

SAARC Training Workshop 'Power System Studies for Synchronization of Multiple Systems'

Fault Current Calculations In PSSE Using IEC 909

Day-2-G

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PSSE FUNCTIONS

- ASCC – basic AC RMS fault calculations
 - 3 phase and Single phase to ground only
 - Uses ZPOS, ZNEG and ZZERO generator data
 - No DC component
 - No AC decrement
 - Have to change generator data for different time studies

PSSE FUNCTIONS

- SCMU – more advanced version of ASCC
 - Handles any fault type, and multiple faults
 - Same restrictions as ASCC
 - Not normally needed for a 'fault survey' but useful for checking 2 phase faults

RUNNING ASCC 1

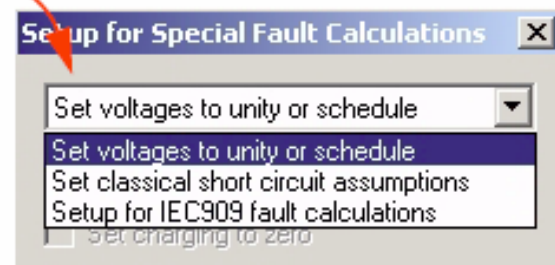
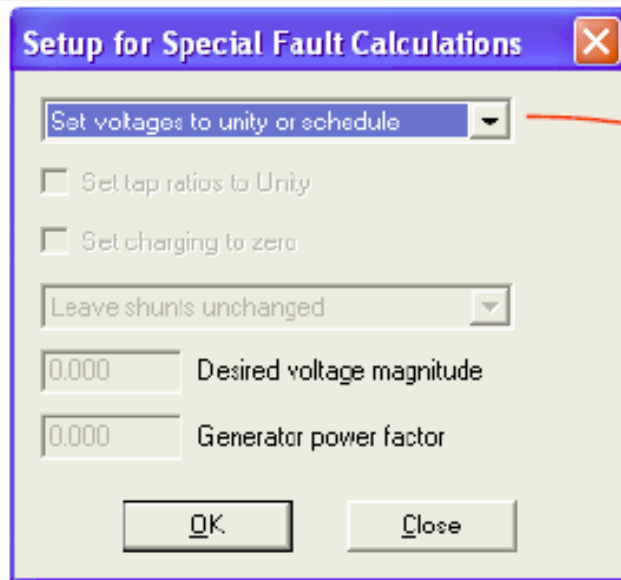
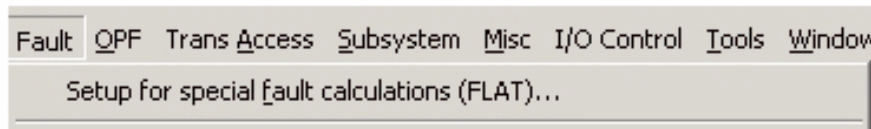
- Load the required loadflow case
- Misc. Menu – check a couple of settings
 - Change program settings (OPTN) – check that :
 - Short circuit output = Physical
 - Short circuit co-ordinates = Polar
- Fault Menu
 - Setup network for unbalanced solution (SEQD)
 - Click Go
 - Automatic sequence fault calculation (ASCC)
 - Choose Line to Ground faults if required
 - Choose outputs required and detail of reporting
 - Fault Current Summary Table is the briefest
 - Full Output at Home Level , summary at N levels with N=0 is a useful level of detail

RUNNING ASCC 2

- Output should appear in a report window and can be copied to a text file
- Can re-direct to a file (I/O Control menu – Direct Report Output (OPEN) – do this BEFORE you run ASCC)
- More advanced features :
 - FLAT (in the Fault menu) allows you to impose classical fault conditions (no load, nominal voltages, unity taps on transformers etc)
 - FLAT also allows some settings from IEC 909 to be applied but this is far from comprehensive
 - In ASCC only a FLAT study gives the correct Thevenin impedance and X/R ratio at a faulted busbar (longstanding bug in PSSE)

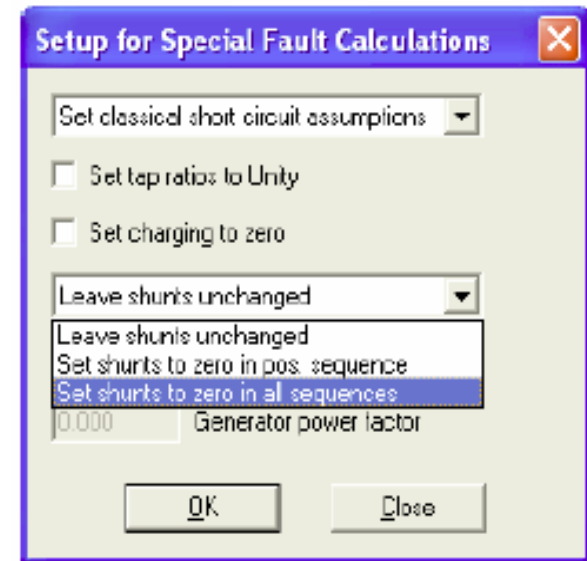
Special Condition: Set voltages to unity or schedule

- Leaves network voltages as established in the power flow case, or
- Set all bus voltages to one per unit at zero phase angle



Special Condition: Set classical short circuit assumptions

- All bus voltages are set to one per unit at zero phase angle
- Constant power, current and admittance loads are set to zero
- Generator power outputs are set to zero
- FACTS devices and DC lines are removed
- Transformer phase shift angles are set to zero. Any transformer impedance, which is a function of phase shift angle is set to its nominal value
- Optionally, all transformer turns ratios are set to one
- Optionally, line charging is set to zero (all three sequences)
- Optionally, shunt elements, including magnetizing admittances of transformers, are set to zero



Special Condition: Set for IEC909 fault calculations

- Voltage magnitudes are either left at their present values or are all set to a specified magnitude; phase angles are all set to zero
- Constant power, current, and admittance loads are set to zero
- Any machine whose active power is zero or negative has its active and reactive power outputs set to zero. All machines whose active power outputs are positive have their reactive power outputs either left unchanged or set such that a specified power factor is maintained.
- FACTS devices and DC lines are removed.
- Transformer phase shift angles are set to zero. Any transformer impedance, which is a function of phase shift angle, is set to its nominal value.

Special Condition: Set for IEC909 fault calculations

- Optionally, *all* transformer turns ratios are set to one.
- Optionally, shunt elements, including magnetizing admittances of transformers, are set to zero. The user may elect to have fixed bus shunts and line connected shunts zeroed in only the positive sequence network or in all three sequences; switched shunts are zeroed in all three sequence networks
- Optionally select a voltage magnitude or leave voltages as in the power flow case.
- Optionally select a generator power factor or leave generator MVAR unchanged.

Special Condition: Set for IEC909 fault calculations-cont'd

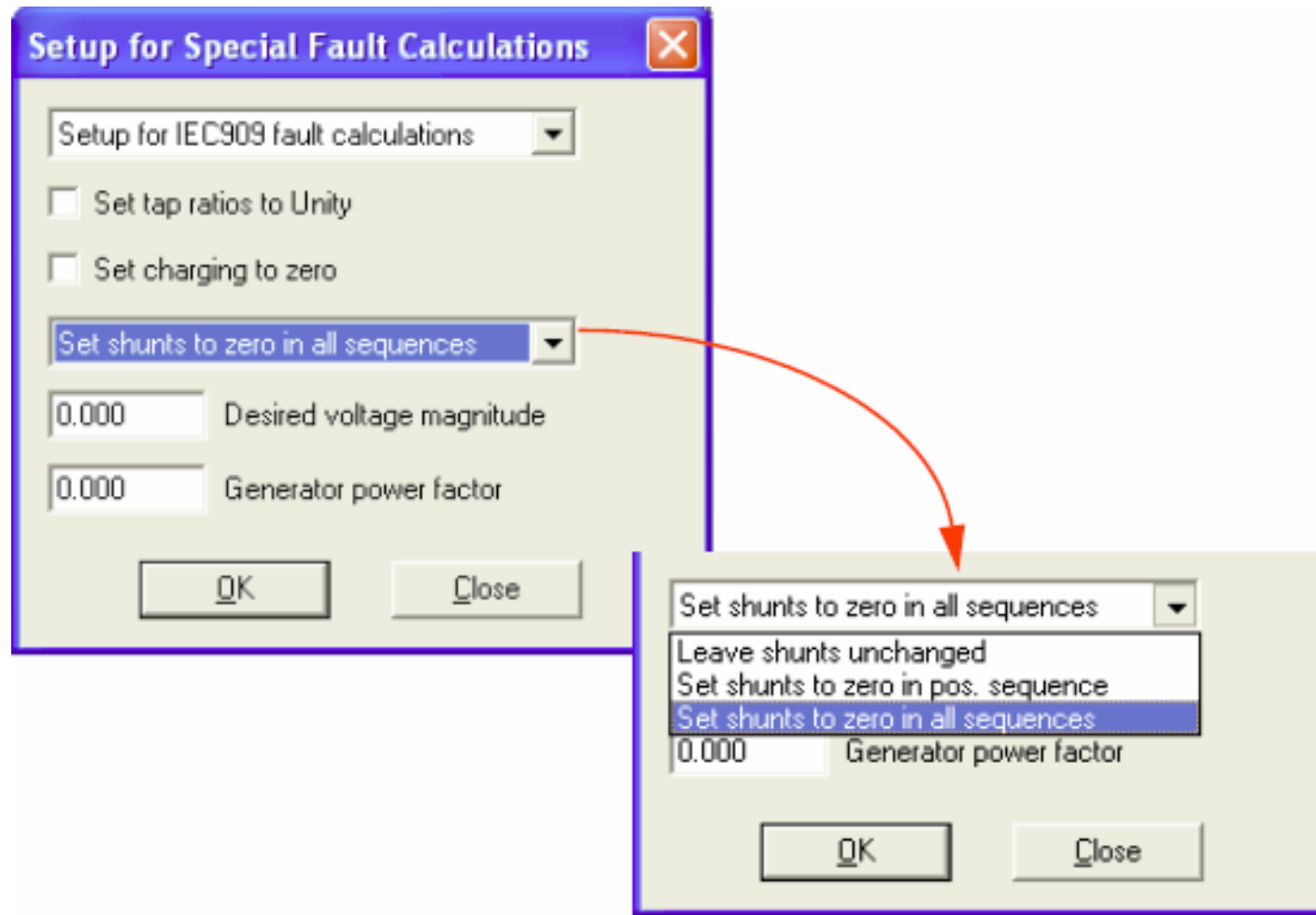


Figure 7-15. Setup for IEC fault Calculations

Maximum and Minimum Fault Currents as per IEC 909

- System Generation Dispatch
 - Maximum generation dispatch for Maximum SC current i.e. dispatch all the generation available in the system i.e. Maximum peak conditions
 - Minimum generation dispatch for Minimum SC current i.e. dispatch all the must-run generating units i.e. Minimum of Off-Peak conditions
- System Voltages

Nominal Voltage U_N (LL r.m.s.)	Voltage factor c for the calculation of	
	maximum short-circuit currents, $c_{\max}^{(1)}$	minimum short-circuit currents, $c_{\min}$
Low voltage 100 V to 1000 V (IEC 60038, table I)	1.05 ⁽³⁾ 1.10 ⁽⁴⁾	0.95
Medium voltage >1 kV to 35 kV (IEC 60038, table III)	1.10	1.00
High Voltage ⁽²⁾ >35 kV (IEC 60038, table IV)		

1. $c_{\max}U_N$ should not exceed the highest voltage U_m for power systems equipment.
2. If no nominal voltage is defined $c_{\max}U_N = U_m$ or $c_{\min}U_N = 0.90 \times U_m$ should be applied.
3. For low-voltage systems with a tolerance of +6 %, for example systems renamed from 380 V to 400 V (LL r.m.s.).
4. For low-voltage systems with a tolerance of +10 %.