WIRING TESTS
WITH THE CPOL2

Having the correct polarity for voltage and current transformer circuits is essential if the protection relay that is connected to them is going to function properly.

For example, distance relays use measured values to determine if the direction of a fault is forwards or backwards. Therefore, incorrect polarity can sometimes make it impossible to draw proper conclusions, which in turn causes failures.

The problem of transformer core magnetization

Until now, polarity checks have often been carried out with a battery and an analog voltmeter. This is done by briefly injecting power from the battery after which the checker is shown either a positive or negative output on the voltmeter. This method is quick and simple, but it has one key disadvantage: The direct current from the battery magnetizes the transformer core over time. It should then be demagnetized following the test, but this rarely occurs in practice. If a fault occurs in the power supply system, the magnetized transformer reaches saturation too soon and distorts the current on the secondary side, which can result in protection system malfunctions and costly failures. Furthermore, this method also doesn't allow the polarity along the entire path from the current transformer to the relay to be measured simply and reliably.

Sophisticated and reliable polarity checks

For this reason, it is advisable to only carry out polarity checks using DC-free testing methods. Modern test sets are able to measure direct phase relationships between AC signals in order to determine the polarity. But there is an even more sophisticated method that doesn't depend on phase relationships. This method allows you to check the entire secondary wiring, all the way from the current transformer to the protection relay without a cable connection to the test set.

The "CPOL method" injects a DC-free saw-tooth signal, which the transformers are able to transmit without any difficulty. This signal can be generated using a wide range of our test sets, including the COMPANO 100, CPC 100, CMC test sets, or the CT Analyzer.

The CPOL2 polarity checker then analyzes the direction of the saw-tooth signal with a high degree of precision and sensitivity before determining whether or not the polarity is correct.

Three methods for wiring tests with the CPOL2

First the checker injects the saw-tooth signal from the test set into the primary side of the current transformer (variant B in the figure below) and uses the CPOL2 to check the correct polarity on the secondary side of the current transformer (measurement point 1 in the figure) according to the display.

The signal can then be injected into the secondary side of the current transformer in order to carry out the check with lower currents (injection point A in the figure). The CPOL2 then checks the polarity across all terminal points up to the protection relay.

Method 1

The test signal is usually generated and analyzed directly in the CPOL2 (or CPOL). This is simple, safe, and quick. For certain applications, two things should be observed: Sometimes crosstalk can occur between the phases, whereby, the test set may also detect a test signal in the wiring of a neighboring phase due to its high degree of measurement accuracy.

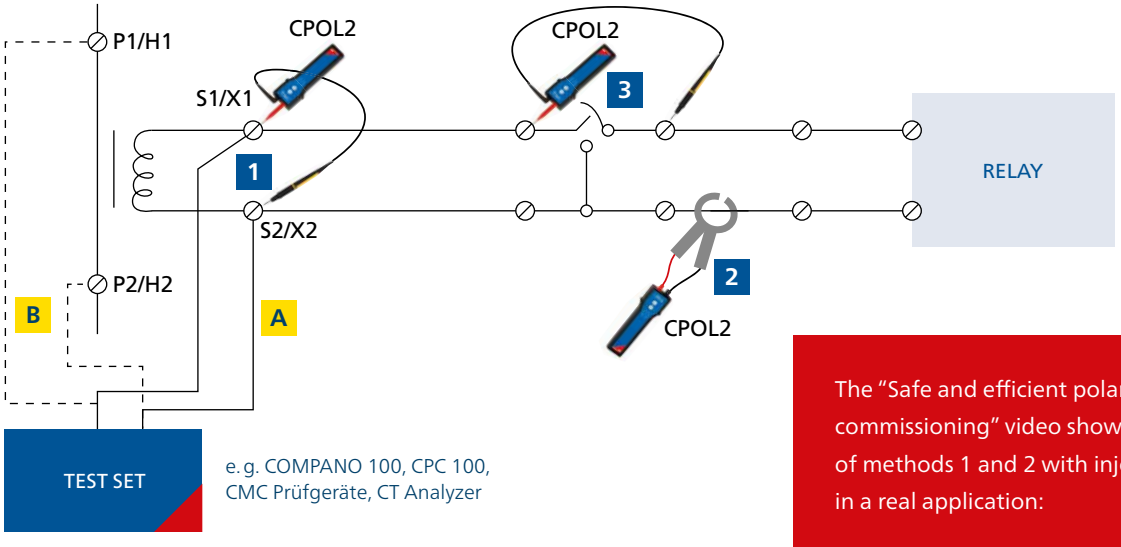
The standard method (1) is also less suitable for self-supplied relays, as the relay can significantly distort the voltage in the current path. Method 2 or method 3 are more suitable for both instances.

Method 2

By combining the CPOL2 with the C-Probe 1 current probe, the current can be measured directly. There is no interference from crosstalk or self-supplied relays, as only the current is analyzed. The only drawback is that the cables for the current probe are not always easily accessible.

Method 3

The CPOL2 has such a high degree of measurement sensitivity that in many cases just a single terminal point provides enough resistance to clearly determine the polarity. In this case, it is used as a kind of shunt through which the CPOL2 can record the signal for the polarity measurement. The terminal points are usually easy to access and this method delivers the same advantages as method 2.



Schematic diagram of a polarity check with the CPOL2

The "Safe and efficient polarity check during commissioning" video shows a demonstration of methods 1 and 2 with injection method A in a real application:

www.omicron.energy/video-cpol2