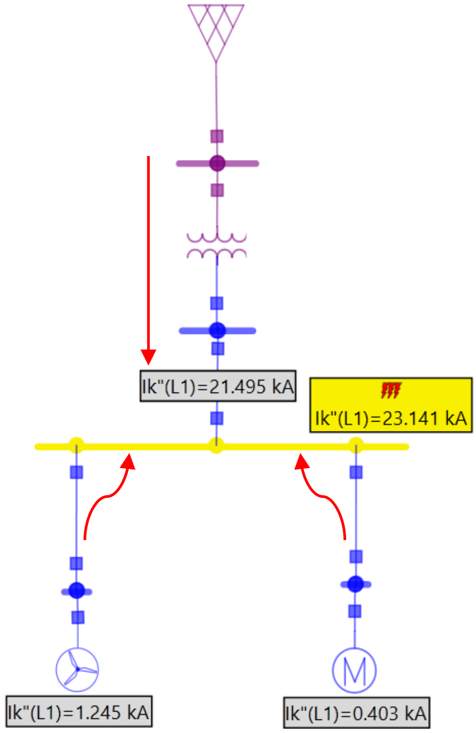
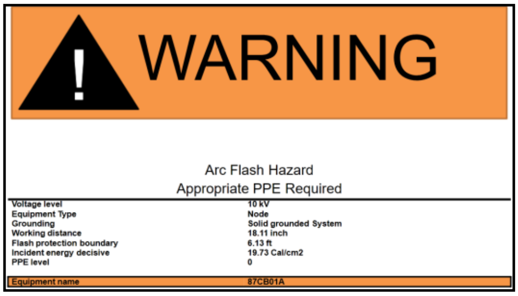
Short Circuit Analysis

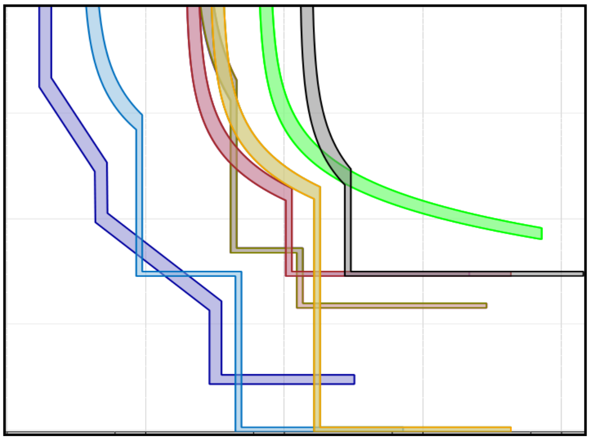
Short circuit calculations is used to define the sizing of the installation (equipment rating), location, sizing and co-ordination of protection devices. This module performs single-, two- (with and without earth connection) and three-phase faults on symmetrical as well as unsymmetrical AC and DC networks. Faults on busbars as well as on lines with user defined fault distance can be computed. NEPLAN provides an option to simulate special faults such as double earth faults, faults between two voltage levels, conductor opening, etc.



- Short circuit equipment rating
- Contribution from Static converter & adjustable frequency drive



- Arc flash evaluation using short circuit results



- Relay co-ordination using short circuit results

Why Short Circuit Analysis?

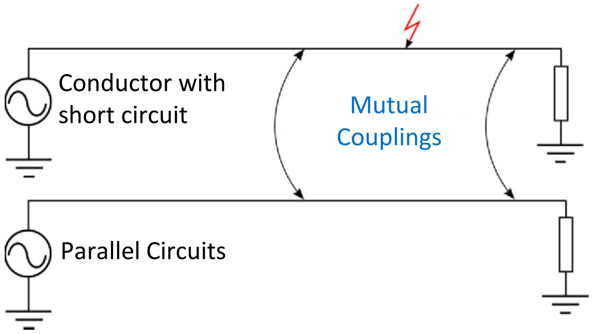
- If unusual high currents exceed the capability of an equipment, it can result in a large release of energy in the form of heat which could eventually lead to explosion
- Short Circuit calculations are necessary to properly select the type, interrupting rating and tripping characteristics of protection devices
- To determine the currents that flow in a power system under fault conditions
- To determine both the switchgear ratings and the relay settings
- The results of Short Circuit Analysis are used to selectively co-ordinate protection devices

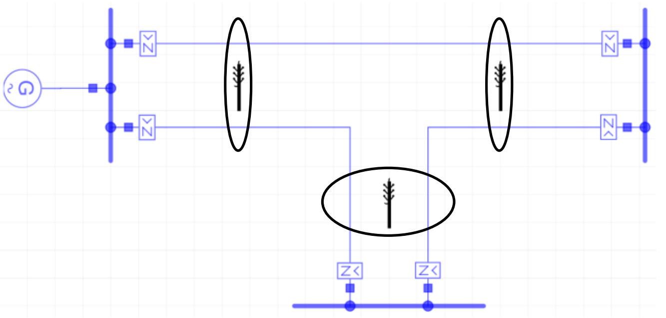
Benefits of Short Circuit Analysis

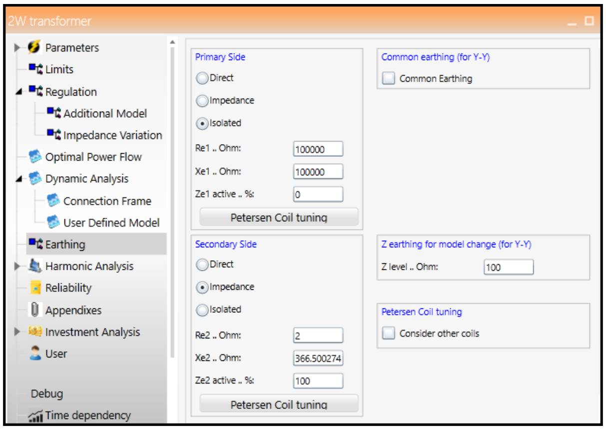
- Helps avoid unplanned outages and downtime
- Critical for avoiding interruptions of essential services
- Reduces risk of equipment damage and fires
- Increases safety and protects people from injuries
- Determines the level and type of protection devices that are needed
- Reduces the risk a facility could face and helps avoid catastrophic losses
- Increases the safety and reliability of the power system and related equipment

General Characteristics

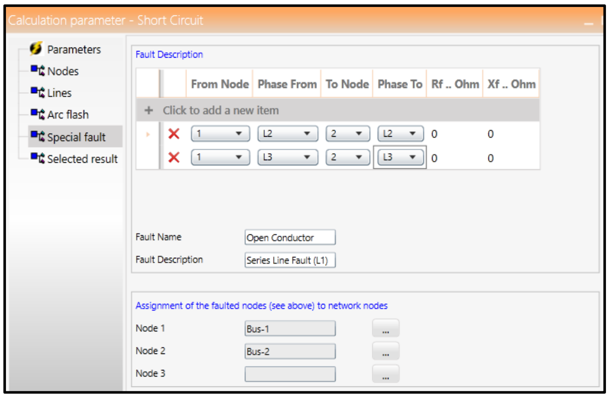
- Fault calculation according to the following standards:
  - IEC 60909:2016 / VDE 0102:2016
  - IEC 60909:2001 / VDE 0102:2002
  - IEC 909:1998 / VDE 0102:1.90
  - ANSI/IEEE C37.010
  - ANSI/IEEE C37.013
  - G74 Engineering Recommendation
  - IEC 61363-1 for off-shore/ship plants
  - IEC 61660 for DC networks
- Superposition method with consideration of pre-fault voltage from load flow
- Accurate model for transformer earthing connection
- Earthing system for common earthing of any number of transformers, generators, etc.
- Peterson coil tuning in resonance earthed networks
- Current limiting due to circuit breaker and MOV
- Transformer phase shift
- Correction factor for transformers in parallel with different Un/Ur ratio
- IEC + superposition method for calculation of voltages in order to have right settings of distance relays
- Consideration of arc impedances







- Peterson coil tuning for transformer



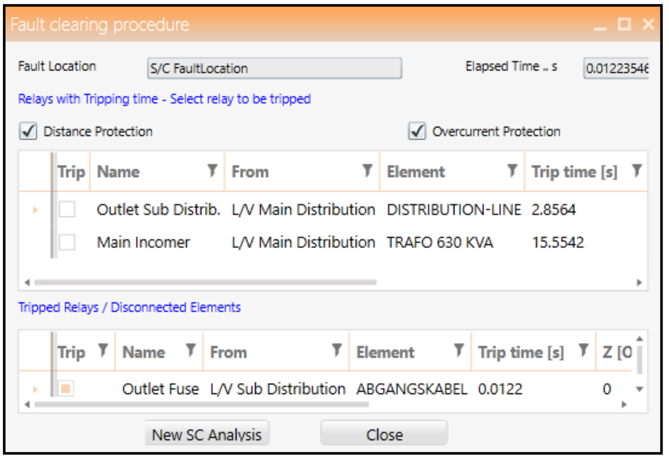
- Simulation of special (user-defined) faults such as:
  - Double earth fault
  - Open conductor fault, etc.

Line Coupling

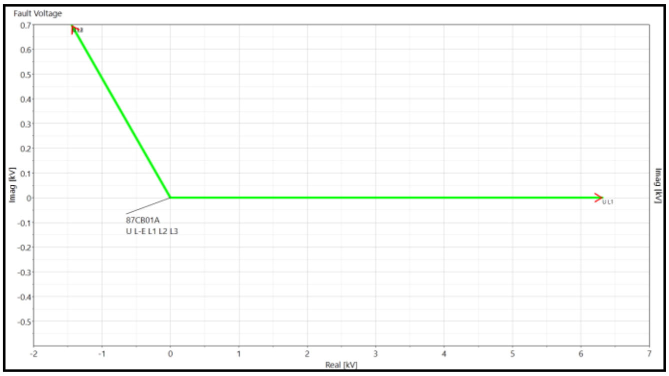
- Mutual impedances and capacitances in the positive and zero sequence systems can be computed using line coupling element
- Circuit and coupling parameters of the overhead lines are computed from the conductor configuration
- Overhead lines with up to six 3-phase systems and three earth wires can be computed (earthing of 3-phase systems considered)
- Unrestricted number of overhead lines can be entered
- Parameters and conductor configuration are saved in the database

Results

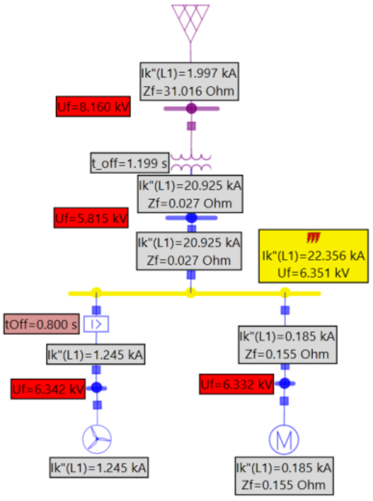
- Key short-circuit results:
  - Initial symmetrical short-circuit current Ik” and power Sk”
  - Peak current ip
  - Breaking current Ib
  - R/X ratio
  - Fault Voltage Ule
- Computation of minimum and maximum short-circuit current
- Thermal and asymmetrical breaking currents, plus DC component
- Calculation of relay tripping time for overcurrent and distance protection
- Contribution of adjustable frequency drives ands static converters to short-circuit currents
- Fault flow calculation (currents and voltages in the whole network) for a single fault location
- Overloaded equipment (current transformer, voltage transformer, circuit-breaker, etc.) are highlighted
- Phase values as well as symmetrical components are available for shot-circuit currents and impedances
- Short-currents and voltage can be plotted as vectors on the chart
- Fault current direction



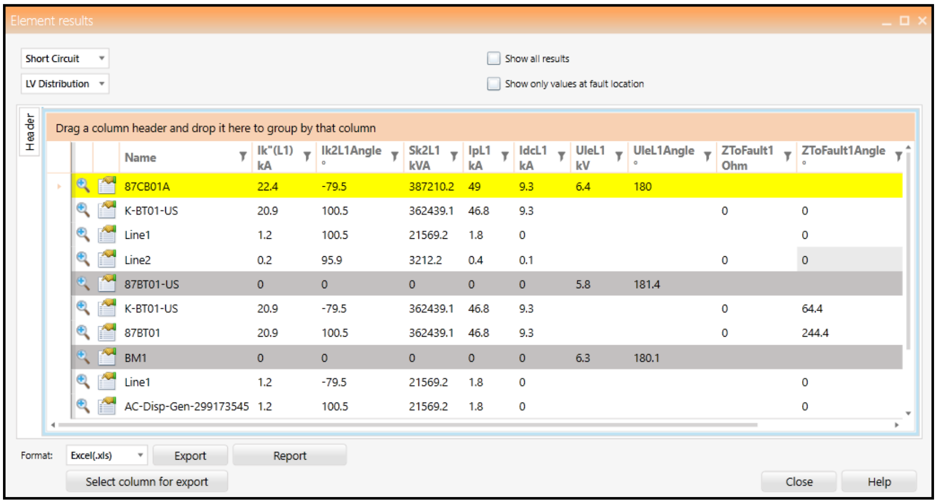
- Fault clearing procedure for tripped relays



- Phasor representation of the short circuit results



- Graphical representation of results



- Short circuit results for faulted node and fault contribution from the rest of the network