GRIDSCALE X ADVANCED PROTECTION ASSESSMENT

Equipment Protection Module

Enhance your productivity by quickly evaluating the protection status of your equipment. Easily perform a comprehensive protection analysis on a single thread, capturing the results in one single place.

SIEMENS

At a glance

The inherent characteristics of transformers, generators, transmission lines, motors, capacitor banks, or other power system apparatuses present several factors that need to be analyzed by the protection engineer. Promptly removing the equipment from service during an abnormal state to limit damage to equipment and reduce stress on the power system are some of the main objectives in mind.

The Equipment Protection module allows you to quickly collect all associated apparatus protection and relevant equipment operational curves to perform comprehensive protection evaluations, enhancing the productivity of the protection engineers, as well as ensuring that all aspects of the equipment protection are well covered and complete.

The results of selected protection analysis are consolidated into a single, progressive report that clearly describes the current status of the protection performance.

The challenge

The protection analysis tools in the Advanced Protection Assessment (APA) software are sophisticated features that produce valuable insights in particular aspects of the protection of the equipment. These tools may use graphical components to show operational or damage curves, obtain electrical information of the equipment stored in the database, perform faults and outages, determine protection operation time, etc. APA has developed a very powerful and comprehensive library of specialized tools through the years.

However, these studies are not necessarily integrated into one single process when the task is focused on analyzing a single piece of power system equipment. When such a task arises, the APA user may need to use several tools in existence in the software that may be scattered in different modules or locations. The task of analyzing a single piece of power system equipment then may become a time-consuming, manual process, as there is not an existing process in APA, until now, that executes the overall analysis of the protection of a particular equipment all at once.

Our solution

The Equipment Protection module consolidates several protection analysis studies in one single, automatic process.

It aggregates important tools already in existence in the program. With little data preparation and one click, the user initiates the execution of these tools, one after the other.

The Equipment Protection module automatically collects all the necessary information from the APA database, information related to the equipment's electrical configuration, connection, system voltage base, associated primary protection, etc. The gathered information is then used by the tools for their computations and analysis. The protection analysis results are rendered graphically and/or textual in the report area.

The Equipment Protection module enhances productivity by automatically running protection studies that otherwise would be executed separately in a manual way. The Equipment Protection module also assures that the important aspects associated with the protection of a particular piece of equipment are all covered and evaluated to satisfaction.

Transformer protection analysis

Currently, the Equipment Protection module only supports transformer protection analysis. In the future, this module will be enhanced to include other types of power system equipment.

The transformer equipment protection analysis is currently made of the following studies:

- Transformer damage curve computation, both mechanical and thermal, and Coordination Graphics module plotting.
- Automatic aggregation of transformer terminal overcurrent protection curves in Coordination Graphics module plotting.
- Automatic execution of close-in faults in transformer terminals; produced table of operation times of overcurrent protection and transformer damage curve.
- Table of time differences (delta) between overcurrent protection and transformer damage curve.

Easy set up for automatic, one-click execution

The transformer equipment protection study is automatically executed with one simple click. This automation requires some easy data preparation: the module will study the overcurrent protection functions that have assigned contact logic codes.

Type	Designation	Zone/Uni	Setting (secondary)	Logic Code
TOC	51N1		3.5	51GT_HV
TOC	51N2		3.5	51GT_LV
TOC	51N3		8	51GT_TV
TOC	51P1		8	51PT_HV
TOC	51P2		5	51PT_LV
CDIFF	87R			87R
CDIFF	87U			87U

Figure 1: Assignment of Contact Logic Codes to Elements.

Set up once, study anytime

With the Advanced Protection Assessment Equipment Protection Module, once you have assigned contact logic codes to your protection functions, you may rerun these studies as many times as you want, with only one click.

Flexible study configuration

The Equipment Protection module allows flexible configuration of the protection analysis studies, including those that control the transformer damage study and faults applied.

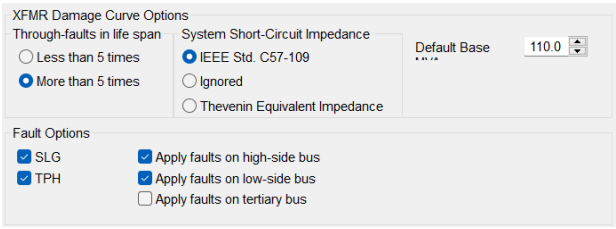

Figure 2: Equipment Protection XFMR Preferences.

Protection analysis results

Graphical and text reports are generated to provide a complete picture of the transformer protection analysis. This reporting quickly provides comprehensive evaluation of the transformer protection in summarized tables.

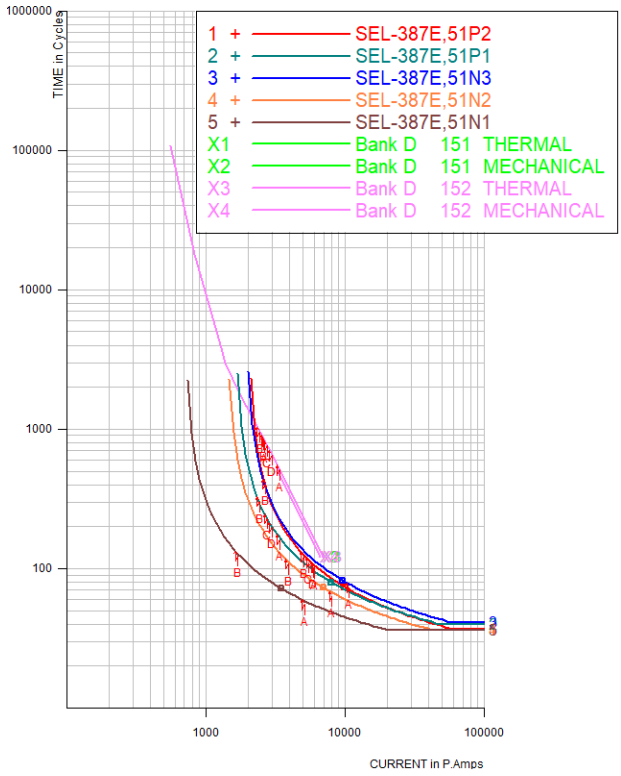

Figure 3: Plotted Transformer Damage Curve and Overcurrent Protection Curves under Fault.

Operation Times for curves (cycles)

Protection Curve	Curve Label	Fault A	Fault B	Fault C	Fault D
577 TOC 51P2	1	109.34	130.95	119.31	110.81
577 TOC 51P1	2	175.56	326.74	246.42	214.14
577 TOC 51N3	3	79.15	436.74	Infinite	Infinite
577 TOC 51N2	4	68.70	116.52	Infinite	Infinite
577 TOC 51N1	5	59.74	133.37	Infinite	Infinite
Thermal Damage Curve #1	T1	551.45	1036.67	819.57	708.86
Thermal Damage Curve #2	T2	881.94	907.39	819.57	708.86
Mechanical Damage Curve #1	M1	Infinite	Infinite	Infinite	Infinite
Mechanical Damage Curve #2	M2	Infinite	Infinite	Infinite	Infinite

Figure 4: Transformer Overcurrent Protection Operation Times.

Time Delta between OC and XFMR damage curves (cycles)

XFMR Damage Curve	Fault	Curve #1	Curve #2	Curve #3	Curve #4	Curve #5
T1	A	442.11	375.89	472.30	482.75	491.71
T1	B	905.72	709.93	599.93	920.15	903.30
T1	C	700.26	573.15	N/a	N/a	N/a
T1	D	598.05	494.72	N/a	N/a	N/a
T2	A	772.60	706.38	802.79	813.24	822.20
T2	B	776.44	580.65	470.65	790.87	774.02
T2	C	700.26	573.15	N/a	N/a	N/a
T2	D	598.05	494.72	N/a	N/a	N/a

Figure 5: Operation Time Differences between Transformer Damage Curve and Transformer Overcurrent Protection.

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