



ACTAS P260 P360 **Testing switchgear quickly and economically –** **Requirements to be met by professional test systems**

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Switchgear devices are situated at the key points of electrical energy transmission and distribution systems. Their reliability has a decisive influence on the availability, safety and economic efficiency of electricity supply systems. Switchgear devices are constantly exposed to external factors, such as dirt, moisture and temperature fluctuations, which can have negative effects. Often they are not operated for years at a time and then have to operate reliably up to 20 times within a very short period under fault conditions, should there be a disturbance due to a thunderstorm, for example. The demands placed on their operational reliability are still extremely high.



Fig. 1: Switchgear devices are constantly exposed to external factors, such as dirt, moisture and temperature fluctuations, which can have negative effects. Often they are not operated for years at a time and then have to operate reliably under fault conditions.

In order to be able to take preventive measures at an early stage in reaction to changes in breaker performance, regular acquisition and verification of all the relevant device parameters are essential and should not be limited to the maintenance cycles laid down in the revision plan. In order to make a full assessment of the reliability of a switchgear device, various mechanical and electrical parameters must be determined, including the main contact velocity, its

stroke and the operating time of the breaker. Deviations from the rated values point to defects in the drive or in the main contact chamber. Electrical parameters as well as mechanical parameters are important indicators for impending faults. The amplitudes and time-dependent characteristics of the operating currents of release coils, for example, give a good indication of what state they are in: changes in the operating forces which can occur as a result of mechanical wear and tear, for example, usually show up directly in the amplitude and curve shape.

Because of this, as well as measuring main and auxiliary contact status, modern test systems should also be capable of measuring resistive contacts, coil operating currents, the operating currents of spring-charging or pump motors, valve pressures and travel and mechanical main contact travel. Only then is it possible to investigate all the parameters which determine the reliability of a switchgear device and to assess the conditions inside the switchgear device without having to open the drive or even the main contact chambers.

Simple test technology saves time and money

While the demands placed on switchgear testing are increasing all the time, less and less personnel are available to carry out the tests. The person carrying out the test often does not have enough time to assess the recorded measurement data and results adequately. This increases the pressure on test technology to provide tools for the automatic execution and evaluation of tests. KoCoS Messtechnik AG has long been recognized as the leading manufacturer of switchgear test systems worldwide. Switchgear testing is the company's core competency, the products and solutions reflect the extensive know-how the company has built up in this area. ACTAS test instruments for circuit breaker testing, PROMET ohm meters and the EPOS MC3 motor and coil test system together make up the system solution offered

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by KoCoS for the automatic execution and evaluation of any conceivable test on a switchgear device. These professional test systems provide precise information as to the condition of the chamber and drive. The sheer number of parameters to be determined, the wide variety of different types of switchgear to be tested and the harsh environmental conditions encountered during on-site tests place extreme demands on test equipment. The wide variety of functions and high flexibility of the system solution bring significant advantages:

- Precise analysis of the entire contact system and all actuators
- Joint operation of all devices and central data management with the ACTAS testing software
- Common test plan for controlling the individual test devices
- Stand-alone operation of each individual system for maximum flexibility
- Price advantage compared to all-in-one systems

Networking and flexible deployment of individual test devices allow all conventional measurements to be carried out with one test setup. Figure 2 shows the setup for testing an outdoor breaker. PROMET SE ohm meters are put into position on the main contact chambers and are connected to the ACTAS test instrument via a data line only.

Combining the switchgear test system with three ohm meters makes it possible to carry out dynamic and static resistance determinations on 6 interrupter units. In addition, the operating times of the main and resistive contacts of 6 interrupter units can be determined with the Dynamic Timing method. This is also possible when the switchgear device is earthed on both sides, ensuring that the most stringent safety criteria are fulfilled while considerably reducing the time and effort involved in cabling. With conventional measurement methods, resistance measurement is often only possible on one interrupter unit; for the outdoor breaker mentioned above this means that at least 6 measurements have to be made, taking up much more time.

Contact travel visualization

Unlike evaluation based on a simple binary signal, as is used in high-frequency measuring methods, the use of switchgear test systems in combination with ohm meters enables a sound diagnosis of interrupter units throughout the whole switching operation. The result of the measurement is displayed in the form of a curve which visualizes in detail all the events of a switching operation. This allows an accurate assessment of the start of travel and the final position of the contacts and even reveals time differences between the movements of the main and resistive contact.

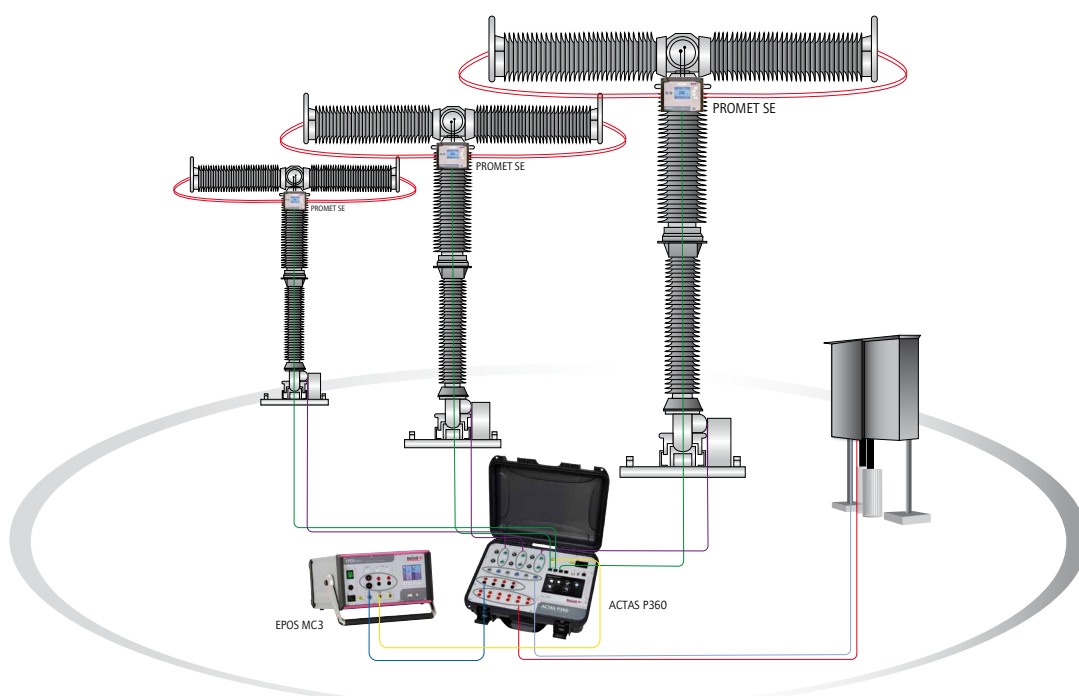


Fig. 2: Test setup for an outdoor breaker. ACTAS test instruments for circuit breaker testing, PROMET ohm meters and the EPOS MC3 motor and coil test system together make up the system solution offered by KoCoS for the automatic execution and evaluation of any conceivable test on a switchgear device.

Assessing the interrupter unit by analysing contact resistance

Regular measurements of the static and dynamic contact resistance allow an accurate assessment of the condition of the entire contact system. This ensures that maintenance requirements can be identified at an early stage and down times kept to a minimum. With the PROMET SE ohm meter, contact resistance measurements can be carried out on up to 6 main contact chambers and can be incorporated directly in the test procedure. The test current can be set to a maximum of 200 A. Even very low resistance values in the single-digit micro-ohm range can be measured extremely accurately. The measured values are used in the evaluation of tests and are included in the test report.

A high contact resistance within a switchgear device leads to high power loss coupled with thermal stress which can potentially cause serious damage to the switchgear device. Problems, such as high transfer resistance resulting from poor connections, can be identified by measuring static contact resistance. Dynamic contact resistance measurements can be used to determine the resistance characteristic during a freely definable switching operation. Measurements of this type give an indication of the length and state of the arcing contacts of high-voltage breakers, for example.

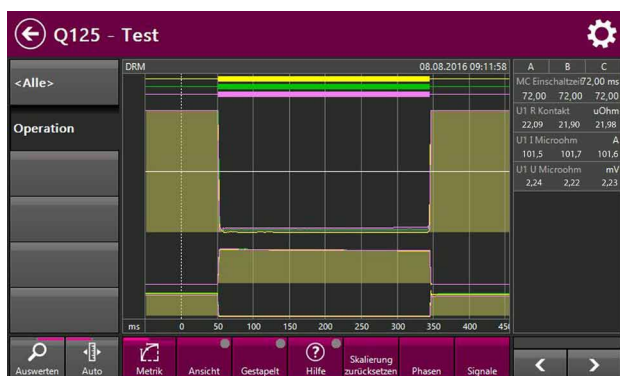


Fig. 3: Analysis monitor with DRM measurement. Regular measurements of the static and dynamic contact resistance allow an accurate assessment of the condition of the entire contact system.

Motor and coil tests

The ability to connect a powerful AC/DC voltage source makes it possible to test the correct functioning of the additional components of switchgear devices directly and independently of the station voltage. In combination with the EPOS MC3 motor and coil test system, analyses of motor and coil operation, through the determination of the minimum operating voltage and through testing undervoltage releases for coils, for example, are reproducible and can be carried out within a single test plan always under identical conditions.

Portable test systems with an integrated control panel

As well as being able to carry out the abovementioned measurements, modern test systems also need to score high on functionality, ergonomics and performance. The experience which KoCoS has drawn on for the development of the portable test systems ACTAS P260 and ACTAS P360 (ACTAS - Advanced Circuit Breaker Test and Analysing System) results from more than 20 years work in developing and manufacturing switchgear test systems and from close cooperation with network operators and switchgear manufacturers. An integrated control panel with touch screen, a streamlined operating concept and powerful hardware guarantee simple operation with optimum display of all information. The user interface is clear, well structured, self-explanatory and user-intuitive. All test parameters are displayed clearly and can be set directly. The measurement results are shown on the display together with the associated signatures enabling conclusions to be drawn directly as to the state of the switchgear device. Test reports can be produced in PDF format to document the test. The ability to control the test system using a smartphone, tablet etc. also allows the test instrument to be remotely controlled. This makes it possible to carry out measurements with the prescribed safety distance.

The number of analog and binary signals to be measured differs depending on the type and design of the specific switchgear device. The requirements for a test on a medium-voltage breaker with only one interrupter assembly per pole and a three-pole spring energy drive are of course much less exacting than for a test on a high-voltage breaker with four interrupter assemblies and a single-pole hydraulic drive. ACTAS P260 and ACTAS P360 are equipped to fulfil these different requirements.

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Fig. 4: ACTAS P260 (left) and ACTAS P360. The high-precision, portable stand-alone test systems can carry out function tests on various types of switchgear device, including circuit breakers, disconnectors or earthing switches, regardless of the type of drive unit.

Quick, easy handling, intuitive testing software

Direct integration in a rugged hard-top case makes a test system able to withstand dust and water. A low weight and compact dimensions are ideal for on-site use. The weight of cables and accessories should also be taken into account as many technicians travel all over the world with their portable test systems.

Time is often the limiting factor when preparing tests, connecting cables and carrying out tests on site. With ACTAS, tests can be prepared in full with all the necessary switchgear and test parameters. No further settings need to be made on site and the desired test can be carried out without delay. Once the device under test has been connected up to the test system, the test prepared in advance can be started and run immediately.

Configuration and analysis of tests are carried out with the aid of testing software and the control panel located on the test system itself or a PC. Test data and parameters can be imported or exported as required using a USB flash drive or network connection. The ACTAS testing software is the product of many years of practical experience and close cooperation with network operators and switchgear manufacturers. A graph of all measured signal characteristics, featuring zoom functions and measurement cursors, offers additional options for detailed analysis. This makes it easy for tests to be called up, edited or used as templates. Switchgear data and measurement results can be compressed and sent by e-mail, for example. Archiving the data in databases is child's play too.

Following fast test execution, modern devices should provide help in evaluating the measured results. It should be possible to set limits and there should be options for subsequent calculations or recalculations with the raw data from the test systems. At the end of a test, the test system should provide a test report directly.

The ACTAS testing software features a comprehensive help function to support users in the selection of the measurement results they require and the subsequent evaluation of those results. Descriptions and graphs facilitate the correct interpretation of the results obtained.

The software includes an option for automatically creating test reports to document test results. As well as results and curve characteristics of recorded signals, these reports can also comprehensively document switchgear data and test parameters.

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