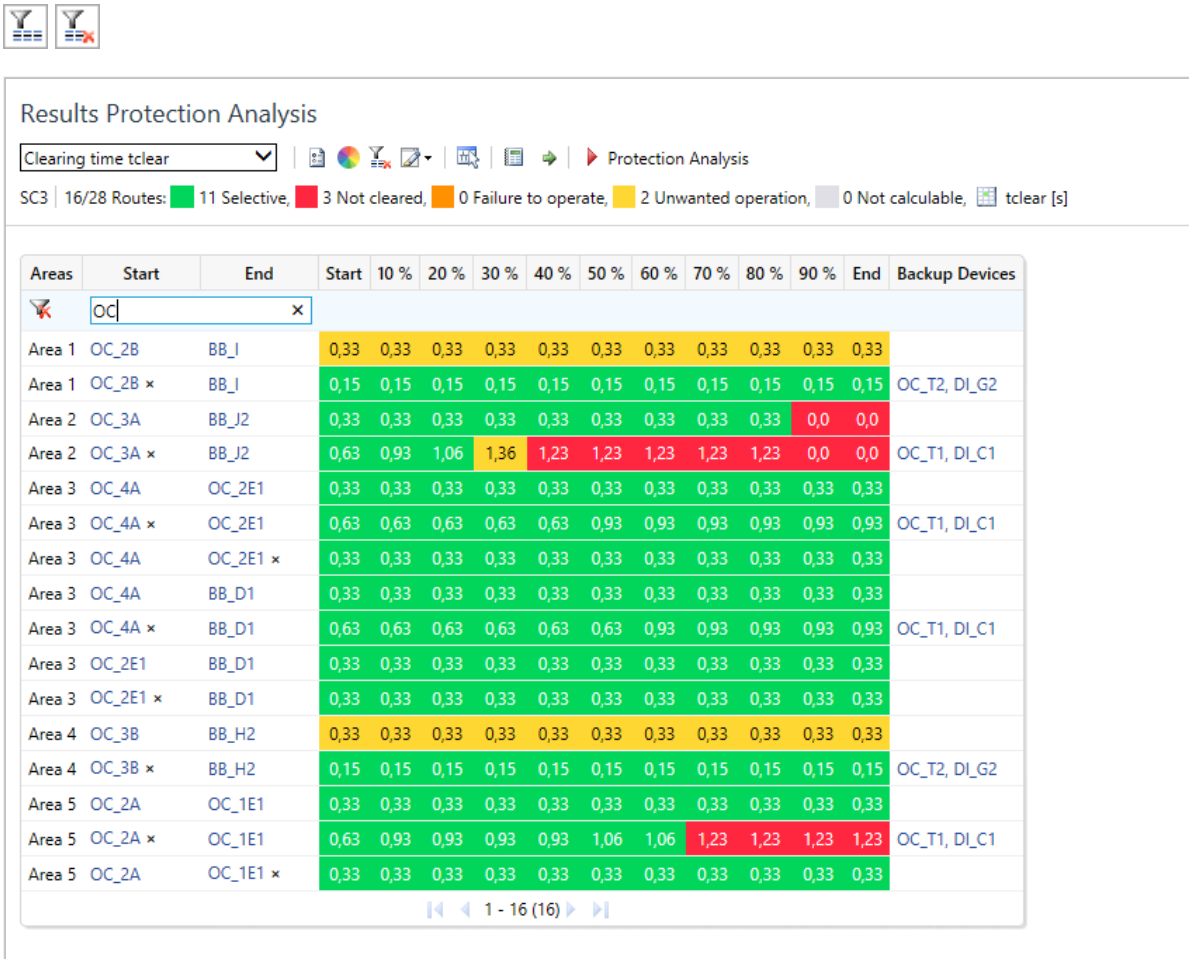
Depending on the calculation module, status information is displayed below the buttons. In the case of the protection analysis, the error type and the information on the color coding of the cells in the result table are displayed here.

Below the header the **input data and results (#3)** are visualized. Content and display are done according to the display mode selected in the selection field of the header. Depending on the calculation module, you can choose between the display of settings and different results. In the example shown, the results display with the clearing time for the various fault locations in the network is selected.

Areas	Start	End	Start	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	End	Backup Devices
Area 1	DI_A1	DI_C1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,63	0,63	
Area 1	DI_A1 ×	DI_C1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	OC_T1
Area 1	DI_A1	DI_C1 ×	0,93	0,93	0,93	0,93	0,93	0,63	0,63	0,63	0,63	0,63	0,63	DI_F1
Area 2	DI_C2	DI_F1	0,63	0,63	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,63	0,93	
Area 2	DI_C2 ×	DI_F1	0,63	0,63	0,63	0,63	0,63	0,63	0,93	0,93	0,93	0,93	0,93	DI_A1
Area 2	DI_C2	DI_F1 ×	0,93	0,93	0,93	0,93	0,53	0,53	0,53	0,53	0,53	0,63	0,93	DI_G1
Area 3	OC_2B	BB_I	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	
Area 3	OC_2B ×	BB_I	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	OC_T2, DI_G2
Area 4	OC_3A	BB_J2	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,0	0,0	
Area 4	OC_3A ×	BB_J2	0,63	0,93	1,06	1,36	1,23	1,23	1,23	1,23	1,23	0,0	0,0	OC_T1, DI_C1

Advanced Filter Functions

In the revisited result views, the filter functions are now integrated directly in the table. There is a filter row that can be shown and hidden using the buttons in the header:

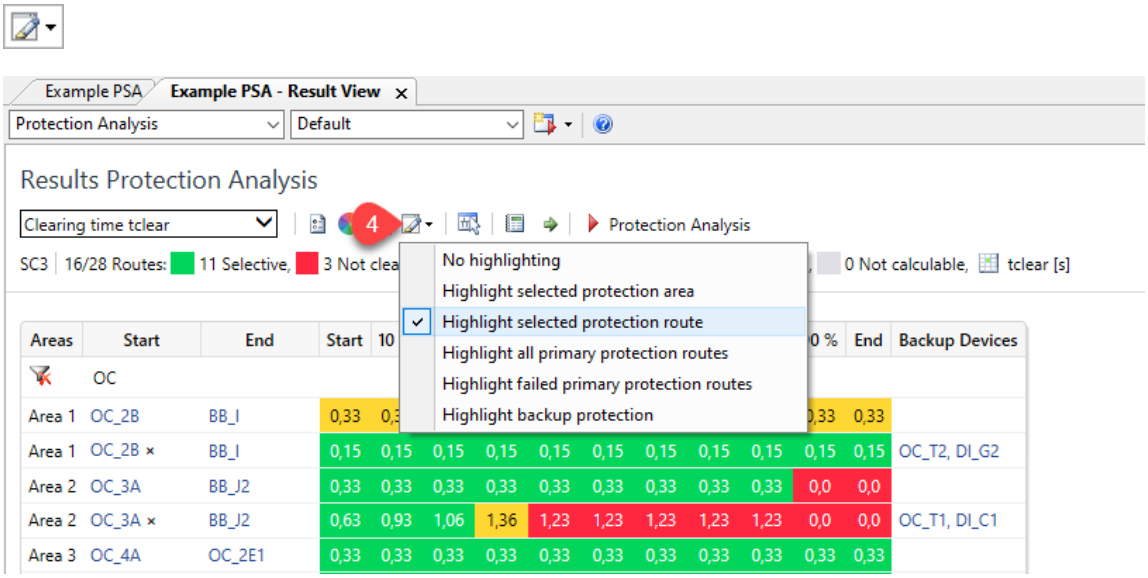


In the displayed input fields of the filter line, the criteria for reducing the displayed data can be entered. In the above picture, all protection routes are displayed where the name of the start or end device contains the character combination "OC".

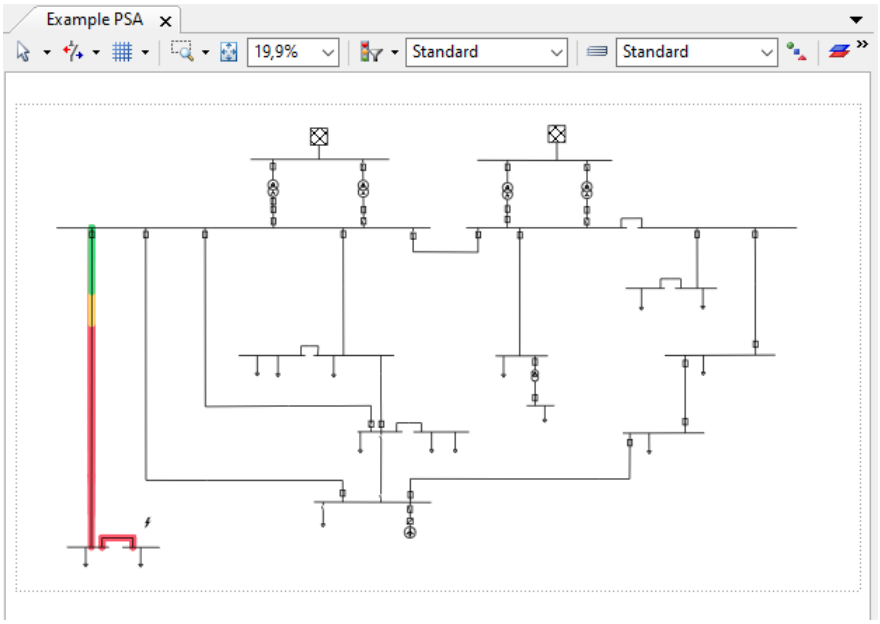
Wildcards (*, ?) as well as filters with operators (>, >=, <, <=, ...) for numerical values can also be used in the filter line.

Access Highlighting Functions

The access to the highlighting function for visualization in the network graphic has been adjusted. In those result views where different highlighting functions are available, they are made available via a drop-down menu in the header (#4). This makes it easy to switch between the different evaluations.



The row selected in the table (highlighted in blue) is thus automatically highlighted in the network graphic and when the row is changed, the highlighting is automatically adjusted.



Excel Import

The creation of a network model usually takes place step by step (e.g. first basic topology, then extended equipment and protection system), since not all data originate from the same source system or are only available later. During the life cycle of a network model, it is also necessary to extend or update it (e.g. with measured values, load data, settings). These tasks are optimally supported by the Excel import.

Excel Import is a fully configurable import adapter available in the PSS SINCAL user interface for importing data into Excel Worksheets. In addition to the import mode, it also offers modes to extend and update existing (or previously imported) network models.

General Information

During the Excel import, it was previously necessary to **define selection values** in the Excel Worksheet according to the language selected in the user interface. This is now no longer necessary. Additionally, the English notation can be used at any time.

The **generation of error messages** has been improved. The message texts are more workflow oriented and support in locating data or configuration issues in the Excel Worksheet. To detect identification problems of network elements, non-unique multiple assignments of data are now also detected during import and logged with error messages.

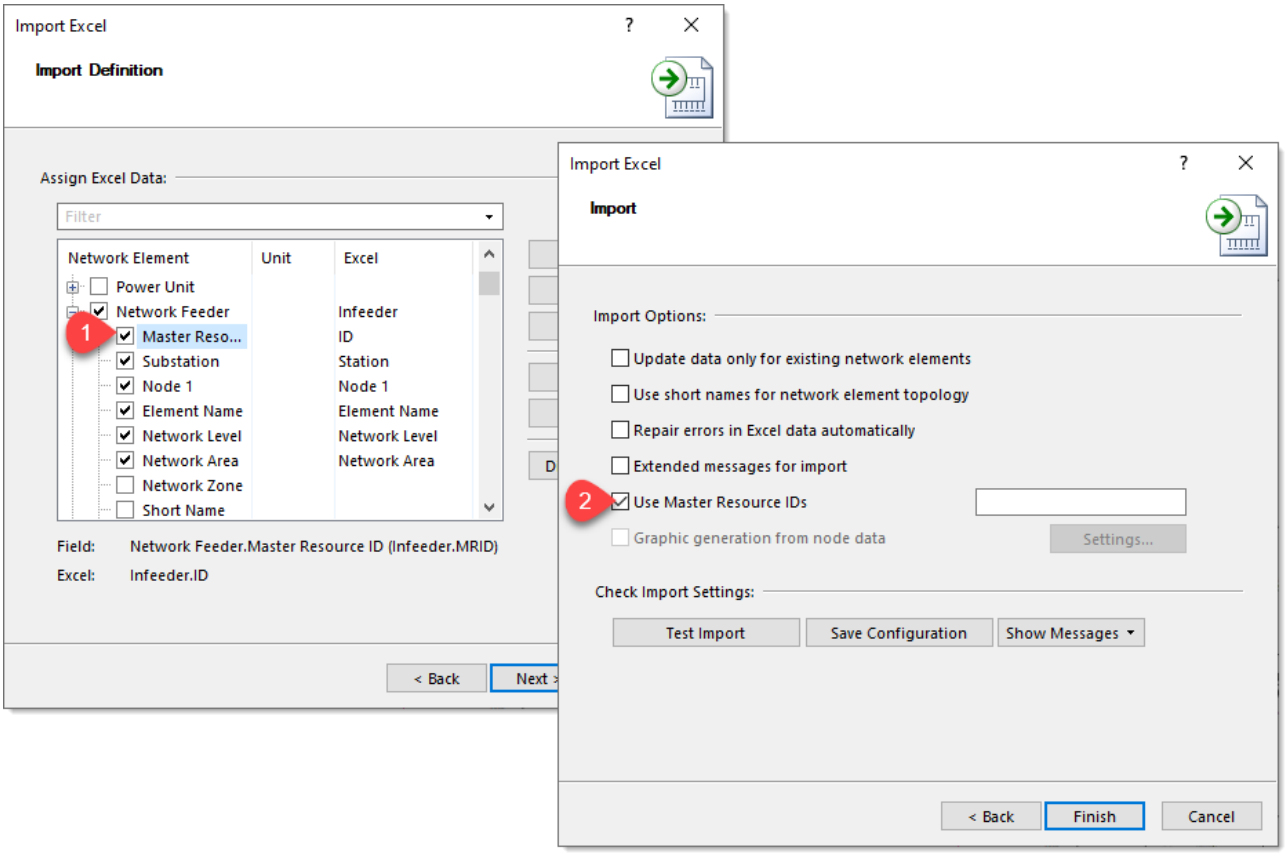
The hierarchical import of network areas is now supported. The network model can be structured into hierarchically ordered network areas directly during import. The prerequisite for this is that the network areas are arranged according to the hierarchy as shown in the following picture:

	A	B	C	D	E
1	**Name**	**ID**	**Parent Area**		
2	CompleteNetwork	1234-4548			
3	Area1	1234-4549	CompleteNetwork		
4	Area2	1234-4550	CompleteNetwork		
5					

Master Resource IDs (MRID): Import and Identification

With this product version, Master Resources (MRID) for identification of the respective network elements are supported during import and update of the elements. This means that records can also be uniquely assigned to elements in PSS SINCAL via keys used in other systems (e.g. GIS, SCADA).

For this purpose, the Master Resource ID (MRID) is now available in addition to the name and short name during the import definition (#1):



With the option **Use Master Resource IDs (#2)** the identification can be activated during import on master resource IDs instead of the topology assignment. The category of the master resource can be specified optionally via the associated input field. If no category is specified, all master resource IDs are used.

Identification by means of MRIDs can be used both during import of new and update of existing network elements.

Import of Measuring Devices

Measuring devices with their measured values are now supported by the adapted. In conjunction with the new option of identification via MRIDs, measurement data (e.g. for automatic load assignment in the feeder) can be easily transferred from external systems to PSS SINCAL network models.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Element	Name	ID	Side of Branch (1/2)	State	Phase	DataType	Direction	P [kW]	Q [kvar]	I [A]	cosPhi	Infeed	P_s	Q_s
2	T2	Meas_T2	ABSCE123	2	1	L123	3	2	19000	3000			0		
3	L14	Meas_L14	ABSCE124	1	1	L123	3	1	250	120			0		
4	L 3-4	Meas2	ABSCE125	1	1	L123	1	1			50	0,98	1	500	0

Load Container Import

In electrical networks and also gas networks, consumers can be grouped in containers. These load containers are now also supported during import.

	A	B	C	D	E	F	G	H	I
1	LoadContainer	Customer Number	ID	PF Type	Phasing	P [MW]	Q [MVAr]	fP	fQ
2	L1	L Cl1	1234-4580	P and Q	L123	4,845	1,592	1	1
3	L1	L R1	1234-4581	P and Q	L123	14,994	3,045	1	1
4	L3	L Cl3	1234-4582	P and Q	L123	0,225	0,14	1	1
5	L3	L R3	1234-4583	P and Q	L123	0,276	0,069	1	1
6	L10	L Cl10	1234-4584	P and Q	L123	0,068	0,042	1	1
7	L10	L R10	1234-4585	P and Q	L123	0,475	0,119	1	1
8	L12	L Cl12	1234-4586	P and Q	L123	5,016	1,649	1	1
9	L12	L R12	1234-4587	P and Q	L123	14,994	3,045	1	1
10	L14	L Cl14	1234-4588	P and Q	L123	0,332	0,205	1	1

Sample for Excel Import

In order to illustrate the various functions of the Excel import, the application example "Example Imp Excel" is now available for electrical networks. This shows step by step the establishment of a network model starting with an empty template, the import of the network model, the import of additional elements (DERs), the extension with protection devices and finally the update of existing elements.

Automation for Excel Import

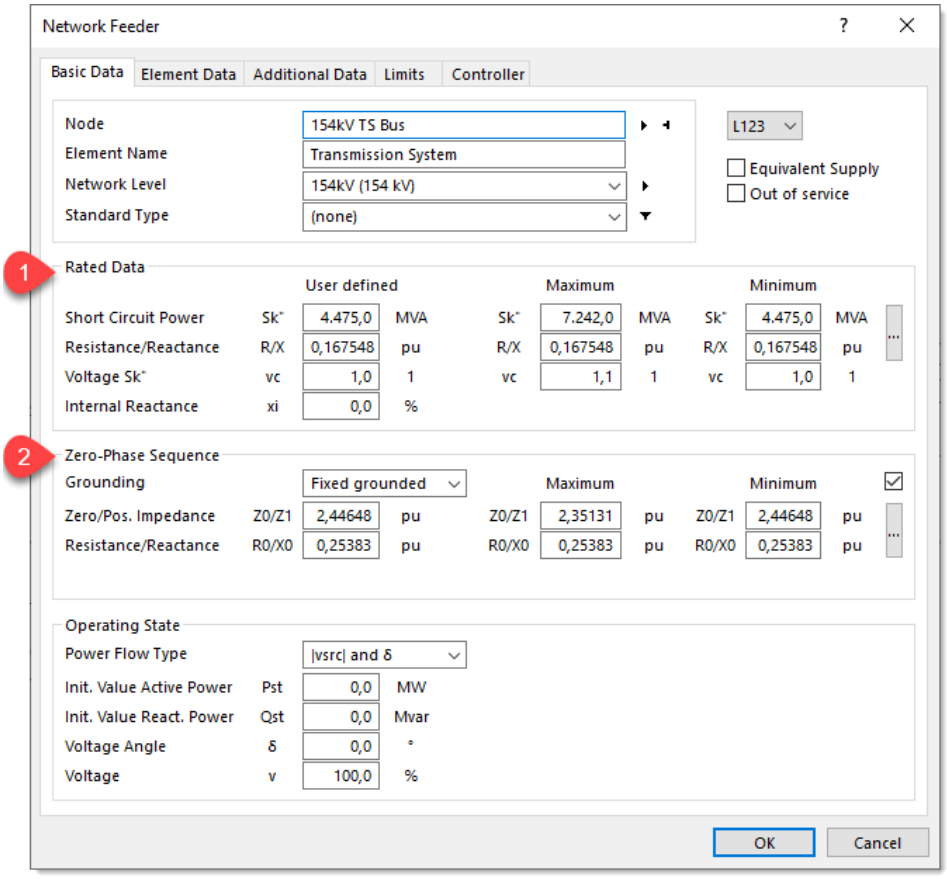
The Excel import can now also be addressed by API functions. The new functions are presented in the **Automation** chapter that follows later.

Electrical Networks

General Extensions

Short Circuit Data of Network Feeders

The input data screen form of the short-circuit parameters of network feeders has been revised to simplify the input. For the calculation of the short circuit with maximum, minimum or user-defined settings the user-defined, minimum and maximum short circuit data of the network feeder is set accordingly. The input is now aligned for rated data (#1) and zero-phase sequence data (#2). The 3 possible considerations are now grouped in columns in the screen form and provide the input fields used in the respective calculation type (short-circuit data):

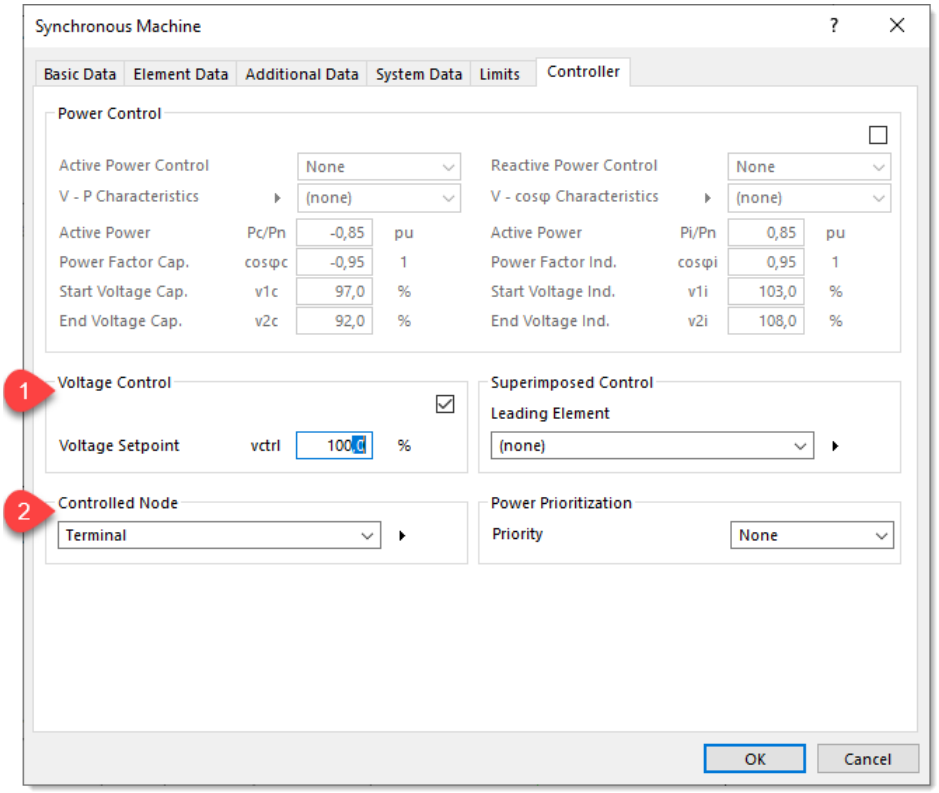


Advanced Control

Basically, a distinction is made between two forms of control (corresponding to PQ or PV typing).

- The voltage control can be activated for the power flow types that are traced back to a PV type (P and |uq|, ...) to specify a setpoint vctrl different from the specified value.
- The power control can be activated for the power flow types that are traced back to a PQ type (P and Q, ...) in order to control power values for P and Q depending on the network state or the active power specification.

The voltage control can now be parameterized separately from the node to be controlled. For this purpose, the definition in the controller data screen form has been adapted:



In the **Voltage Control (#1)** section, a target voltage can be specified for network feeders with the power flow type **active power and voltage**.

In the **Power Control** section, this is activated and parameterized as before, provided that the power flow type corresponds to **active power and reactive power**.

The **Controlled Node (#2)** is specified separately. Here you can choose between the connection node (**Terminal**) of the network element or any other node in the network. The set node is then taken into account as:

- either as reference node for the target voltage of the **Voltage Control** or
- or as a reference node for the voltage measurement of the **Power Control** (depending on the selected mode of operation, e.g. Q(V)).

This extension is available for the following network elements:

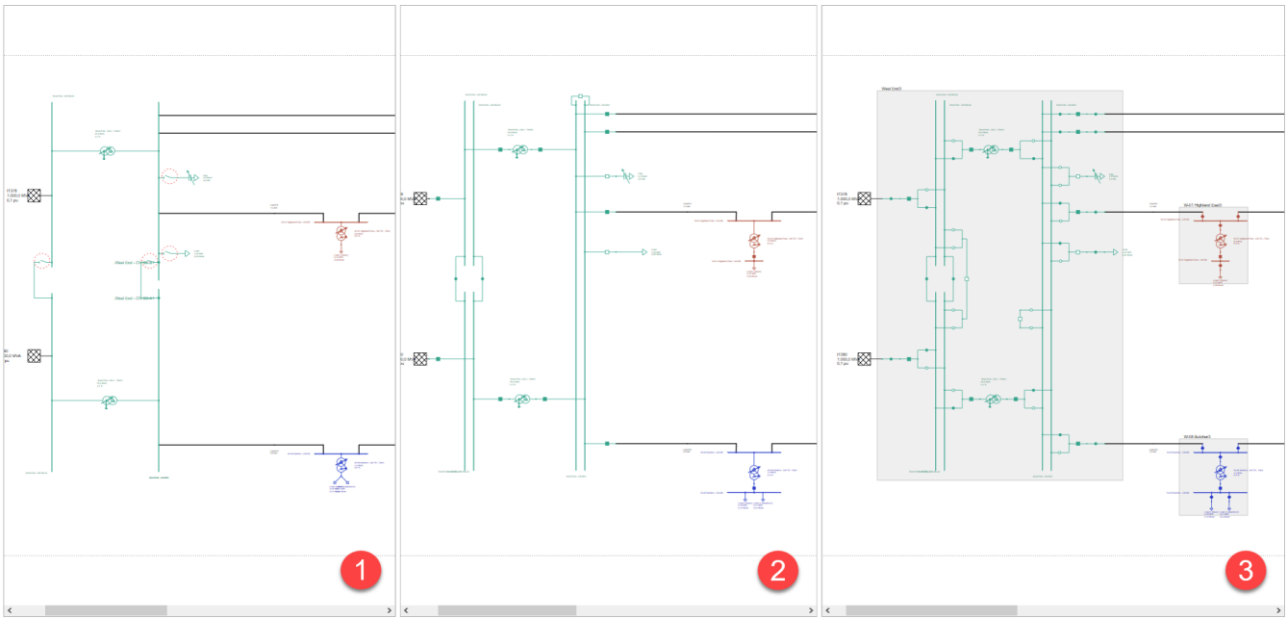
- Network Feeder
- Synchronous Machine
- Power Unit
- Converter

New Modeling of Switches

Addressing operational and protection aspects as well as the interfacing capabilities to the network models in geographical information systems (GIS) and SCADA systems increase the (required) modelling depth of planning models. PSS®SINCAL therefore adopts a more detailed modelling paradigm for switches (of different kinds) to support the model conversion, equipment identification and CIM conformity. This supports a use case adequate network modelling ranging from simplified bus-branch to complex bus-switch-branch ("node-breaker") representation of the power system.

The new switch is implemented as a branch element in PSS SINCAL to cover all modeling requirements. The previously used breaker as add-on element for network elements is no longer available and is replaced by the new switch.

The implementation supports and individual modeling depth depending on the use case and its required network model granularity.



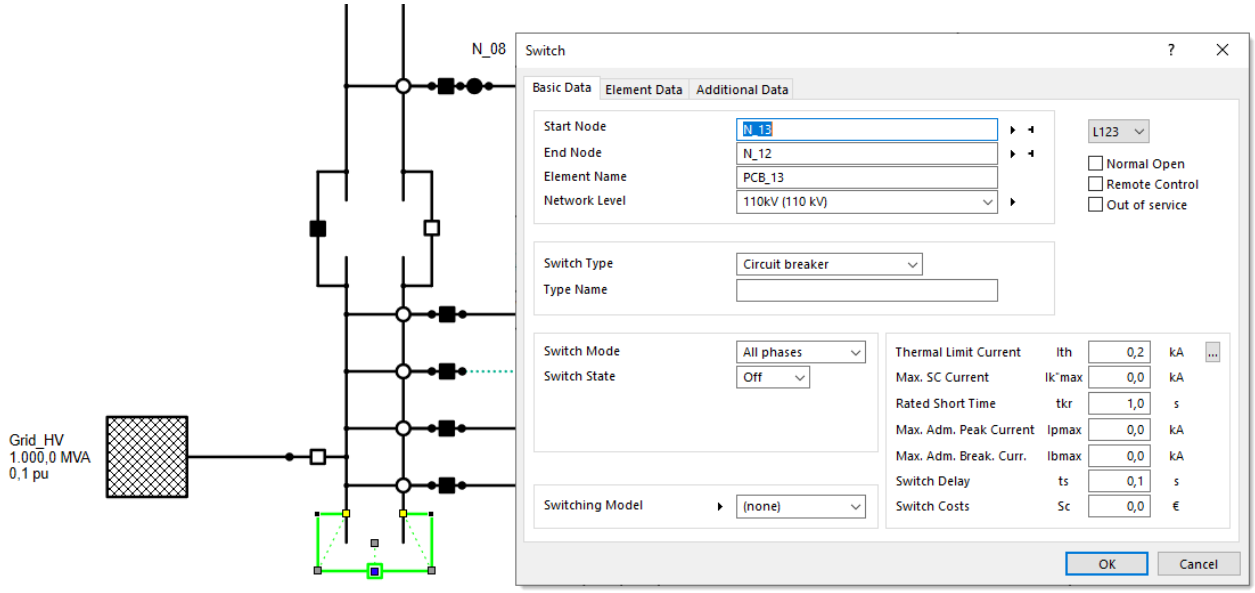
Network model #1 shows a modeling concept without the use of switches. The implicitly available connection capability of a terminal in PSS SINCAL allows each network element to be switched using its terminal(s). For conceptual studies in the network model in early planning phases, this approach is sufficient and can be applied without the detailed planning of substations and outgoing sections.

Network model #2 shows a hybrid modeling concept. Switches are placed in the network model where they are relevant for the respective calculation modules used, for example for the evaluation of the short-circuit current capability of switchgear (represented by e.g. only the circuit breaker), the persisted classification open points or the Optimal Branching (OT) module. The breakers are taken into account according to their topology and rated data (Ith, Ik"max, ...). This supports as well the design of the protection concept, since the positioning and number of circuit breakers can be used as an integral part of the network model.

Network model #3 shows the detailed modeling concept based on a detailed substation representation with all physical switches. This granularity represents the network with its equipment and is required for mapping networks for operations management with the highest level of detail. Network models with this level of detail are often kept in SCADA/DMS/ADMS systems or partly also in GIS systems. If no reduction of the network model (e.g. in #2) takes place during the transfer (e.g. via CIM) of this data, it can be directly used in this form for the planning use cases. At the same time, however, a network model of this granularity contains many representations of equipment that are not necessarily required for every planning task. It is therefore possible to model additional, future equipment with the level of detail #1 or #2 in a network model #3 and refine the modeling over time if required.

Implementation Concept

The new switch is implemented as a branch element. It has two terminals and is thus integrated into the network model.



A switch element has the same topology data as all branch elements. The two **Terminals**, the **Element Name** and the **Network Level** can be defined. As with all network elements, there is also the **Element Data** tab, where further topological assignments to **Network Area**, **Network Zone** and **Substation** can be made and also the **Establishment Date** and **Shutdown Date** can be defined.

In the **Basic Data**, the **Switch Type** is used to specify whether the switch is a circuit breaker, disconnector, disconnecting circuit breaker, switch disconnector or load breaker. The switch type is considered in calculation methods where applicable.

The most important information for the switch is the **Switch State**. It defines whether the switch is closed (switch state = on) or open (switch state = off). Depending on the selected switch mode, all phases can be switched in common mode or individually per phase.

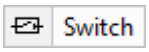
The other input data of the switch essentially contain only the rated data of the physical switch, such as thermal limit current and max. admissible short-circuit current.

The switch is modeled in the calculation modules as a connection without impedance. When all phases of a switch are closed, it is eliminated in the internal calculation model and the two nodes are combined. This ensures that switches do not have a negative impact on the calculation time and convergence.

The results for the switch are the same as for all other branch elements. I.e. from the power flow, currents, powers, utilization, etc. are provided in the tables "LFBranchResult" and "ULFBranchResult". In the case of a short circuit, the results are provided in the tables "SC3BranchResult", "SC2BranchResult" and "SC1BranchResult".

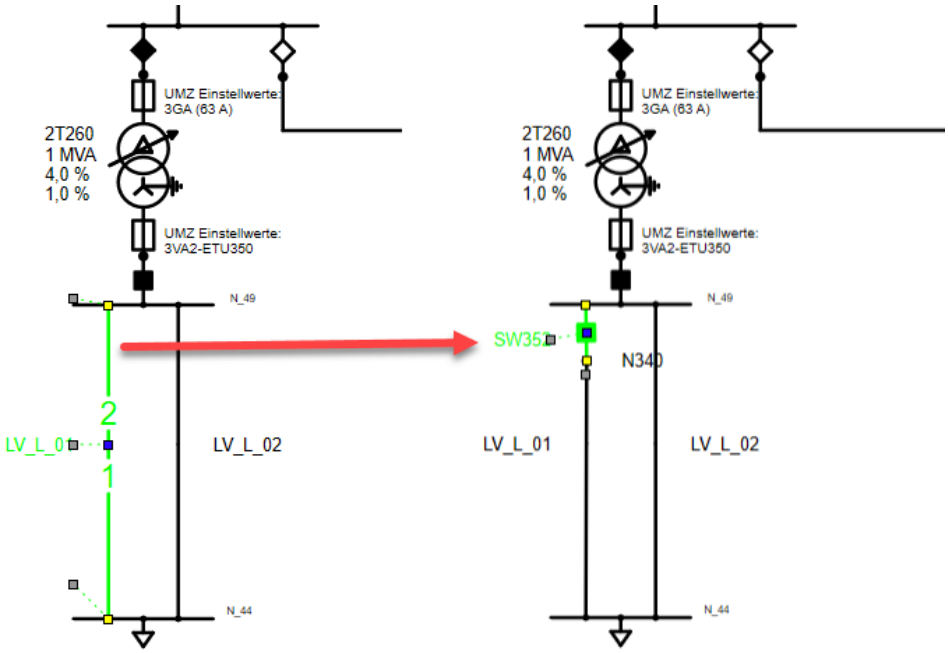
Inserting Switches

Inserting new switches in the network graphic is started from the Toolbox or from the menu **Insert** – **Branch Elements** – **Switch**.



The placement here is analogous to all other branch elements. I.e. start and end nodes are selected between which the switch is to be placed.

In addition, a function is available that can also be used to insert the new switch into existing network elements. The function can be started via the pop-up menu of the network elements with the menu item **Insert** – **Switch**. This will insert a switch in the network element and connect the originally selected network element to the end node of the switch:



In the case that a large number of switches have to be inserted in existing network elements in a network model, the insert mode **Insert Switch** (e.g. can be activated in the **Toolbox**) is also available.

Updating Existing Networks

When updating existing PSS SINCAL networks, existing breakers are replaced with the new switches automatically during the update process. Topological changes are made in these networks with the insertion of new nodes and switches. These changes may require adaptions of the graphics in the network models manually in some cases. Extensive testing has been performed in characteristic network models to ensure that the impact of this change is minimized, and no problems are caused.

If after updating the changes do not meet the expectations, the network models in the original version (see also Creating a network archive when updating networks) can be sent to the PSS SINCAL Platform Support (sincal.support.it@siemens.com) for analysis.

Changed License Check

The new switches increase the number of nodes in the networks. In order to take this circumstance into account during the license check and to avoid that networks can no longer be calculated for licenses with a reduced number of nodes, the number of switches is subtracted from the number of nodes actually present.

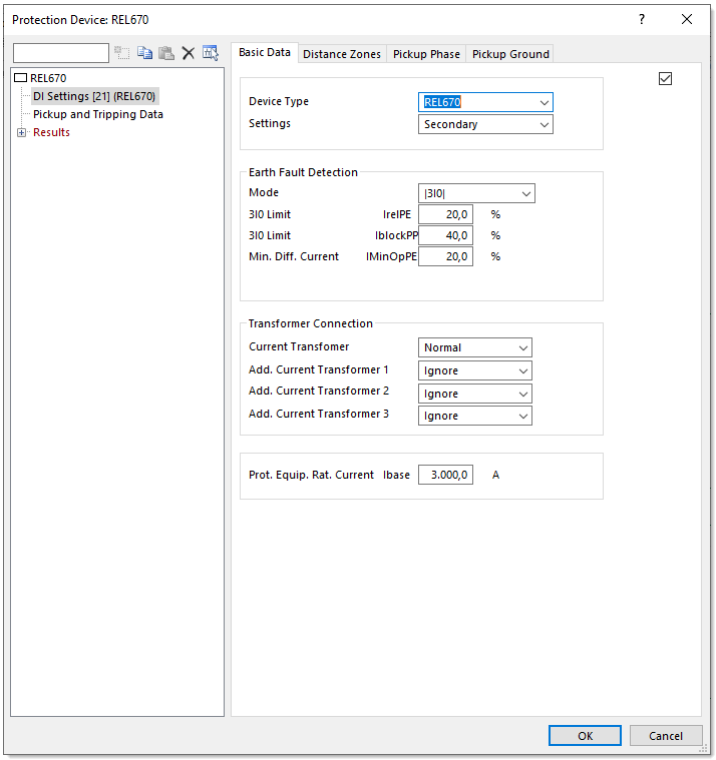
Protection Coordination (OC, SZ, DI)

Distance Protection

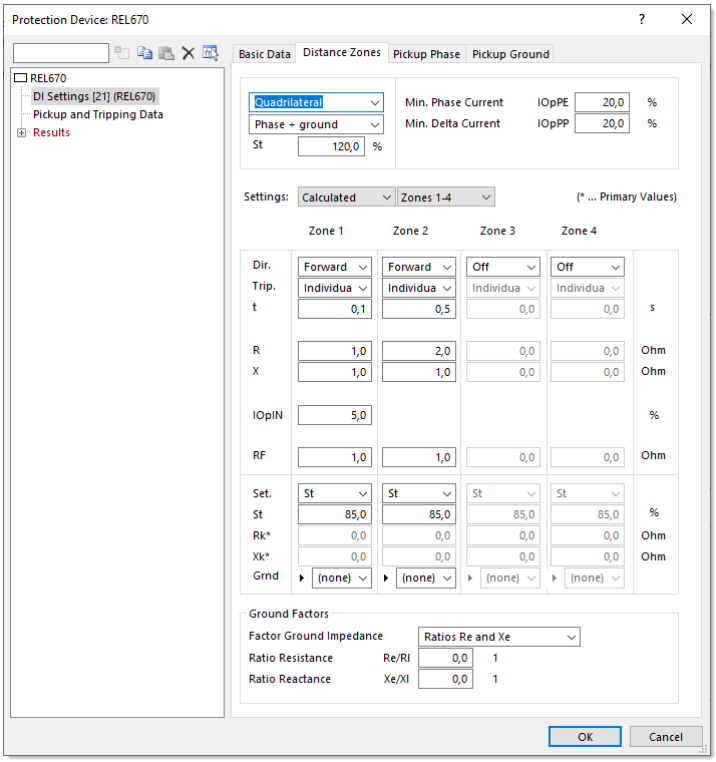
The distance protection has been significantly improved both functionally in terms of pickup and in terms of user-friendliness through simpler specification of the settings and comprehensive documentation.

In general, the distance protection devices are now integrated in the user interface in such a way that only those parameters are displayed that match the selected device type. This applies to the **Basic Data**, the **Distance Zones** as well as **Pickup Phase** and **Pickup Ground**.

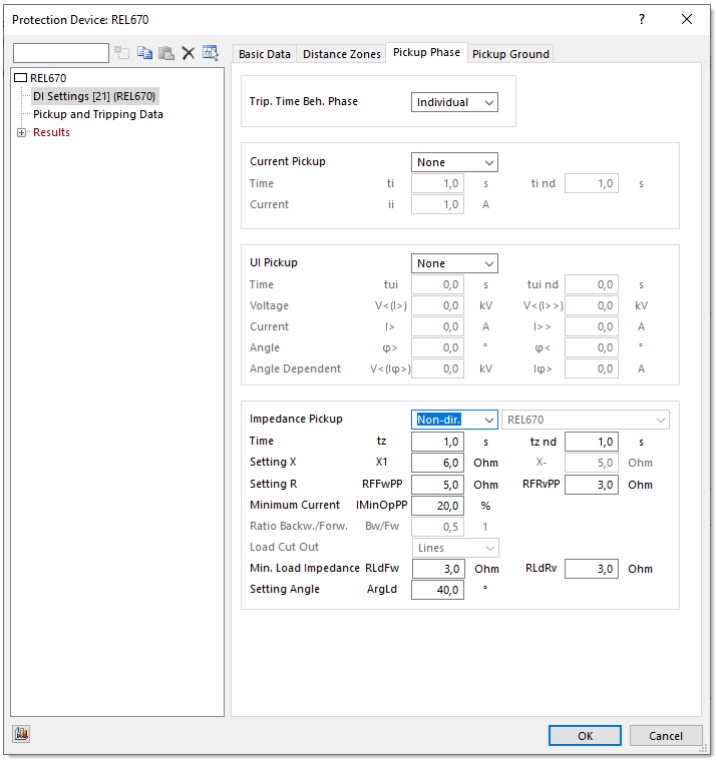
The following picture shows the data screen form of a distance protection device of type REL670. In the basic data, the parameters for **Earth Fault Detection** and also the Protection Equipment Rated Current are now displayed in accordance with the device type.



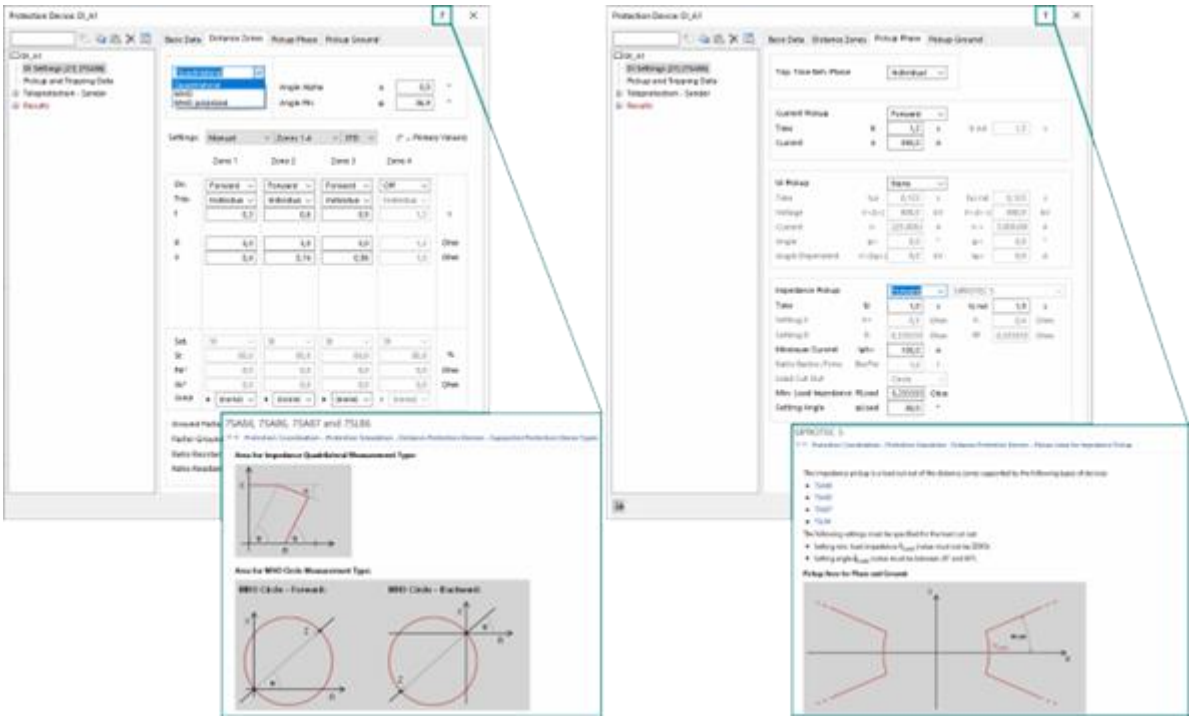
The zone settings of the distance protection devices have also been adapted. In the **Distance Zones** tab, only those parameters are now available that depend on the device type and the selected measurement type (here impedance quadrilateral).



The pickup has been extensively revised. Now an individual impedance pickup is available for all distance protection devices modeled in PSS SINCAL. The selection of the adequate impedance pickup is done automatically when assigning the device type. The correct names of the settings are also displayed to match the device type.



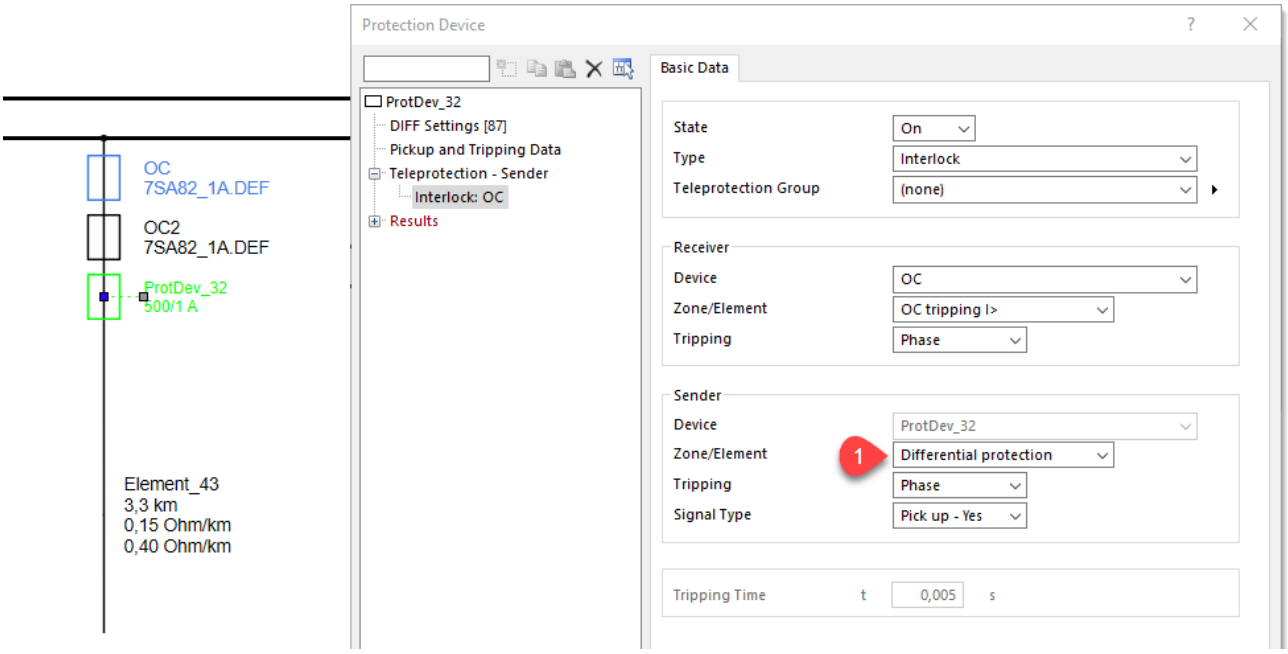
In addition, there is a device-specific description of the tripping areas and impedance pickup for each distance protection device. This makes the implementation available in PSS SINCAL for the respective device type much clearer and also facilitates correct parameterization of the devices.



Differential Protection

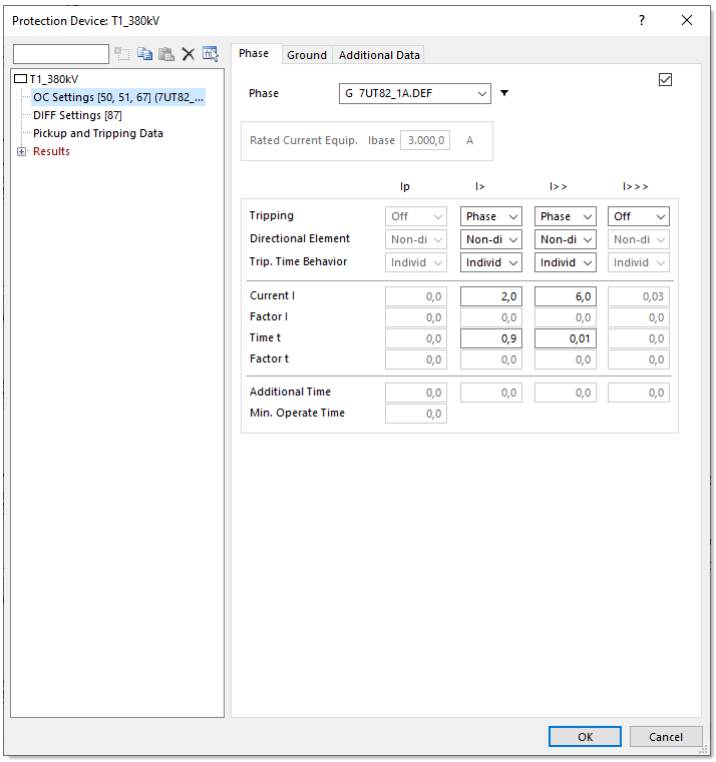
For protection concepts where the backup of the differential protection is a protection with a different principle, such as the overcurrent protection, and the network conditions do not allow a tuning, the tripping from the backup protection can be prevented by means of teleprotection.

This modeling is now also possible in PSS SINCAL. The differential protection can be used as a sender in the teleprotection (#1) to prevent tripping of a zone in the OC protection device, as shown in the following picture.



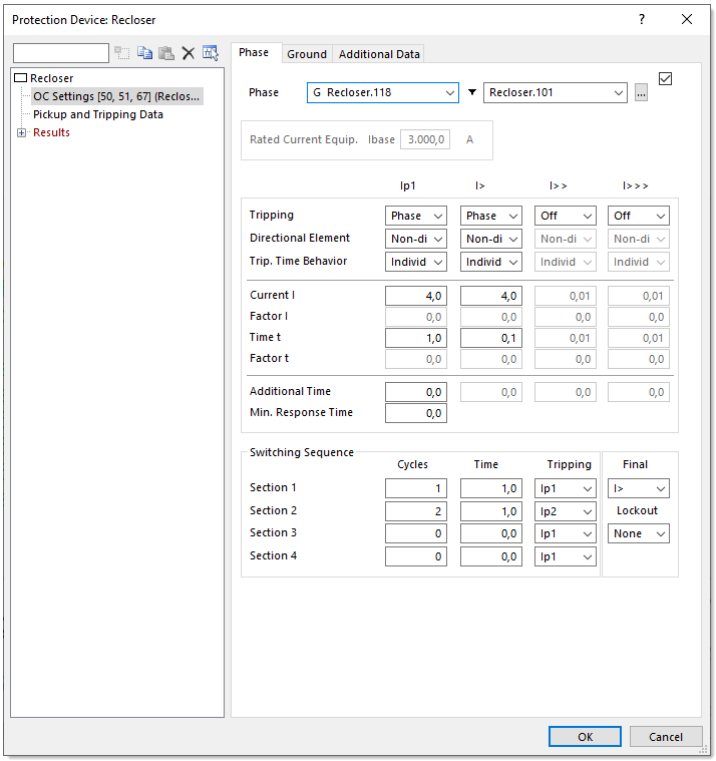
OC/IDMT Protection

The data screen form for OC/IDMT protection devices has been made clearer. Unnecessary parameters for the rated data and the I²t supplementary characteristic have been removed.



Recloser

A new data screen form is available for parameterization of the recloser. As with the OC/ IDMT protection devices, unnecessary parameters have been removed from the rated data and the I²t additional characteristic.



The implementation of the recloser in the protection simulation has also been extended. A switching sequence of the recloser that has been started (disconnection, pause time, reconnection) is now also run through if the fault is cleared by other protective devices during the switching sequence.

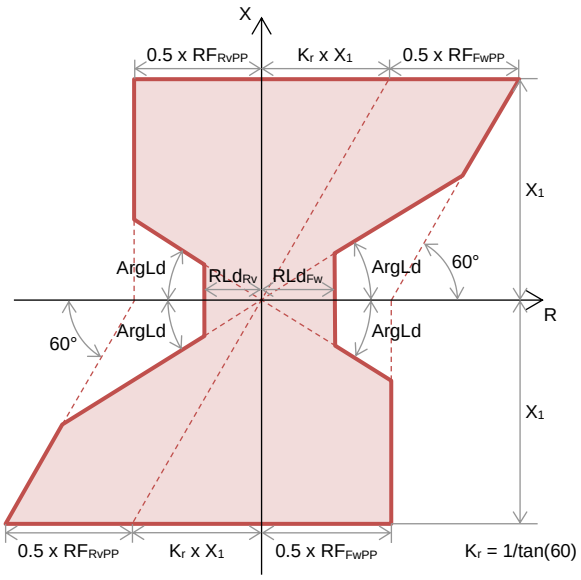
REL670 Protection Device

Impedance pickup has been implemented for the REL670 protection device. The shapes of area for the pickup depend on the type of fault. Accordingly, there are different shapes of area for phase-ground, phase-phase and three-phase faults.

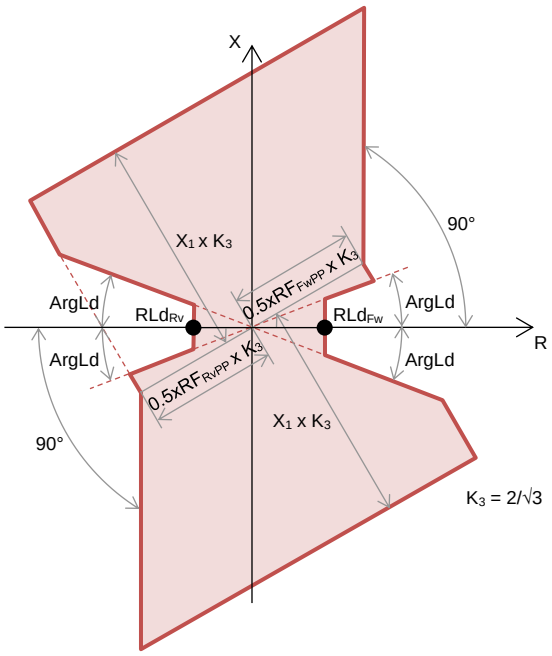
The impedance area and load cut out can be defined with the following settings:

- Setting X_1 (value must not be ZERO)
- Setting RF_{FwPP} for phase
- Setting RF_{RvPP} for phase
- Setting RF_{FwPE} for ground
- Setting RF_{RvPE} for ground
- Setting min. load impedance RLd_{Fw} (value must not be ZERO)
- Setting min. load impedance RLd_{Rv} (value must not be ZERO)
- Setting angle ArgLd (value must be between 0° and 90°)

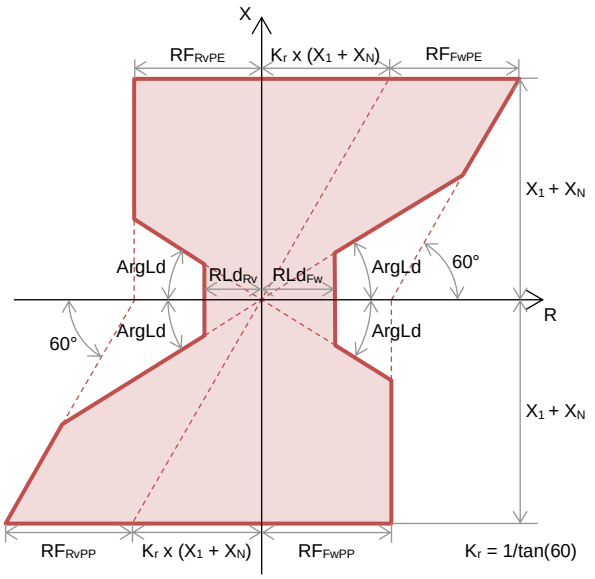
Pickup Area for Phase:



Pickup Area for the 3-Phase Fault: This special pickup area of the REL670 is used for 3-phase faults. Here the impedance pickup settings for phase in all directions are internally extended by a factor of 2/√(3) and at the same time the surface is rotated 30° counterclockwise.



Pickup Area for Ground: The data for the resistance RN and reactance XN are determined via ground impedance factors. If no assignment is made, the specifications of distance zones are used.



The consideration of the minimum tripping currents has also been extended. **IminOp$_{PP}$** and **IminOp$_{PE}$** must be specified as a percentage for this device type. The **Protection Equipment Rated Current Ibase** (in the settings for distance protection devices in the **Basic Data** tab) is used as the reference value. Loop-specific enabling of the impedance pickup requires that the following criteria are met:

For phase: $IminOp_{PP} < 2 \times IL_n$

For ground: $IminOp_{PE} < IL_n$

IL$_n$ ... RMS value of current in phase L$_n$

SIPROTEC4 Distance Protection Device

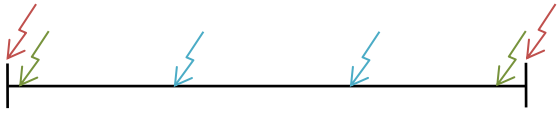
For the 7SA610, 7SA611, 7SA612, 7SA631 and 7SA632 SIPROTEC4 devices, the number of maximum possible zones has been increased from 4 to 6. In addition, a new X- setting has been added to the settings. This makes it possible to set the reactance range for X- in zones 5 and 6 separately.

Thermal Destruction Analysis (TDA)

In the operation of electrical transmission and distribution networks, the occurrence of faults can never be completely prevented. The task of the **Thermal Destruction Analysis** calculation module available in PSS SINCAL since 2022 is to check the effects of these faults in terms of destruction of equipment and to ensure continued operation of these elements after the fault has ended.

For this purpose, automatically generated faults are calculated in the network to identify all possible problems. The fault locations are thereby generated on lines and transformers according to a user-defined subdivision specification.

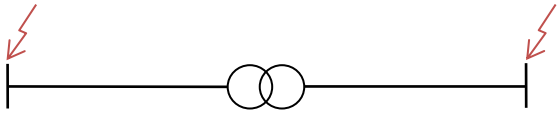
Lines



Generated fault locations:

- Fault at start node
- Fault shortly after the start node
- Fault according to subdivision specification (here 3 parts = 2 faults).
- Fault shortly before the end node
- Fault at end node

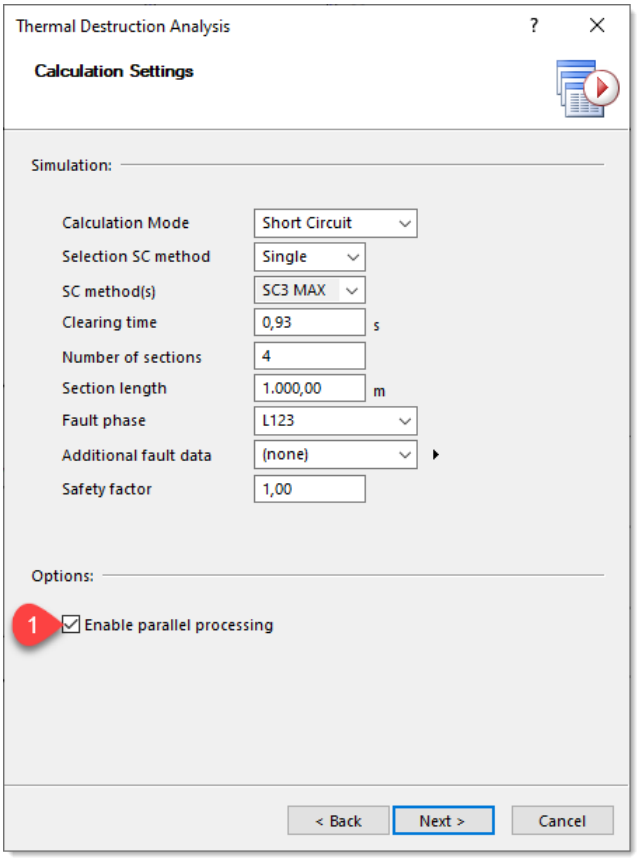
Transformers



Generated fault locations:
- Fault at start node
- Fault at end node

For each of these generated faults, the thermal load of the network elements is checked. Here, the maximum possible thermal resistance of the network element must be greater than the determined thermal load.

In large network models, depending on the selected subdivision specification, a very large number of different calculations must be performed. To reduce the calculation time and to better utilize current computer hardware, **Parallel Processing (#1)** can now be enabled in the module.

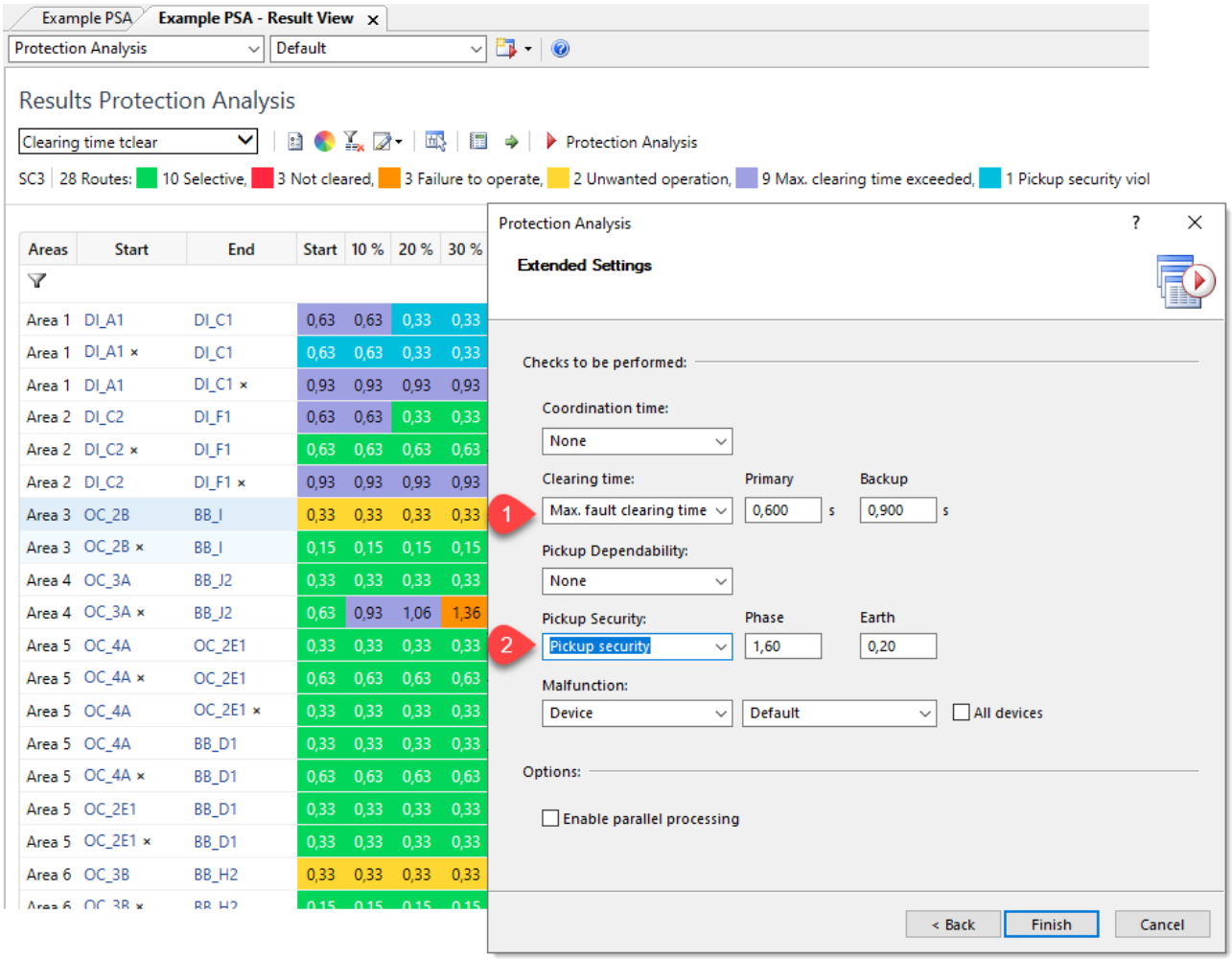


This automatically breaks down the calculation task into subtasks and distributes them to the computer's available calculation cores or those defined in the Options dialog box. The merging of the results also proceeds automatically.

Protection Analysis (PSA)

In the course of the revision of the result views, the one for the protection analysis was also redesigned. The usability of this result view benefits particularly from the simplifications, as a wide range of results and extensive evaluations are now available here and are even easier to access.

Also new in this calculation module is a separate state for checking the **Maximum fault clearing time (#1)** for primary and backup protection. Violations of the selected time specifications are checked and also visualized in the result view.



The check for **Pickup Security (#2)** has been extended. It is checked whether the maximum operating currents do not lead to a pickup when the specified factor is taken into account. The factor can now be specified separately for phase and ground and is taken into account accordingly in the calculation.

Pipe Networks

General Extensions

Heating

In PSS SINCAL district heating networks, it was previously not possible to define supply line or return line temperatures that were lower than the ambient temperature. This restriction has been removed and makes it possible to map heat gains by the ambient temperature.

Contingency Analysis (WCA, GCA, FCA)

In the contingency analysis, the maximum volume flow was only documented if it was greater than in the steady-state calculation. The result of the steady-state calculation is saved as a malfunction result to enable evaluation of the limit violations and maximum values in the steady-state network. In this way, it is possible to see which results are caused by malfunctions and which are already present in the basic state.

API (Programming Interfaces for Automation)

API of the User Interface

Diagrams

In PSS SINCAL, diagrams are defined by assigning signals and further objects such as labels, markers, etc.. This definition is usually done manually or with a wizard directly in the user interface.

For those use cases where many networks are generated automatically, diagram generation with automation functions is now available.

The following snippet shows the creation of voltage history diagrams with the subsequent addition of diagram objects.

```
print("\n--- Create Chart ---\n")

# Get the ChartManager for the active document
ChartMgr = SincalDoc.GetChartMgr()

# Create diagram pages for VoltageProfile
arNames = ["U-Grp1", "U-Grp2"]
Charts = ChartMgr.CreateDiagramPages("LF_VoltageCurve",
           r"\Power Flow\Voltage Curve (API)", arNames, "Voltage", "Overwrite")

# Add additional objects (marker) to the created chart pages
iCharts = len(Charts)
for i in range(0, iCharts):
    Chart = Charts[i]
    iSignal = Chart.GetSignalIndex(1, "Voltage [%]")
    Chart.SetProperty("Title", "Test")
    Marker = Chart.AddObject("Marker", "Umax", 1)
    Marker.SetProperty("Value", 99.1)
    Marker.SetProperty("ReferenceAxis", "Y")
    Marker = None
    Chart = None

print(f"Created {iCharts} charts!")
Charts = None
ChartMgr = None
return
```

This example is also available in the sample script "GuiAutoSincal.py" in the function DoChart(). The description of the new API functions can be found in the **Automation** manual in the following chapters:

- Automation in the User Interface – Diagram Manager Object
- Automation in the User Interface – Diagram Data Source Object
- Automation in the User Interface – Diagram Signal Object
- Automation in the User Interface – Diagram Page Object

Excel Import

The Excel import enables both the import and the extension and updating of network models with data from an Excel Worksheet. Previously, this import could only be used interactively in the PSS SINCAL user interface, but now it can also be used in the course of automation. This means that, in combination with other automation functions of the PSS SINCAL Platform, complex workflows can now also be mapped, such as the creation of the network database with subsequent import of the network and graphics data from Excel.

The following snippet shows the usage of the import function. It performs various imports with XLS files and XML configuration files from a directory:

```
# Open the newly created SINCAL network model
SincalDoc = SincalApp.OpenDocument(strSINFile)
if SincalDoc == None:
    print("Error: Opening SINCAL network model failed!")
    CleanupAndQuit()

# Import all excel files with their configurations
arExcelFile = glob(strDirExcelFiles + fr"\{strUseCase}*.xlsx")
arExcelFile.sort()

for strExcelFile in arExcelFile:
    iExtension = strExcelFile.rfind(".xls")
    strConfigFile = strExcelFile[:iExtension] + ".xml"

    if os.path.exists(strConfigFile):
        ## Additional excel import parameters can be set with SincalDoc.Parameter("Excel.")
        SincalDoc.ImportExcel(strExcelFile, strConfigFile)

# Import workspace
strWorkspace = strDirExcelFiles + fr"\{strUseCase}workspace.xml"
if os.path.exists(strWorkspace):
    SincalApp.ImportWorkspace(strWorkspace)
```

The snippet is an excerpt from the new automation example "ImportExcel.py", which is delivered with PSS SINCAL.

Join Lines

The new API function **JoinLines()** is available for combining lines. This is used to join selected lines in the graphics editor to form a new line. Also new here is the **SelectRoute()** function, which can be used to select a route between two selected network elements or nodes.

```
# Join Lines (Route from ID 1 to 10)
SincalDoc.SelectRoute("Line", 1, "Line", 10)

arErrors = SincalDoc.JoinLines(0)       # 0 ... Check only
print(arErrors)

arErrors = SincalDoc.JoinLines(1)       # 1 ... Join lines, ignore any warnings, abort on errors
```

Print to File

The functionality for printing has been extended. Now, when printing to a file (e.g. PDF printer driver), the output file can be defined directly in the script. This means that the **Save As** dialog box is no longer displayed when printing. For this purpose, the new document property **PrintFile** is available, with which the output file can be defined.

```
# Define output file for print
SincalDoc.PrintFile = r"c:\temp\print1.pdf"
```

```
strFile = SincalDoc.PrintFile
print(f"Print output to {strFile}")

# Print area of network diagram defined by coordinates
SincalDoc.PrintFile = r"c:\temp\print2.pdf"
SincalDoc.PrintArea(0.0, 0.0, 0.523750, 0.41350)
SincalDoc.PrintDiagram()
```

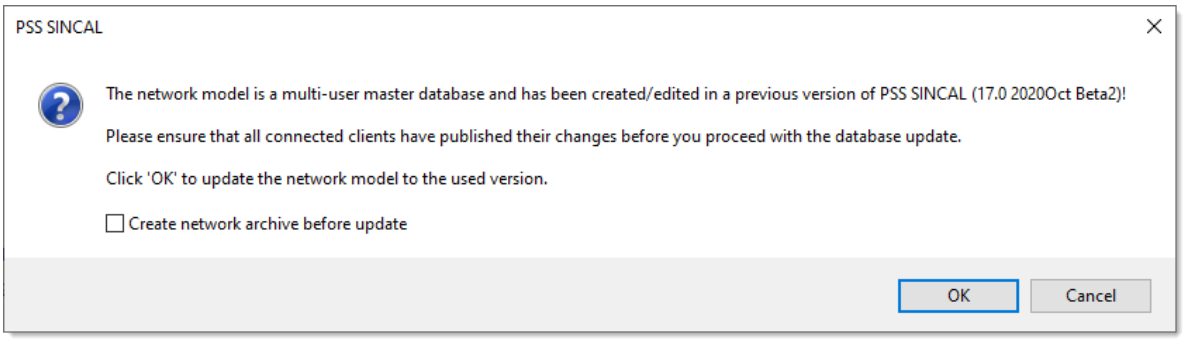
Multi-User Master Database

Functional Extensions

Advanced Version Management

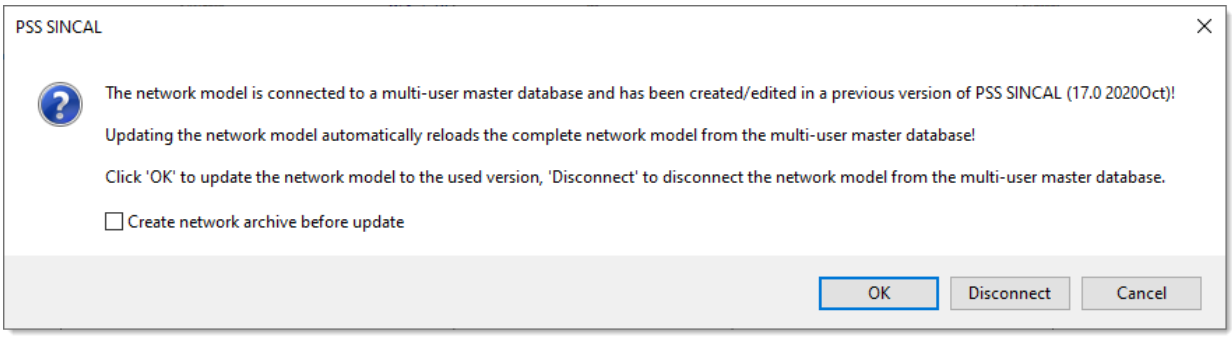
In order to use the multi-user master database, the database versions of the master database and client databases must match. To avoid possible application errors, the version management has been extended and additional messages are now also displayed in case of problems.

When opening a master database from an older product version, the following message is now displayed before updating the database:



Clicking **OK** will update the database. All client databases must then also be updated if the master database is to be used.

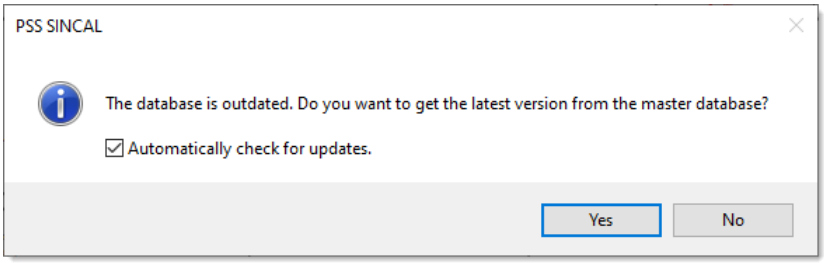
When opening an older client database, the following message is displayed:



Here you have the possibility to update the client database by clicking **OK** or to disconnect it from the master database by clicking **Disconnect**. Then the client database is converted into a normal PSS SINCAL network.

Advanced Publishing of Changes

Publishing changes (**File** – **Multi-User Master Database** – **Publish**) in the client database has been enhanced. If the option to automatically check for updates is active, then a check is made to see if there are any changes in the master database before publishing the changes. If this is the case, it will be displayed in a message box.

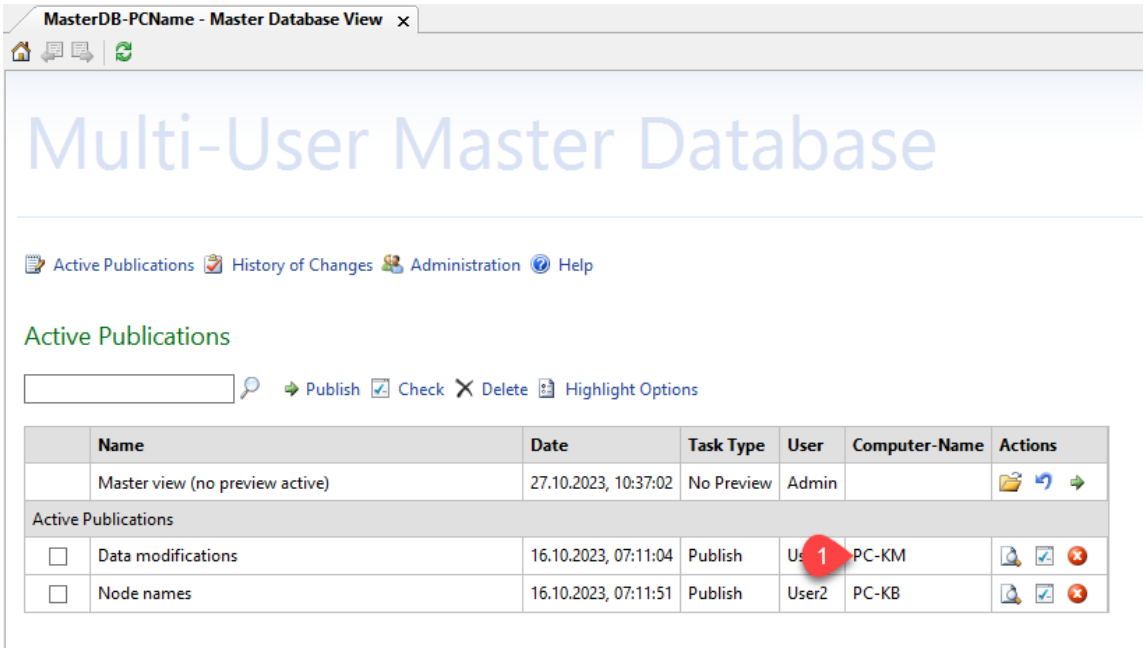


The changes in the master database can be applied to the client database simply by clicking **Yes**. After that, the changes will be published from the client database.

Administrative Extensions

Computer Name in Master Database

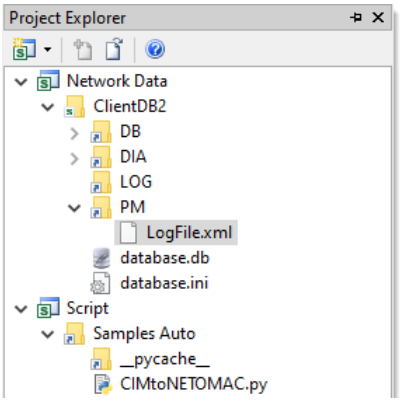
All connected client databases are managed in the master database. In addition to the user name, the name of the client computer is now also stored and displayed here (#1). This is to simplify administration in environments where there are very many users with many PCs.



Advanced Logging

For the multi-user master database, extended logging is available in the form of an XML file "LogFile.xml". This XML file is generated for all actions in the master database and in the client database and contains extended information about the last executed action.

The "LogFile.xml" file is generated in the "PM" directory of the network model:



This XML file can be evaluated by external programs if required, but can also be visualized directly in the PSS SINCAL user interface in the result view: