PSSE G74 Fault Current Tool
Work Instruction

For: Scottish Hydro Electricity Power Distribution

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Power Systems Consultants UK Ltd

Client Reference:
PSC Reference: JK7938-01-0
Revision: 0
Date: 2nd December, 2019

Document History

Revision	Date	Description of changes
0	02-12-2019	Initial Issue for SHEPD testing

Revision	Date	Author	Peer Review	Approved
0	03-12-2019	David Mills	Michail Bitos	David Mills

Contents

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1. Introduction

PSC are developing the PSSE fault current calculation scripts in use by Scottish Hydro Electric Power Distribution Ltd. (SHEPD). These scripts apply the principles detailed in the ENA Engineering Recommendation G74 [1]. This document provides work instructions on the use of the PSC fault current calculation tool with full documentation of the implementation detailed in [2].

2. Installation

To be able to run these scripts the user will need to have PSSE version 33 and Python 2.7 installed.

2.1. Python packages

There are also the following python package dependencies required as part of this script and these are provided with the package, if these are not already installed, they will be installed during first run:

- et_xmlfile
- jdcal
- numpy
- openpyxl
- pandas
- pip
- python_dateutil
- pytz
- setuptools
- six
- xlrd
- xlwt

3. Process

The flowchart shown in the figure below sets out the computation process that is being carried out by the scripts.

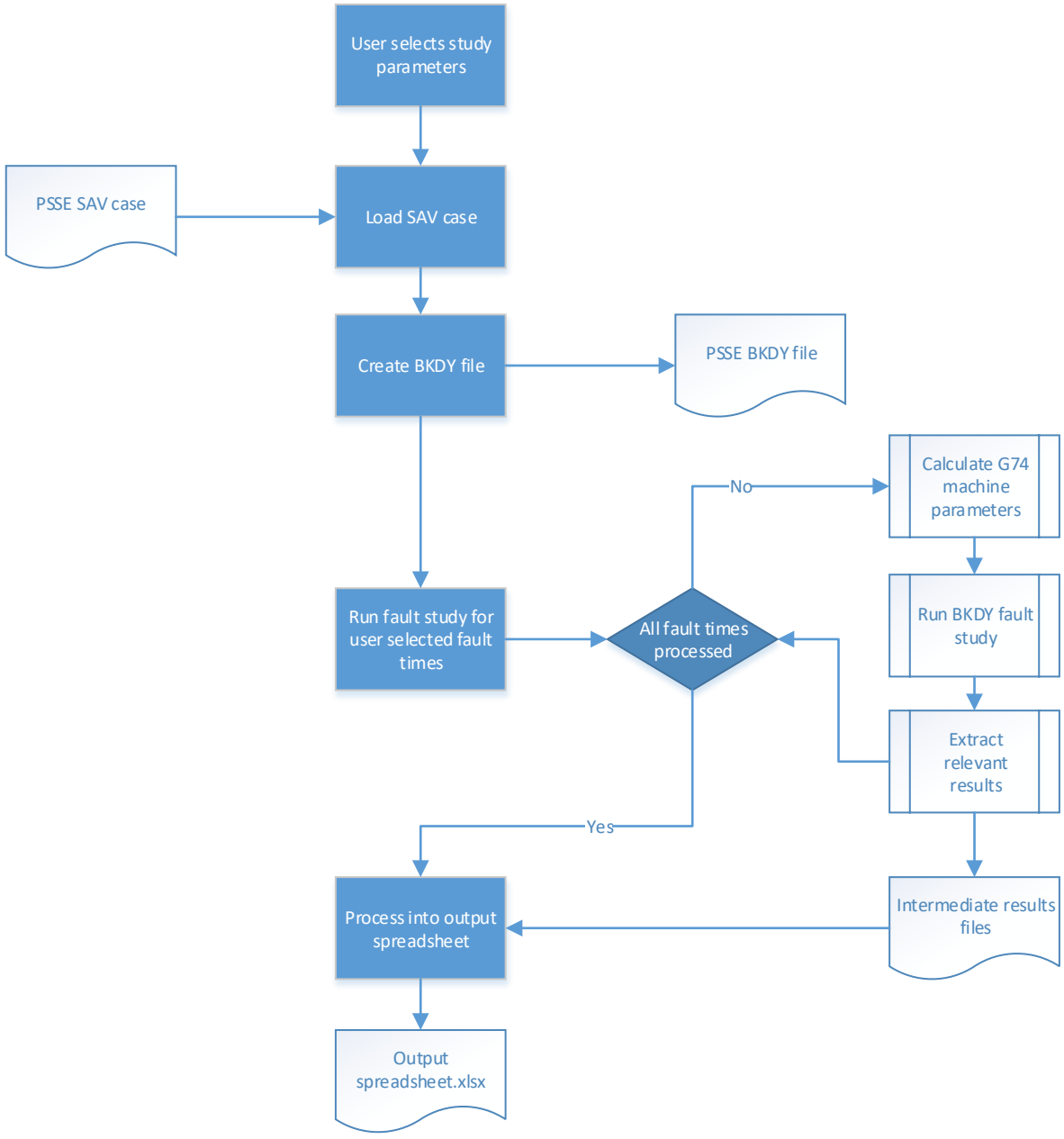

Figure 3-1: Flowchart for PSC G74 Fault Study Tool

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4. Running Studies

This section provides details of the user interface and the various options which can be input by the user.

4.1. Script Execution from PSSE or Python

These scripts can be run from PSSE or directly from Python, the results and process are the same with some slightly different options produced if run from PSSE. The following sections show the process of running the studies from either PSSE or Python.

4.1.1. PSSE Based Execution

If running from PSSE, click the tool to run automation files and then select the Fault_Calculations.py script.

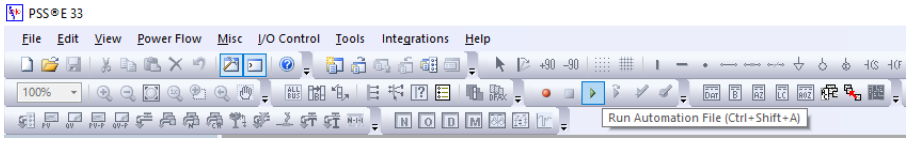

Figure 4-1: Run Fault_Calculations.py from PSSE

4.1.2. Python Based Execution

If running from Python directly, run the script Fault_Calculations.py in python 2.7 and the execution will follow the same procedure as detailed below. However, the user will not be able to select busbars in the PSSE user interface (section 4.2.1)

4.2. Main Script User Interface

The first window that will appear once the script has initialised is shown in Figure 4-2 and asks to the user to select the main parameters for the fault study which include:

- SAV case study fault study is to be run on
- Fault type and calculation methodology to be considered[1]
- Select busbars to fault with the following options:
  - Select busbars in the PSSE user interface (4.2.1)
  - Import a list of busbars (section 4.2.2)
  - Edit the list of busbars to be faulted (section 4.2.3)
  - Fault all busbars (section 4.2.4)
- Fault times to be considered (section 4.2.5)
- Run the fault study (section 4.3)

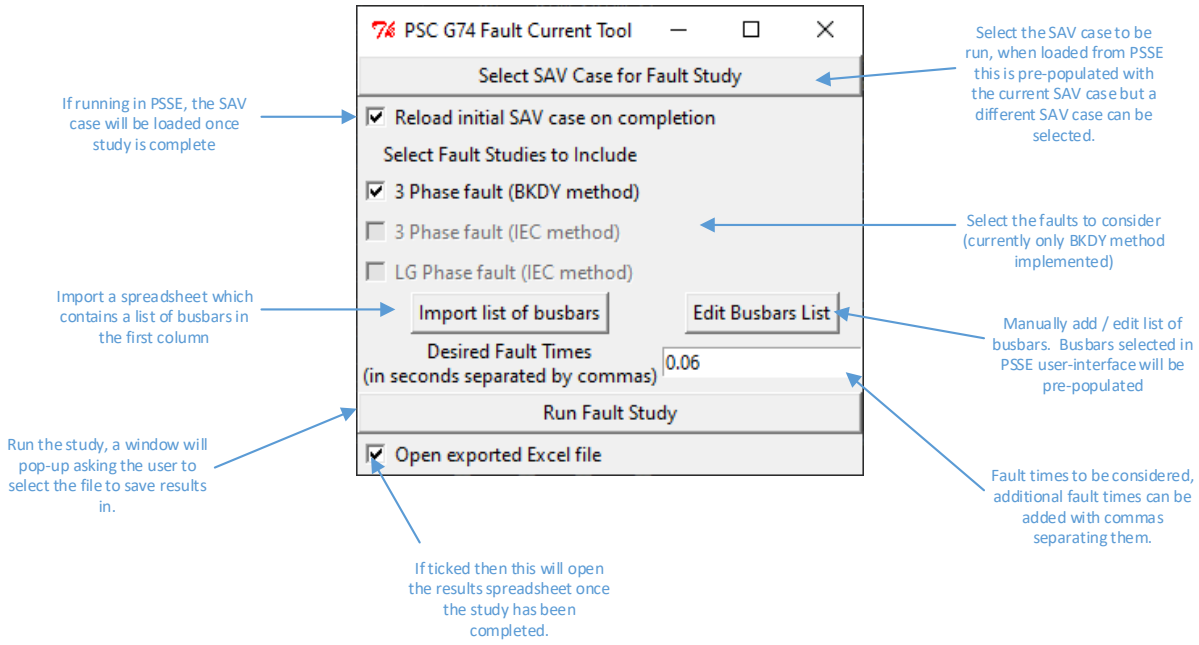

Figure 4-2: Main user interface window

4.2.1. Select Busbars in PSSE User Interface

If running in PSSE and busbars have been selected prior to running the script, then these will automatically be added to the list of busbars to fault. This list can be further adjusted using the Edit Busbars List detailed in section 4.2.3.

4.2.2. Import List of Busbars

It is possible to import a list of busbars from a spreadsheet and is particularly useful for studies which are run on repetitive studies. An example would be producing the fault current results necessary for inclusion in the LTDS.

The spreadsheet that is imported needs to be of type *.xlsx and the first column should contain only busbar numbers. An example is included in the script package g74\test_files\test_busbars.xlsx. Any

[1] While in beta testing mode only the BKDY method is available

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unrecognised busbars or those which do not exist in the model will be skipped in the fault study and an error message displayed to the user.

4.2.3. Edit Busbars List

If the user selects the Edit Busbars List button, then a window like the one shown in Figure 4-3 will appear. If busbars have been imported / selected in the PSSE user interface they will be populated in this window. The user can add more entries or remove entries from this window as appropriate.

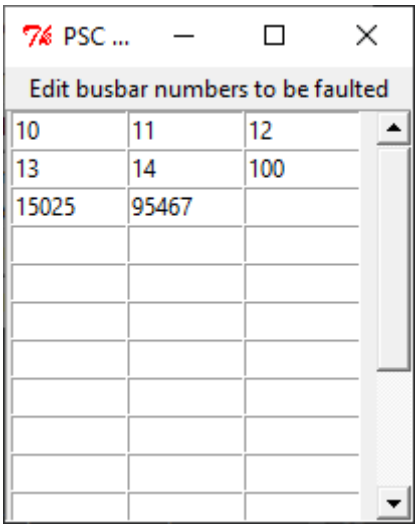

Figure 4-3: Edit busbars table

4.2.4. Fault All Busbars

If no busbars are selected or imported, then the fault current at every busbar in the selected PSSE model will be faulted. This can take a reasonable amount of time as a large spreadsheet of results needs to be produced.

4.2.5. Desired Fault Times

The user can select the desired fault times to be considered in the study. Any number of fault times can be included and need to be detailed in seconds and separated by commas. The accuracy of the reducing fault current values is dependent on the inclusion of accurate sub-transient, transient and synchronous reactance values for the generation in the system. Where this data is not included, the values will remain constant once the G74 motor contribution has decayed to zero (after approximately 120 ms).

The following fault times are necessary in all studies and will be added automatically:

- 0.00 seconds – This is required to obtain the instantaneous fault current value (I_k'') and for deriving the DC decay.
- 0.01 seconds – This is required to obtain the peak fault current value for circuit breaker fault current withstand consideration.

4.3. Run Fault Study

When the user selects, Run Fault Study a window will popup asking for the filename of the results file in the format *.xlsx. This file can be saved anywhere the user has appropriate file permissions to save and if the check box “Open exported excel file” is selected it will then be opened.

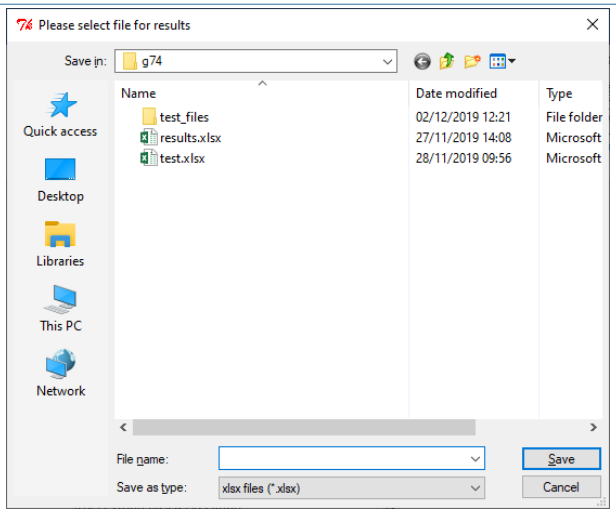

Figure 4-4: User to select file for the results to be saved in

4.4. Missing Python Package Installation

If when running the main script Python detects that the packages listed in section 2.1 are not installed, then these will be installed locally. The user will receive a notification that these are being installed and it may take longer to run than normal. These are installed by execution of the batch file: JK7938_Missing_Packages.bat

Running of this script should require manual user intervention and so long as the user has located the files in a location that they have write access permissions.

5. Log Messages

When the script is run it will display log messages in either the PSSE or Python window about progress, if any errors or warnings occur these will also be displayed. If an error occurs a log file will be saved in the script folder with contents of the error messages that can then be reviewed / checked to understand if this has a material impact on the results.

6. References

[1] Energy Networks Association, “Engineering Recommendation G74 - Procedure to meet the requirements on IEC 909 for the Calculation of Short-Circuit Currents in Three-Phase AC Power Systems,” Energy Networks Association, London, 1992.

[2] D. Mills and M. Bitos, “JK7938-02-00 PSSE G7_4 Fault Current Tool - Implementation,” PSC, Warwick, UK, 2019.

[3] PB Power, “61781A: Method for Calculation of Short Circuit Levels on The Distribution System Using PSS/E,” PB Power, 2004.

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