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Dynamic vs Static Testing Effective End to End Relay Testing

Claiming a test set has End-to-End testing capabilities does not guarantee that you are able to perform dynamic testing of a relay or determine the dynamic response of the overall protection system.

Dynamic vs. Static Testing: What is the Difference?

Some test set manufacturers define testing with a state sequence of static values as "dynamic testing", but this is a misrepresentation. In essence, a series of state transitions containing 60Hz or 50Hz waveforms only qualifies as a "static test". For most digital relays being installed today this type of test can only demonstrate that the relay will operate and not much more. It cannot test the performance of the relay because this requires a transient waveform to which the relay's algorithm will respond. So when these static tests are used for end-to-end testing, the only purpose of such tests is to verify the overall scheme coordination of the relay's internal logic and the "external" communication equipment functionality, nothing more.

True "dynamic testing" can only be accomplished by applying a waveform composed of time-based events of the power system that includes all component variables. Multiple scenarios (or test cases) are required and they cannot be created without some working knowledge of the power system. One alternative is to collect the test cases through disturbance recordings from the actual power system. But one must have the appropriate "event" occur that provides the correct test case. Both efforts are not trivial, but software solutions are available.

EMTP and ATP are both common software-modeling tools that have been used by engineers to generate the required dynamic



test cases. But these tools require deep knowledge of the software, equipment modeling data, and detailed design parameters of the particular power system. Preparation and verification of the test cases is time consuming and once finished cannot be altered in the field if something changes or is found to be incorrect with the relay protection system.

A flexible software that requires minimum training to use, minimum power system parameters, allows for field changes of the test cases as required but still produces accurate dynamic waveforms that are repeatable would provide an ideal test solution.

OMICRON Solution: Both EMTP and APT can be easily played back using OMICRON's *Advanced TransPlay* module. This powerful module even allows these files to be "enhanced" by modifying the simulation to

(Continued on page 1)

include Binary Output simulations (like 52a) and Timing Markers (like Start of Fault) that permit automatic timing of the relay's responses making pass/fail assessments possible. *Advanced TransPlay* can be used multiple times in the OMICRON Control Center (OCC) resulting in an automated Test Plan. This allows any number of test cases to be performed sequentially without interruption and yet still be time synchronized with a GPS.

However, another OMICRON Test Module provides a unique solution custom tailored to the issues of dynamic testing. The *NetSim* module is the only PC-based power system simulator available with "instant" recalculation of the power system parameters producing the correct dynamic waveforms instantly for the modeled system and selected test case. Coupled with GPS synchronizing and multiple system models, *NetSim* provides the easiest dynamic testing solution available. As part of OMICRON's Test Universe, it can also be used in the OCC to develop a complete automated Test Plan for End-to-End testing.

For the easiest setup of End-to-End testing in any scenario, OMICRON integrates our CMGPS receiver software directly into each test module's controls. This tight integration ensures complete synchronization of the test execution with the

hardware for the most accurate test start and test timing. Numerous lab and field tests have demonstrated that no other manufacturer can compare to our accuracy or repeatability using this test methodology.



Demo CDs Available!

A demo CD for the CMC test system (includes a new meter testing video), as well as an Application CD for the CPC 100 primary injection test set are available by contacting your local OMICRON office.



The revolutionary CPC 100 primary test set is making a big impression on customers. Here's what several of them have written:

"The biggest benefit observed with CPC100 is considerable reduction of preparation and testing time. This also includes the report preparation time (the reports in CPC100 are generated automatically after each test is performed). With all the innovations built in this product, even the rewiring time is reduced to a very large extent."

"From this experience I would estimate that the CPC100 performs between 6 to 10 times more quickly than conventional test equipment for the same range of test."

"Testing time was the most significant gain. The automatic CT magnetisation curve feature proved to be very fast and, importantly, very safe. Man-hours were further reduced as the OMICRON CPC100 allowed CT polarities to be tested by one person..."

"84 CT mag curves and 120 CT ratio tests were tested in only one day..."

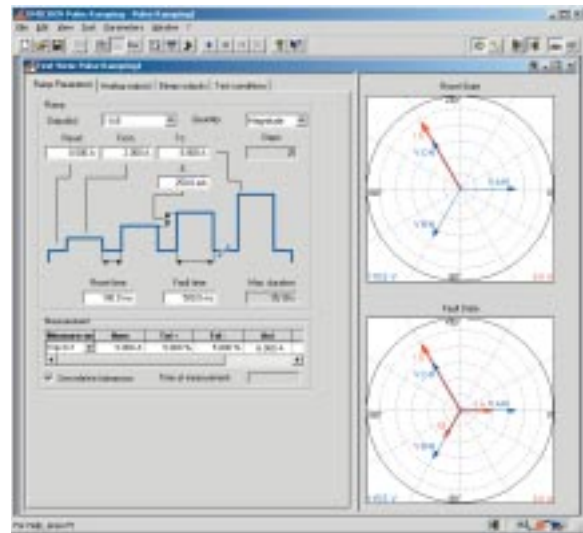
New test modules were recently added to the CMC Test Universe software Version 1.61

Following is a brief description of each:

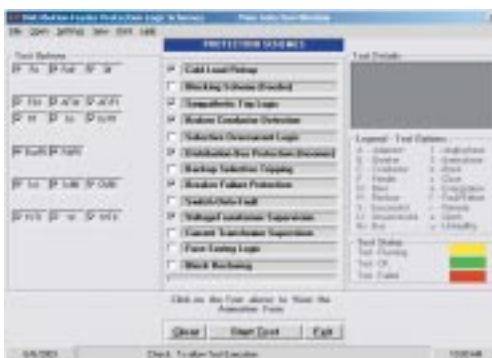
Autoreclosure – module for easier configuration of test sequences for the automatic reclosure. The test module automatically sets up test conditions for the successful and the unsuccessful sequence. Essential criteria like the three-phase final trip at the end of an unsuccessful sequence are automatically evaluated. The ARC function with overcurrent, distance or line differential relays can be tested.

Pulse Ramping – module for the determination of pick-up values can now be done with a pulsed ramp. Typical applications are pick-up testing of multifunctional relays with overlapping elements, overcurrent relays with multiple elements, generator protection, motor protection, or rate of change relays.

VI Starting – module for testing the voltage dependent overcurrent starting characteristic used in many distance relays. Additionally, many overcurrent and undervoltage functions can be tested. Pick-up values, drop-off values and the ratio are found for any specified test point.



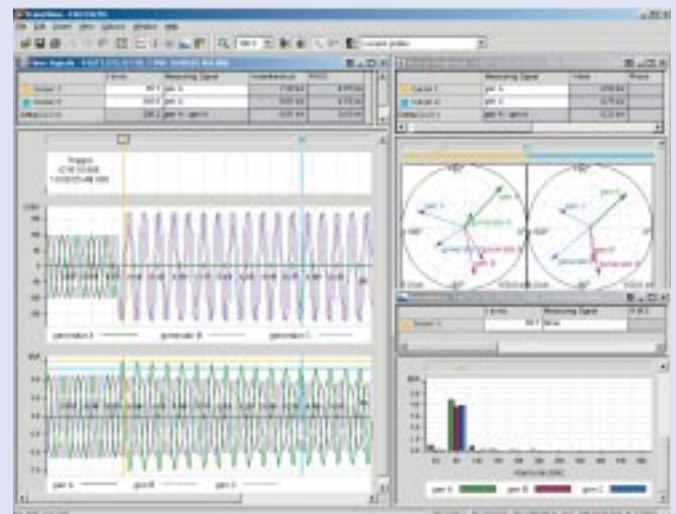
New Scheme Testing Tool



DLogicPro - "Scheme Testing Tool" module specially designed for testing the logic schemes found in distribution feeder protection relays. It contains 13 of the most typical schemes found in feeder protection (i.e. cold-load pickup, fuse saving, sympathetic trip logic, broken conductor detection, selective overcurrent logic tripping, breaker failure, etc). In addition to quick relay tests and multiple scheme tests, our T&D scheme testing tools are excellent for benchmark testing as well as training since they all include the test objectives and an animation sequence view.

OMICRON's TransView software is now available in a standalone version

TransView is a powerful software for visualization and analysis of recorded analog signals that were recorded with transient recorders. While *TransView* will continue to be part of the EnerLyzer software that is available for the CMC 256, it can now be purchased separately for customers using the CMC 156 or without a test set.





FOR THE RECORD WITH **OMICRON**

A series of questions most commonly asked, and responses from OMICRON's renowned electronic test Guru...

UPCOMING EVENTS

VII Seminario Tecnico Protecao e Control

Rio de Janeiro, Brazil
22-27 June 2003

IEEE Power Tech Conference

University of Bologna
Bologna, Italy
23-26 June 2003

IEEE Industrial Power Applications Conference

Acapulco Convention Center,
Booth 14
Acapulco, Mexico
6-12 July 2003

ALTAE 2003

IV Congreso Latinoamericano de Alta
San Jose, Costa Rica
18-24 August 2003

Ineltec 2003

Messe Basel
Basel, Switzerland
2-5 September 2003

IEEE PES T&D Conference & Expo

Dallas Convention Center
Dallas, Texas
7-12 September 2003

Expoman 03

18 Congresso Brasileiro de Manutencao
Salvador, Brazil
8-12 September 2003

IEEE PCIC Technical Conference

Westin Galleria
Houston, Texas
15-17 September 2003

Q: How can I generate a specific waveform with the CMC?

A: There are 2 ways to do this. If you can describe the expected waveform through a mathematical expression, one way is to use a separate software such as Matlab. Matlab has a .wav export and with OMICRON's TransPlay utility you can import .wav files. TransPlay then has a further possibility to export COMTRADE utilizing the ctrl/shift/f12 command while the "Time Signal View" of TransPlay is open. This procedure allows you to generate COMTRADE files out of Matlab. A second method is available if you are using version 1.61 of OMICRON's Advanced TransPlay module. A less known feature called "CSV import" allows you to import Microsoft Excel files into Advanced TransPlay. To access this feature you have to key *.cvs into the "File Name" section of the "open" dialog when

importing files into Advanced TransPlay. This gives you the opportunity to calculate your data in Excel and then import into Advanced TransPlay.

Q: Where can I find additional documentation or help for my CMC test set when I'm working on-site?

A: On the Test Universe CD, as well as in the Test Universe folder that you installed on your PC with the CMC software, you can find all of the CMC users manuals in pdf file format. You can easily access these from the Start Page under "Misc/Help & Manuals" and select "manuals" if you have V1.6, or if you have an earlier version select "Misc/Help" then select "Online help" and choose "users manuals" from the list. In addition, sample test templates and RIO files can be found in the following folder (default location) C:\program files\OMICRON\testuniverse\testlibrary

"WHAT'S NEW"

The 2003 schedules for the OMICRON training courses are now available and can be viewed on our web site at www.omicronusa.com or www.omicron.at. These classes are space limited so be sure to register early.

Be sure to review our latest CMC software additions on page 3 inside.



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