

## Project Combination and Connection Example

### 0 – Introduction

Project combination and connection was introduced in PowerFactory version 2017.

It is a two-stage process, the first step is to combine two or more projects into one, using the *Project Combination Assistant*, and the second step is the connection of the separate networks, using the *Project Connection Assistant* (alternatively this second step can be carried out entirely manually by the user). There are two methods for connecting the network: the foreign key and the virtual node method.

In addition, there is an option to normalise the structure of the project after a combination.

### 1 – Combination

First import the projects:

- *Proj Comb – Sub1 – ForeignKey* and *Proj Comb – Sub4 – ForeignKey* for the foreign key method
- or *Proj Comb – Sub1 – VirtualNode* and *Proj Comb – Sub4 – VirtualNode* for the virtual node method

Do not activate either of them, as a new project is going to be created. These are subnets from the example *MV Distribution Network*, see also Figure 1. Make sure that a *Version* of each subnet with the name *CombVersion* exists.

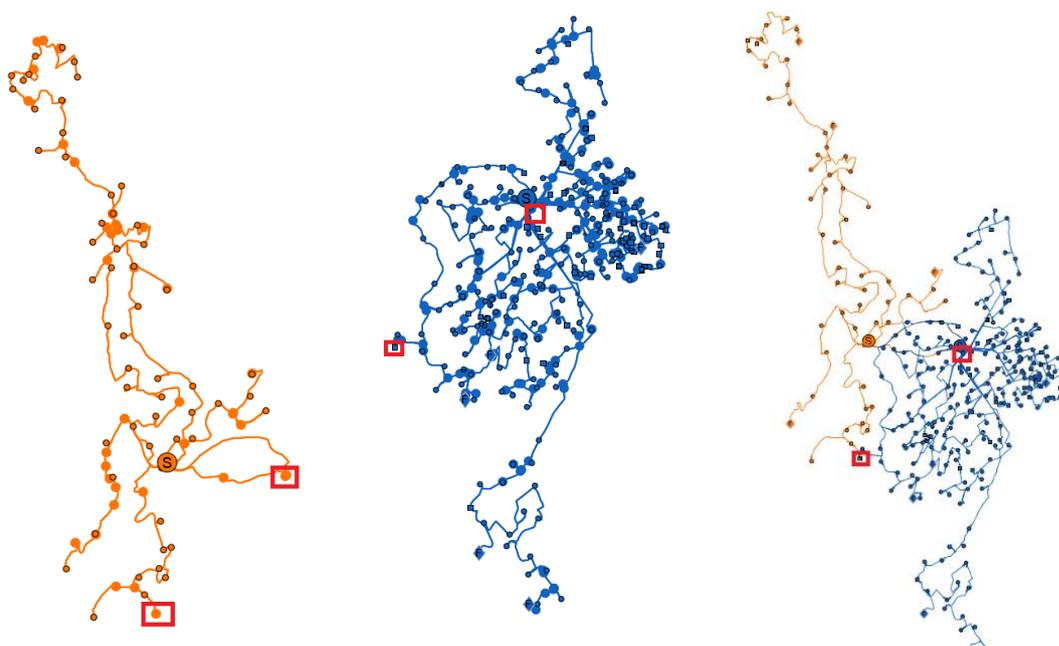
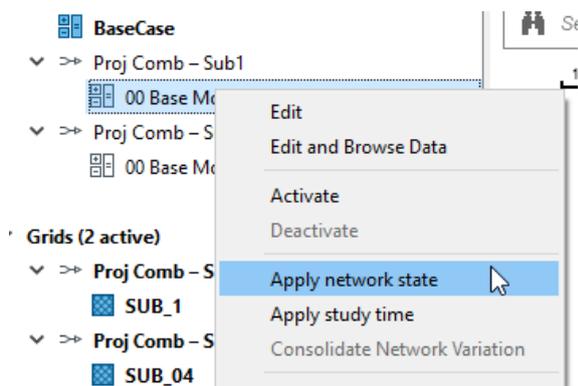


Figure 1: subnet 4 (left), subnet 1 (middle) and combined network (right) with linking points in red

Select the *Additional Tools* toolbar and click on the *Project Combination Assistant* icon .

In the dialog box that comes up, use the *Add project* button to add the two projects. A version inside each project must be selected; in our example it is *CombVersion* in both cases. Then execute the command. This combines the project into a new project, and activates it.

Before moving to the connection step, a common study case has to be created and the grids need to be activated. Create a new study case by expanding the study cases folders, right-click on one study case, and select *Apply network state*.



**Figure 2: Select *Apply network state***

Repeat with the other study case. It is not essential to *Apply network state* for more than one study case, but it will ensure that all grids are active. Ensure within the project overview that all grids are active. Note that the new study case will have default study case settings, which may need adapting.

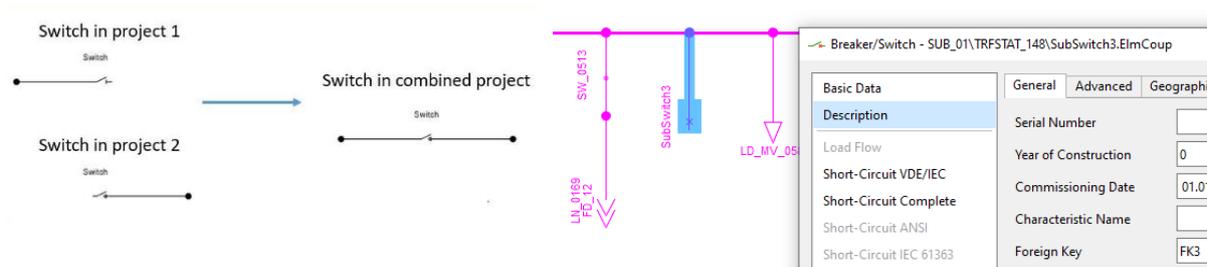
## **2 – Connection**

### **2.1 – Connection via *foreign key* method**

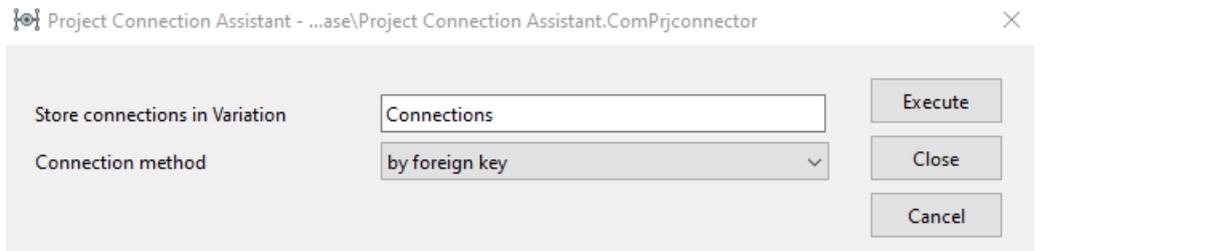
After the combination of the projects, they can be connected via a tool. From the *Additional Tools* toolbar select the *Project Connection Assistant* . Select the connection method *by foreign key*.

Both subnets have switches at the desired connection points, which are only connected on one side. The other side remains unconnected to anything. The connection process identifies such switches and pairs them up using their identical foreign keys. Figure 3 shows an example.

Note that the preparatory measures like adding the switches, setting of the foreign keys and the preparation of a *Version* were already done for these example subnets. For other projects this have to be done by your own.



**Figure 3: One side connected switch and foreign key setting**

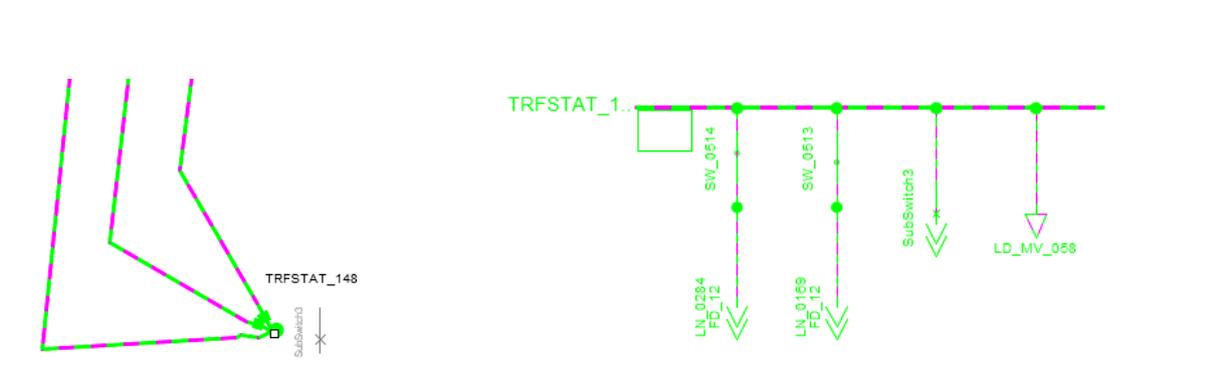


**Figure 4: Running *Project Connection Assistant* by foreign key method**

A report appears showing the connections that have been made, see Figure 5. Open one of the grid diagrams by using e.g. the *Graphic Board*. The networks are now connected by a switch. Figure 6 shows one of the connecting points after the networks have been connected via switches. As you can see, the colour changes due to the connection in green and pink stripes. The switch *SubSwitch3* shows now a link to the other node.

Elements	Terminal i	Network	Terminal j	Network	State
SubSwitch3	ND_0273	SUB_01	ND_0272	SUB_04	connected
SubSwitch1	ND_0277	SUB_01	ND_0276	SUB_04	connected
SubSwitch2	ND_0280	SUB_01	ND_0279	SUB_04	connected

**Figure 5: Switch connections due to the foreign key method**

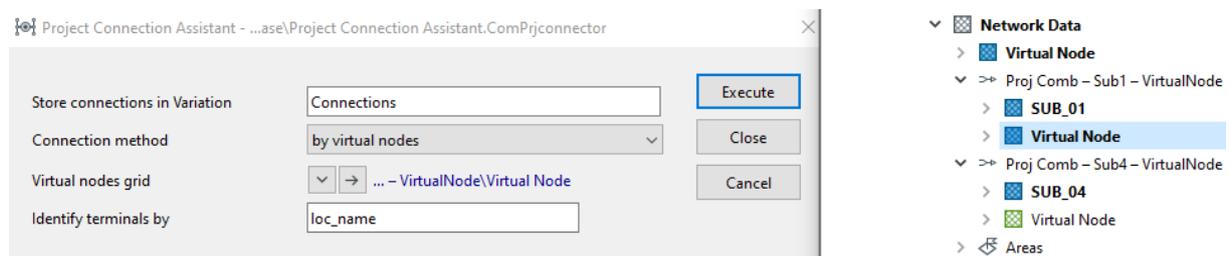


**Figure 6: Example of the end result of the process: out (left) and inside (right) the substation**

As you can see on the left side of Figure 6, one of the switches are still in the diagram. Note that at each connection point one of the two switches have to be deleted manually. In general, whenever projects are combined it is important to ensure that any redundant elements (such as external grids or loads representing the other network) are removed either before or after the networks are joined.

## **2.2 – Connection via *virtual node* method**

After the combination of the projects, they can be connected via a tool. From the *Additional Tools* toolbar select the *Project Connection Assistant* . Select the connection method *by virtual node* and select one of the 'Virtual Node' grids – it doesn't matter which (see Figure 7).



**Figure 7: Running *Project Connection Assistant* by *virtual node* method**

The nodes to connect must have the same names (e.g. 'ND\_0273', 'ND\_0277' and 'ND\_280' as in the example) in each network and in order to prepare for connection they must be moved into separate grids. These must also be given the same name (e.g. 'Virtual Node' as in the example) in each network. As result, a new border grid is created and the two networks are joined through new border terminals.

Existing graphics can be activated and viewed but note that at the two border points the graphics are still referring to the (now deactivated) old border terminals, so would need updating. Note, that the subnets are connected by default, so in case of a tie open point the switch have to be switched off.

## **3 – Normalize**

After combination, the project has a special structure (combined project source folders in the project structure). This can be changed by normalisation. Deactivate the project. Go into the *Data Manager* and go into the setting dialog of the project with right click and *Edit*. Navigate to the section with the name *Combined Project*. Here you should see the included projects. Click *Normalise* and you will see, the projects disappear.

Activate the project. The structure should no be like in other projects but maybe with some duplicate and unnecessary entries. If these are really unnecessary depends on the use case. In our example you can delete the non-activated two study cases since they do not contain any special information.