A new way of testing current transformers

Hot on the trail of residual magnetism

Current transformers play an important role in the protection of electrical power systems. They provide the protection relay with a current proportional to the line current so that it can identify abnormal conditions and operate according to its settings. The transformation of the current values from primary to secondary must be accurate during normal operation and especially during system fault conditions (when overcurrents up to 30-times the nominal current are not an exception).

Testing of protection current transformers (CTs)

Conventional testing methods apply a signal to one side of the CT and read the resulting output signal on the other side. However, these methods can be time-consuming and use a lot of equipment. Sometimes they are not even feasible as very high currents are required, e.g. for on-site testing of current transformers designed for transient behavior (TP, TPX, TPY, TPZ types). As these conventional methods have limitations, OMICRON has developed a new way of testing CTs.

Modeling concept

This led to the development of the CT Analyzer – a test device using a revolutionary testing concept. The new concept of modeling a current transformer allows for a detailed view of its design and physical behavior to be created using parameters measured during the test. It then compares the model with the relevant

specification to confirm the accuracy of the CT. The CT Analyzer is small, lightweight and provides fully automated test plans, keeping testing times as short as possible. The accuracy of the techniques employed has been verified by several renowned metrological institutes including PTB in Germany, KEMA in the Netherlands and the Wuhan HV Research Institute in China.

RemAlyzer – the latest innovation

The newest measurement function to be added to the CT Analyzer is the RemAlyzer which allows current transformers to be tested for residual magnetism.

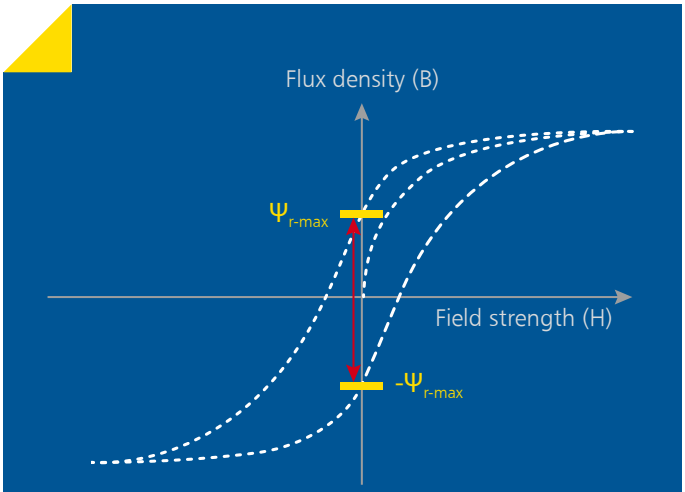
Residual magnetism may occur as a consequence of high fault currents containing transient components, direct currents applied to the current transformer during winding resistance tests or during a polarity (wiring) check. Depending on the level of remaining flux density, residual magnetism can dramatically influence the functionality of a current transformer by driving it into early saturation.

Since saturation effects in protection current transformers are not predictable and barely recognizable during normal operation, they are especially critical. For instance, mismatch of currents due to a saturated CT in a differential protection scheme may cause unwanted operation. Alternatively an overcurrent relay may fail to operate under fault conditions if the current transformer's signal is distorted due to saturation caused by residual magnetism in the CT core.

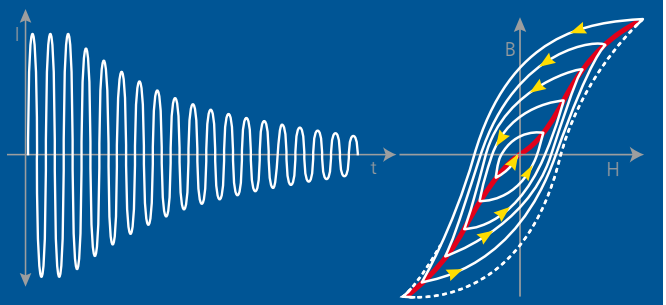
If residual magnetism is present in the current transformer, a demagnetization process is necessary. This can be achieved by applying an AC current of similar magnitude to that which caused the remanence. In a second step, the current transformer is demagnetized by reducing the voltage gradually to zero.

The CT Analyzer performs the residual magnetism measurements prior to the usual CT testing cycle. It achieves this by driving the core into positive and negative saturation alternately until a stable symmetrical hysteresis loop is reached. The CT Analyzer then calculates the initial remanence condition, which varies depending on whether the core is affected by residual magnetism. The results are displayed as absolute values in volt-seconds as well and as a percentage relative to the saturation flux (Ψ_s: defined in IEC 60044-1) on the residual magnetism test card. Additionally, the remanence factor K_r is calculated and is also shown on the test card. The CT Analyzer automatically demagnetizes the current transformer when the test is complete.

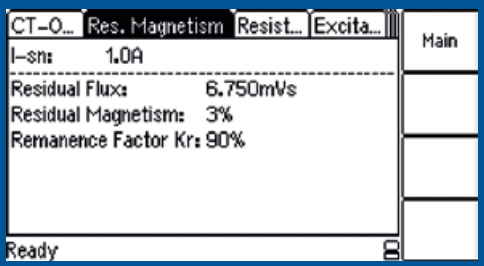
Different test devices and methods are used to verify the performance of current transformers during their development, production, installation and on-site maintenance. OMICRON's CT Analyzer already offers the most extensive range of tests available in a single device. Now with the brand-new RemAlyzer function, the testing capability of the CT Analyzer is even more comprehensive.



Hysteresis curve at the maximum saturation point showing the possible extent of residual magnetism



Demagnetization principle of iron cores



Test card of the CT Analyzer showing the measurement results of a residual magnetism test