

Application Note

Using Test System CAT+SAT for CB Testing

Test system CAT+SAT provides a complete set of functional tests for a circuit breaker including:

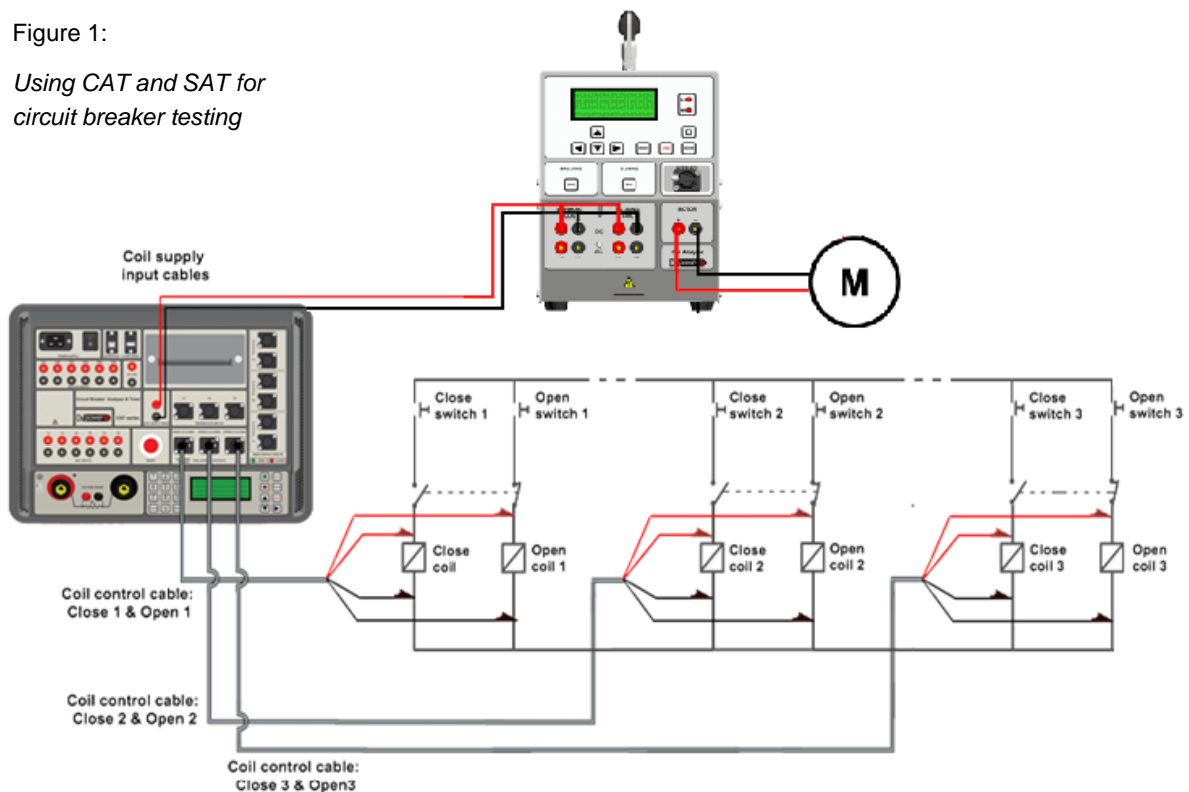
- Timing test,
- Contact resistance measurement (DRM and SRM),
- Undervoltage condition test,
- Motor test,
- Minimum trip voltage test,
- Coil resistance measurement.

All these tests are performed without change of connection during testing.

To establish the test system CAT+SAT and perform all above listed tests, the CAT and SAT devices should be connected to the circuit breaker auxiliary circuitry as shown in the Figure 1. The illustration below presents connection for CAT devices controlling independent-pole operated circuit breakers having a control circuit for each pole separately.

Figure 1:

Using CAT and SAT for circuit breaker testing





Note: Disconnect a substation battery supply from the control circuit of a circuit breaker!

Connections are made in the following way:

- MOTOR output of the SAT device is connected to the power terminals of the spring-charging motor;
- Both BREAKING and CLOSING outputs of the SAT device are connected to the COIL SUPPLY input at the CAT device;
- Both red test leads of the Coil control cables (from CAT analyzer) are connected to the "+" poles of the corresponding coils (cable labeled "TRIP" to the "+" pole of the trip coil and cable labeled "CLOSE" to the "+" pole of the close coil. Both black test leads of the Coil control cables are connected to the "-" poles of the corresponding coils or a common "-" pole. Described explanation is also applicable to a connection of the CAT devices used for independent-pole operated circuit breakers, but the three Coil control cables (instead of only one) should be connected to appropriate poles' control circuits.

Test system CAT+SAT without using PC

There are two testing modes with the test system CAT+SAT without using a PC:

1. Performing the tests supported by the CAT device, while the SAT device serves as a power supply for CB auxiliary circuit;
2. Performing tests supported by the SAT device, while the CAT device serves as a connection between the SAT and a circuit breaker under the test.

The first test mode

In the first testing mode the SAT is used as the power supply for the coils and motor, providing the voltage levels of up to 300 V DC or 250 V AC.

Start by selecting a corresponding menu in the **Main** menu (explained in [1]) on the SAT device (Figure 2), press **ENTER** to enter the menu, set the voltages (Figure 3) and then press **ENTER** to generate voltage at BREAKING/ CLOSING output or **MOTOR** button to generate voltage at **MOTOR** output. If **DC CAT** or **AC CAT** menu is selected, set the voltages for coils and motor (Figure 3) and press only the **MOTOR** button, SAT will supply the **MOTOR** output and **BREAKING/ CLOSING** output alternately in accordance with the requirements for coils or motor power supply. Details of using the SAT as a power supply for the auxiliary circuit of a circuit breaker is described in [1].

Figure 2:
Main menu in SAT
device



Figure 3:
DC CAT menu in
SAT device



With the voltage generated at the coils outputs (BREAKING/ CLOSING) of the SAT device (working as a power supply) it is possible to perform the following tests with the accompanying CAT device:

- Timing tests (O, C, CO etc.) at rated coil supply voltage,
- Undervoltage condition timing tests,
- Static resistance measurement (available for CATs with a built-in Micro Ohmmeter),
- Dynamic resistance measurement (available for CATs with a built-in Micro Ohmmeter)

Since SAT is a controllable power source, the rated coil voltage and minimum coil supply voltage (for undervoltage condition simulation) can be set and generated.

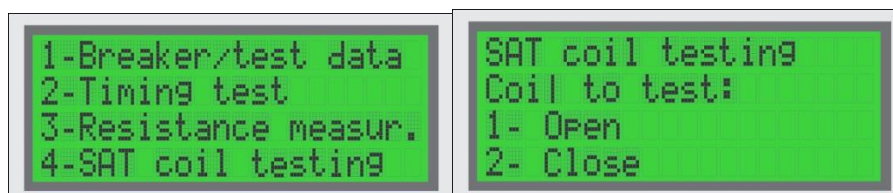


Note: *In first testing mode a motor test can also be performed by pressing the **MOTOR** button on the SAT device.*

The second test mode

In the second testing mode, the SAT works as a coil analyzer. Internal relays in the CAT device need to be closed to provide connection of the SAT coil outputs to the control circuit (to the trip and close coils) of the circuit breaker. To do this please select **SAT coil testing** menu in the **Main** menu (Figure 4 - left) of the CAT device. Then select coil which will be tested (Figure 4 - right). The CAT device used for controlling independent-pole operated circuit breakers offer a choice of selecting any of 6 coils (3 open and 3 close) to be tested.

Figure 4:
Main menu in CAT
device



After selection of the coil to test is done, following tests can be performed by the SAT device:

- Minimum trip voltage test,
- Coil resistance test,
- Undervoltage condition coil functional tests,
- Motor test.

Test system CAT+SAT using PC

To control the test system CAT+SAT by a PC please connect both CAT and SAT instruments to a PC using the USB cables. After running the DV-Win software on the PC, both devices should be detected. Please select option CAT+SAT, as shown in the Figure 5.

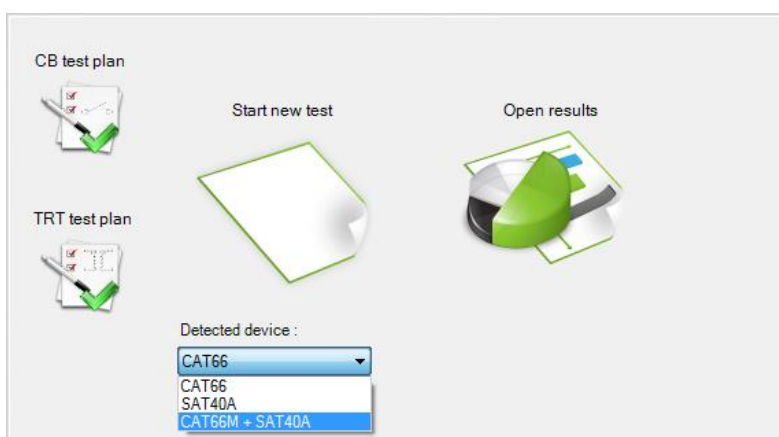


Figure 5. Detection of test system CAT+SAT

Using the DV-Win software, control of the test system CAT+SAT as well as performing tests is much easier. After selecting the **Start new test** (Figure 5) the window with settings and available tests will appear as shown in the Figure 6.

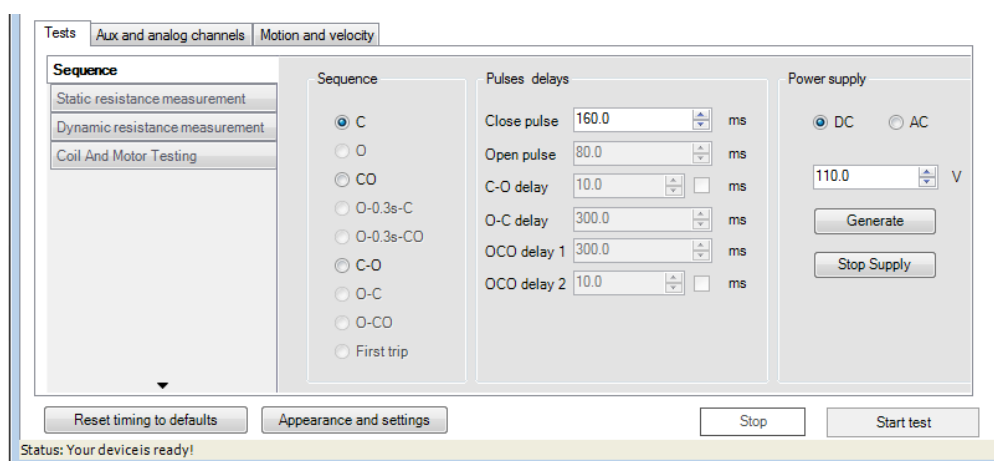


Figure 6. Setting test sequence and coil supply voltage

If the CAT supported tests (Sequence- timing tests or Dynamic Resistance Measurement) are to be performed, the SAT works as a power supply. The user is enabled to set the supply voltage for the coils in the **Power supply** field (as shown in the Figure 6). Prior to starting the test from the CAT device please select the **Generate** icon (as illustrated in the Fig.6) to provide the supply voltage from the SAT coil outputs.

If the **Coil and Motor testing** option is selected in the tab **Tests**, a list of tests available on the SAT device is displayed (Figure 7).

Setting the **Operating voltage** at the minimum standard value provides a condition to test the coils in the undervoltage situation.

Coil for which the **Minimum Trip Voltage** test or the **Resistance** test can be performed is automatically selected depending on the current circuit breaker state. If the circuit breaker is in the open position, these tests can be performed for Close coils and vice versa. If the circuit breaker is in the close position, these tests can be performed for the Trip (Open) coils.

If the operating mechanism is discharged, select the option **Motor** and press **Start test** to run the spring-charging motor. As a result, the **Motor** test provides a spring charging time and motor current values.

Figure 7. Coils and motor tests

REFERENCE

[1] *Using SAT Coil Analyzers as a power supply for circuit breaker testing with CAT series*, Application Note, DV Power, Stockholm 2016