

## Application

# Time-saving intelligence

IEB Colombia shares its experiences with the Protection Testing Library

Testing **5000** relays in one fifth of the time

## Qualitative and quantitative challenges

During our project, we needed to test multiple types of relays. One of the challenges we faced was testing relays with non-linear characteristics. Unlike the more commonly used linear characteristic, the General Electric (GE) relays, Multilin UR T60 and Multilin SR345 are based on a cubic spline characteristic for the transformer differential protection. This is the main protection function of a transformer relay and the most complex function for testing. In order to define the characteristic that needs to be tested, an approximation of the cubic spline with a large amount of lines would be necessary. This would not be a problem if only one or two relays needed to be tested. However, the efficiency of the work needs to be optimized when testing more than a hundred relays.

## The path to optimization

In order to tackle this challenge, we generally chose to work with OMICRON testing equipment. We chose to work with the PTL GE T60 template in particular. We arrived at this decision based on the fact that we not only have experience working with CMC test sets and

Relay Type	Quantity	OMICRON PTL template used as a basis
GE Multilin SR345	112	Multilin T60
GE Multilin SR339	261	Multilin M60
GE Multilin SR350	232	Multilin 745
GE Multilin 750	185	Multilin 745
GE Multilin UR C60	27	None
GE Multilin UR T60	2	Multilin T60
GE Multilin UR M60	9	Multilin M60
GE Multilin UR G60	2	None
GE Multilin UR L30	16	None
EATON C441 Motor Insight	1695	A new test template was created
Cuttler-Hammer D64RPB30	1311	A new test template was created

The relays used in the refinery expansion project, their quantities and the test templates used as a basis.



Test and commissioning engineers working at IEB Colombia were given the task of testing the control and protection system in the electrical substations of the Cartagena oil refinery expansion project. The refinery is the second largest one in Colombia. Their scope consisted of testing about five thousand protection relays that are distributed throughout the 23 substations that make up the electrical power system of the refinery. To accomplish this task they used templates from our Protection Testing Library (PTL), four CMC test sets and the Test Universe software. By using these tools they managed to reduce the execution time of every test to one fifth of the time they would have needed if they had not used the PTL templates. Two of the engineers, Jhonatan Londoño and José Jaramillo, were happy to share their testing experiences with us.

the Test Universe software, but are also familiar with the PTL, the OMICRON Control Center (OCC) and all the support tools provided by OMICRON.

Throughout all of our previous commissioning projects, the test equipment has excelled in its capacity, flexibility, and reliability in comparison to similar products. Furthermore, all the PTL test templates are very helpful when testing protective relays, since the logic of every manufacturer is integrated in the tests of most of the functions included in the relay. Correspondingly, we used multiple templates for this project, depending on the relays we had to test.

#### **Saving time with the T60 template**

With the T60 template, we were able to save a tremendous amount of time, since we only needed to enter the relay settings in the template and the cubic spline characteristic was calculated automatically. Finally, with the input information the reports were also optimized to include all of the relevant information about the relay under test.

#### **The automation process in detail**

We developed a complete application (TECS: Testing & Commissioning of Substations) for the management and follow-up of the project's progress. The TECS is a database that contains all the relay setting files and templates that need to be used. We took advantage of the file format used by GE to store our relay settings (\*.urs files) and we developed a software tool for extracting the settings from these files. The settings were then imported into the proper location in the ▶



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► XRIO Converter files so that they would automatically modify every test template. The results were an amazing improvement in the progress of our work in the field. Compared to test sets from a different manufacturer that we also used for this project, the CMC test sets only consumed one third of the time for testing the same type of relay.

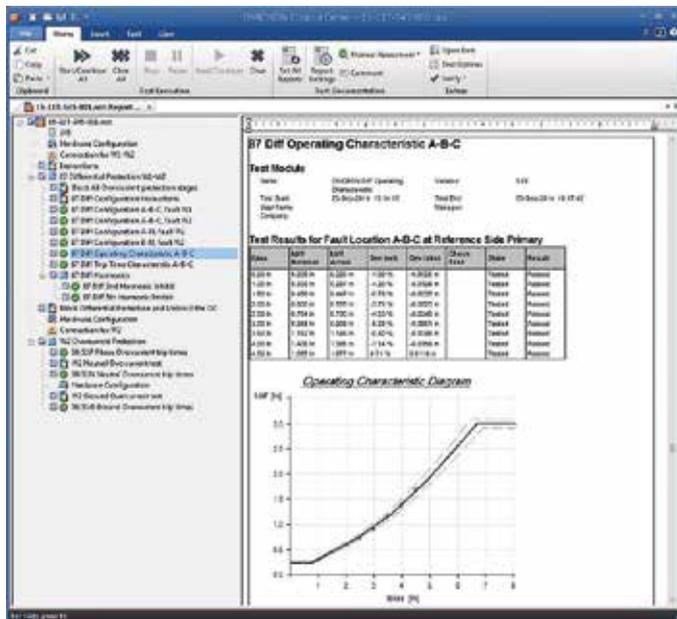


### Mastering future projects with PTL

We have an additional pre-commissioning contract in the short-term where two additional types of relays must be tested. One of them is the Schneider SEPAM T82, which fortunately is included in PTL; and the other is the Allen Bradley E3 Plus motor protection. So for that we will have to develop our own test template by drawing upon the experience we have acquired in this project.

### Our wishes for the future

We would like to be able to import directly from the setting files. For example, with GE relays it would be great to be able to import the \*.urs file. Furthermore, we would be happy to have an easier import option for relays, since a PTL XRIO converter is not available. In general, we are pleased with every additional type of relay that is covered by the PTL templates. 📌



Automatic calculation of differential operating characteristic with PTL template.

**1** Comparison of the relays that need to be tested and the PTL templates in order to identify which one would be the best template to use as a basis for each relay, depending on the active protection functions.

**2** Modification of the base PTL template for matching the project's relay configuration and adding new testing modules or modifying the XRIO as needed.

**3** Recognition of the correct protection function variables in the XRIO via text editor that need to be replaced by the information in the TECS data base.

**4** Implementation of the software tool for automatically completing the information in the items from step 3, and thus enabling the retrieval of the XRIO file with the settings of any specific relay in the project.

1 week

3 weeks

2 weeks

2 weeks

**At a glance:** The preparation time needed for the whole project – Each relay underwent each step.