## Improved Breaker Rating Module

The following describes four new features in the upcoming release of ASPEN *Breaker Rating Module*™, Version 9.

### IEC Standards Supported

Version 9 can check circuit breakers that are manufactured and tested in accordance with IEC standards. The software utilizes fault-current calculation methods recommended in IEC standards 60909-0. You must use *OneLiner*™ version 9.5 or later to enter IEC breaker nameplate data as defined in IEC standard 62271-100. See Figure 1. The program generates separate checking report for IEC and IEEE breakers.



Fig. 1: IEC breaker info dialog box

### AC Decay

It is well known that the short-circuit current contains ac and dc components, and that both components decay over time after the onset of a fault. See Figure 2. The ac decay is most noticeable when the short-circuit current comes mostly from local generators. It is negligible when the generators are all far away.
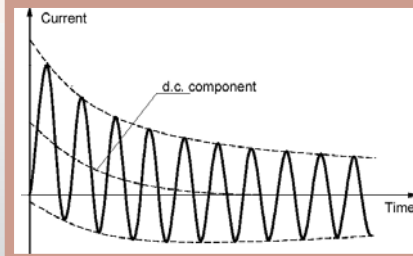


Fig. 2: Plot of current decaying over time

The *Breaker Rating Module*, up to now, took into account only the dc decay when rating the breakers. The omission of the ac decay is justified when the breaker current is all coming from "remote" generators, which, according to ANSI/IEEE standards, are generators located more than one transformation away from the fault, or those that have an external series reactance that is greater than 1.5 times the generator subtransient reactance. When a large portion of the breaker current is coming from nearby generators, the breaker duty given by the *Breaker Rating Module* is conservative in the sense that the program may report a breaker as being over-duty when in fact it is still marginally adequate.

Version 9 of the *Breaker Rating Module* remedies this shortcoming by asking the user to enter for each breaker a non-ac-decay (NACD) ratio, defined as $I_{remote}/I_{total}$, where $I_{remote}$ is the current contribution from remote sources per ANSI/IEEE definition, and $I_{total}$ is the total breaker current. This ratio allows the software to break down the total breaker current into local and remote components, and to apply different multipliers to them when calculating the asymmetrical interrupting duty of the breaker.

The default value for NACD ratio is 1, which means that the breaker current is all from remote sources. The rating results from version 9 will match those of previous versions of the program when NACD is at this value.

For the user, one possible strategy is to leave the NACD at 1 for all the breakers, knowing that the checking results will give rise to larger safety margins for breakers that are near generators. Another strategy is to keep NACD initially at 1, and later, for breakers that are flagged in the screening report, determine the actual NACD for a more accurate rating. Detailed instructions for estimating the NACD are available in the on-line help file.

### Enhanced Breaker Connection Model

For each breaker, the user can list up to two groups of branches and generators that it protects. The user can also specify whether a breaker must interrupt the total fault current from all the protected equipment in the group, or only the highest current. Our experience shows that the program can correctly model nearly

all breaker configurations using this information, which we referred to as the "breaker connection model".

Up to now, the program limits the protected-equipment list to only branches and generators that are directly connected to the breaker bus. In version 9, the user can include in the lists other branches nearby. This enhancement allows the software to accurately check breaker configurations that were not adequately represented in previous versions.

One useful application of this new feature is for breakers that protect a 3-terminal line (which is typically represented as three separate lines in the sequence network). For each of these breakers, by including in the protected-equipment list the two remote lines, the software now correctly considers the case of a closing-in fault on the local terminal, with the other two remote terminals open. Another useful application of this feature is the ability to include in the protected-equipment list branches that are connected to the breaker bus through switches.

### Checking Fuse Interrupting Duty

In addition to circuit breakers, Version 9 can be used to check the interrupting duty of high- and medium-voltage fuses. The user must enter the rated interrupting current for each fuse using *OneLiner* version 9.5 or later. The fuse-rating logic in the *Breaker Rating Module* first simulates faults around the fuse location to determine the maximum short-circuit current going through the



**Fig. 3: Read/Write test form of the Relay Database Web Interface**

fuse. It then utilizes standard methods recommended by ANSI/IEEE and IEC to calculate the momentary (first-cycle) asymmetrical fault current. The software reports the duty, or the ratio of the maximum asymmetrical fuse current to the rated interrupting current of the fuse. Fuses with duty above the predefined limit are flagged in the report.

### Breaker Rating Module Price Increase

Currently, the license fee for the *Breaker Rating Module* is $5,000 for a company that has one copy of *OneLiner*, and $7,500 for companies with multiple copies of *OneLiner*. After August 1, 2004, the price will be $7,500 for all *OneLiner* users.

### Read/Write Relay Database Web Interface

Users of the ASPEN Relay Database™ will soon receive an update Web Interface with read/write-enabled relay setting and test forms. Several users have requested this enhancement to allow technicians to

enter test data through their web browsers. See Figure 3. You can try out the updated Web Interface on our web site.

### Upcoming Events

- *OneLiner* class in Seattle, from September 29 to October 1.
- *OneLiner* users group meeting in Spokane, on October 18.
- *Relay Database* seminar in Spokane, on October 18.

The schedule and sign-up sheet for the *OneLiner* class are available on our web site. The sign-up sheet for the other events will be available soon.

### New Users

*OneLiner*
- Cegertec, Chicoutimi, Quebec, Canada
- Dow Chemical Co., Freeport, TX
- Exponential Engineering, Inc., Fort Collins, CO
- Grand River Dam Authority, Vinita, OK
- Grays Harbor PUD, Aberdeen, WA
- HDR Engineering, Billings, MT

*Relay Database Client/Server™*
- City of Anaheim, CA

*Power Flow™*
- Exponential Engineering, Inc., Fort Collins, CO
- HDR Engineering, Billings, MT

*DistriView™*
- Baccari & Associates, Sheridan, WY
- Hydro One, Toronto, Ontario, Canada
- Rasku Services, Rossland, BC, Canada

*Line Constants Program™*
- Alabama Electric Coop., Andalusia, AL
- Dow Chemical Co., Freeport, TX
- Grand River Dam Authority, Vinita, OK