

## Circuit Breaker Analyzer & Timer CAT126

- Robust design for field use
- Timing and motion measurement
- 12 timing channels (3x4) for main and resistive contacts
- 6 timing channels for auxiliary inputs
- 3 transducer input channels
- 4 additional analog input channels
- Built-in micro ohmmeter 500 A
- Dynamic resistance measurement
- Detailed analysis of test results using DV-Win software



### Description

Circuit Breaker Analyzer & Timer CAT126 is a standalone or a PC-controlled digital instrument for condition assessment of the circuit breakers. The timing channels record closing and opening of the main, resistor and auxiliary contacts. CAT126 records graphs of both the open and close coil currents and displacements of the HV and MV circuit breaker moving parts. The main contact channels can also measure the resistance value of the pre-insertion resistors (if present in the circuit breaker). Both sides grounded feature enables safe and fast testing in high voltage substations. Test results are printed on the 112 mm thermal printer (optional accessory) in tabulated and graphical form.

CAT126 provides an easy selection of different operational modes: Open (O), Close (C), Open-Close (O-C), Close-Open (C-O), and Open-Close-Open (O-C-O). Multiple operations, such as Open-Close and Open-Close-Open, can be initiated by using a predefined delay time or by sensing a breaker's contact position.

The circuit breaker operation can be initiated in different ways (for instance from a control room, by a local switch or externally by a testing device) depending on a testing condition. The several time measurement triggers are available to record a measurement in a various testing condition: an external trigger, analog channels, auxiliary channels and coil currents.

The auxiliary inputs are used to monitor dry and wet auxiliary contacts. The external trigger input can be used as the sixth auxiliary input.

The four analog channels measure and record the coil currents simultaneously (OPEN and CLOSE), up to 35 A DC.

The four additional analog channels have four selectable voltage ranges available ( $\pm 0,5$  V,  $\pm 2,5$  V,  $\pm 60$  V and  $\pm 300$  V AC/DC). They are used for monitoring of:

- circuit-breaker substation battery voltage,
- connection of the current clamps for "The first trip" monitoring test,
- other types of analog signals that may be relevant.

The three transducer channels are intended for measuring displacement of the circuit breaker moving parts, contact wipe, over-travel, rebound, damping time and an average velocity. Either an analog or a digital transducer can be connected to these universal channels.

DV-Win software provides acquisition and analysis of the test results, as well as control of all the CAT126 functions from a PC. Graphical presentation of a variety of measurements and timing test results uses cursors and powerful zoom functions for detailed analysis. Colors, grids, scales and positioning of the test data are all controlled by the user. DV-Win supports an automatic unit conversion (e.g.: cycles to seconds or mm to inches). The test records can be exported in .dwc file format for further analysis.

## Application

The list of the instrument application includes:

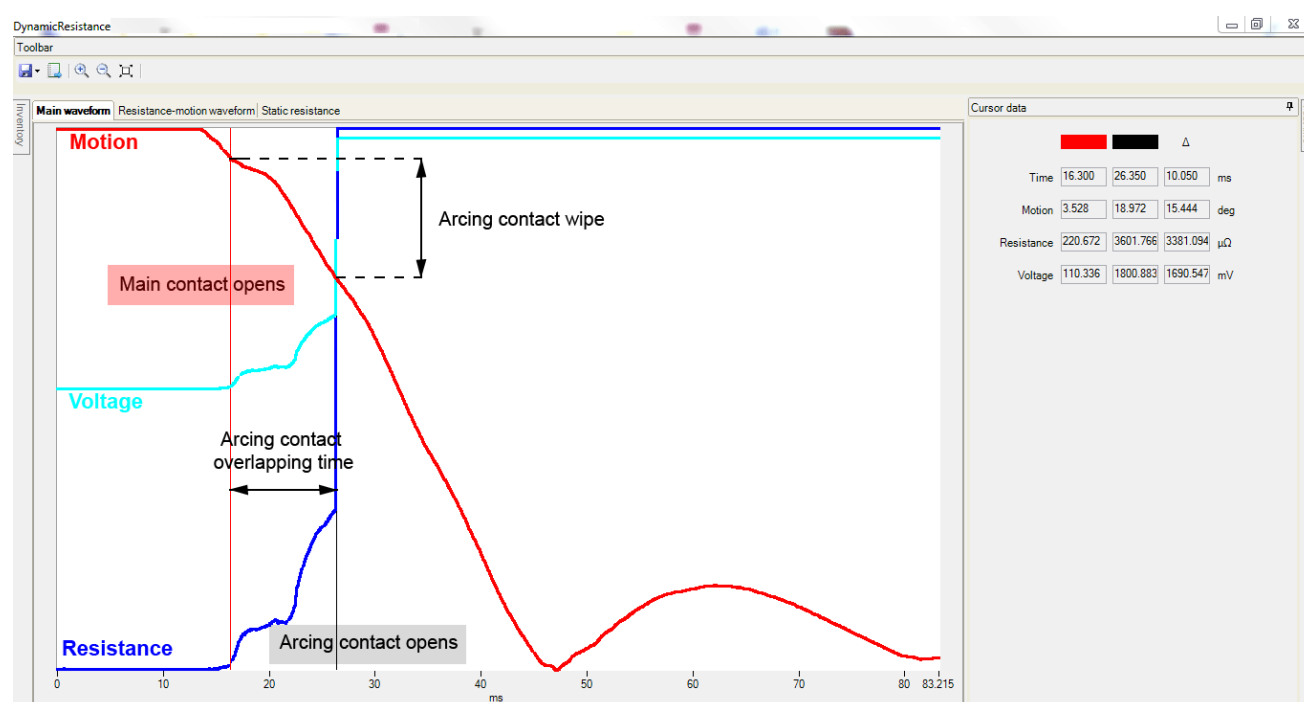
- A simultaneous measurement of 12 main contacts (4 breaks per a phase) including pre-insertion resistors (if present in the circuit breaker) and 6 auxiliary contacts,
- A resistance measurement of the pre-insertion resistors (if present in the circuit breaker),
- An evaluation of synchronization between the circuit breaker poles,
- A measurement of the coil currents, simultaneously for 4 coils,
- Evaluating the state of the substation's batteries by graphically showing the voltage value,
- A measurement of displacement, contact wipe, over-travel, rebound, damping time and average velocity of the breaker's moving parts,
- "First trip" test,
- Static resistance measurement,
- Dynamic resistance measurement

## First trip test

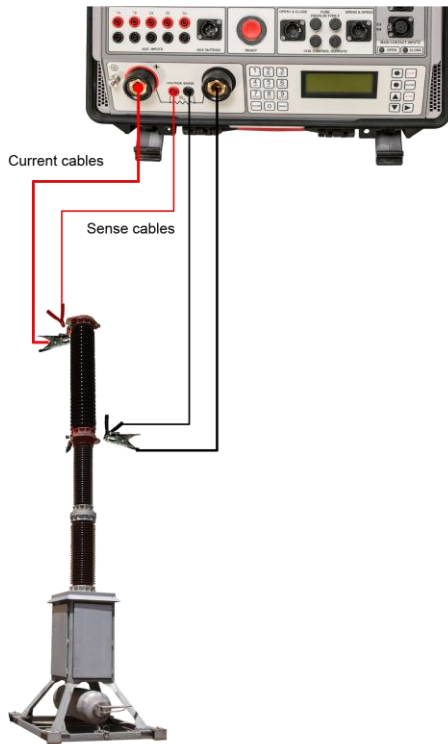
A "First trip" analysis is important to determine a condition of the coil operating mechanism. A circuit breaker spends most of its lifetime conducting a current without any operation. Once the protective relay detects a problem, the circuit breaker, that was idle for maybe a year or longer, has to operate as fast as possible. However, if the circuit breaker has not been operated for a long time, the latch friction may increase. Information about the latch friction can be obtained from the coil current waveform recorded during the "First trip" test.

## DRM (Dynamic Resistance Measurement)

The built-in micro ohmmeter can also be used for the DRM. The DRM test is performed by injecting a current through the breaker contact and simultaneously monitoring the voltage drop across the breaker contact as well as the current flow during the operation of the breaker. The DRM test requires the circuit breaker analyzer with a high resolution measurement. The resistance curve, as a function of a contact travel can be used to reveal potential problems related to the arcing contact condition. The injected current value should be as high as possible but not less than 100 A to provide a reliable voltage drop reading, thus allowing an easier detection of the arcing contact. This model provides up to 500 A.

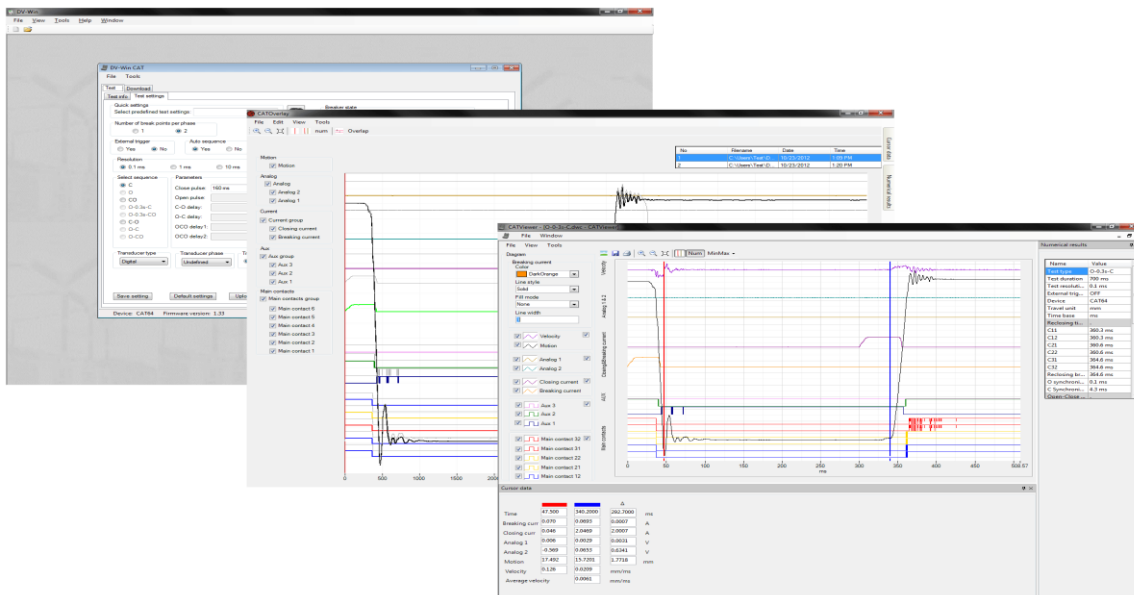


## Static resistance measurement



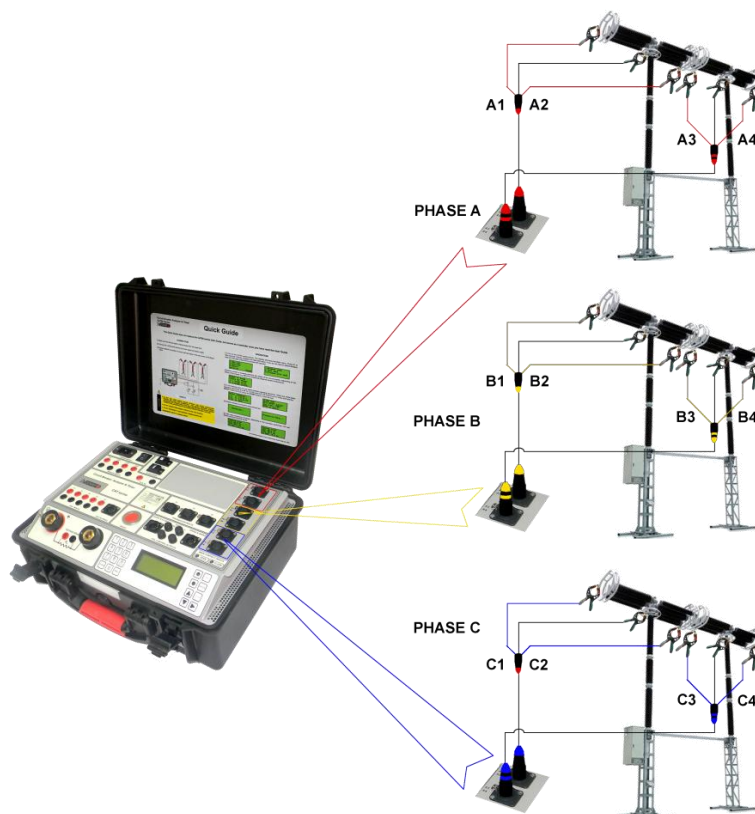
The built-in micro ohmmeter generates a true DC ripple free current with an automatically regulated test ramps. The resistance measurement is using the well known Kelvin's four point's method. The DC current is generated through the closed circuit breaker contacts. The voltage drop is measured between the terminals of the circuit breakers. The resistance is calculated using the Ohm's law  $R=U/I$ .

## DV-Win software



- Full control of the CAT functions from a PC.
- Downloading the test results from the instrument.
- Acquisition and analysis of the test results.
- The test results can be viewed, edited, saved, printed and exported.
- Viewing and overlaying several graphs, for an easy test result comparison.
- Selecting the measurement points and intervals using the two cursors.
- Zoom and pan graph feature.
- Specific test sequence setup.
- Customized configuration of the test result graphs.
- Creation of the predefined test plans for an easy and quick field testing.

## Connecting a test object to the CAT126



## Features

**Mains power supply input**  
90 V – 264 V AC;  
50 Hz – 60 Hz

**Flash drive**  
Used for direct download of  
test results on a USB  
memory stick

**PC communication**  
USB interface

**Thermal printer** (built-in 112 mm  
wide) Graphic and numeric printout  
of test results

**Analog channels  
inputs**  
Used for measurement  
of any type of analog  
signal that may be  
relevant.

**DC output**  
9 V DC supply for  
current clamps

**Auxiliary inputs**  
Used for timing of dry or  
wet auxiliary contacts

**External Trigger input**  
External trigger is used to  
start timing of the breaker  
when sensing a voltage.

**Micro Ohmmeter**  
(built-in 500 A DC micro ohmmeter)  
for static and dynamic contact  
resistance measurement

**READY button**  
Prepares the instrument  
for start of the test

**Alphanumeric keypad**  
Used for entering Breaker data,  
Test data and Control functions

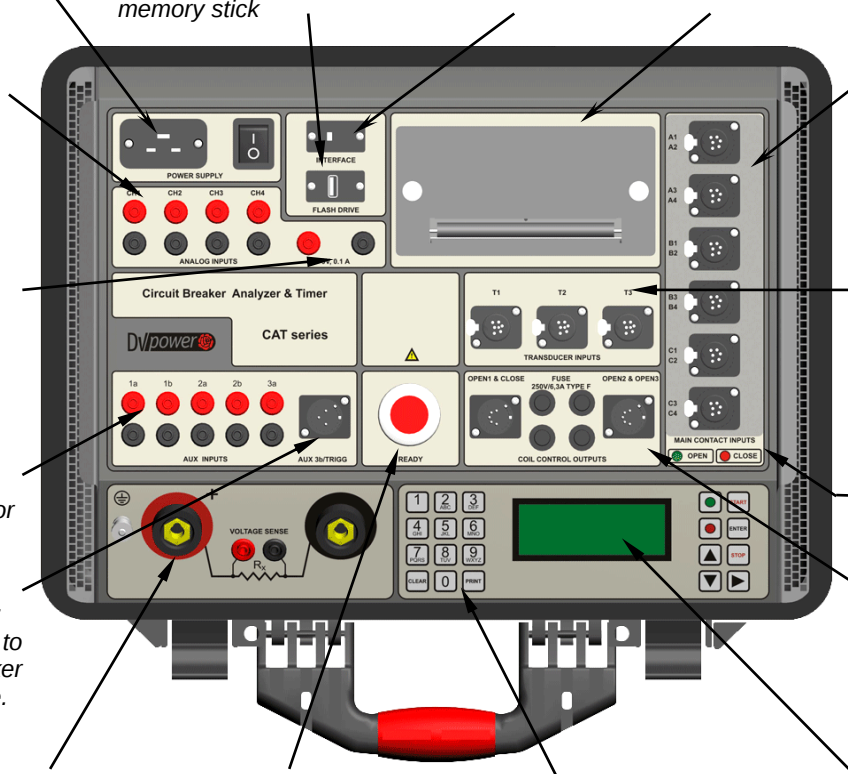
**Main contacts inputs**  
Used for timing of main  
and pre-insertion resistor  
contacts, and for  
resistance measurement  
of pre-insertion resistors

**Transducer inputs**  
Intended for measuring  
displacement of circuit  
breaker's moving parts

**Breaker state indicator**  
The state of circuit  
breaker is indicated

**Coil Control inputs**  
Used for operating of  
circuit breaker's OPEN  
and CLOSE coils

**LCD Screen**  
20 Characters by 4 Lines;  
LCD display with backlight,  
viewable in bright sunlight.



## Accessories

### Included

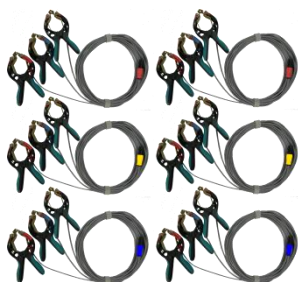
- DV-Win PC software
- Ground cable
- USB cable

### Recommended

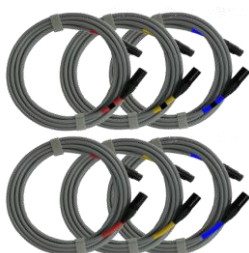
- Main contacts cables 5 m with TTA clamps
- Main contacts extensions cables 10 m
- External trigger cable 5 m with banana plugs\*
- Coil control cable set 5 m with banana plugs\*
- Auxiliary contacts cable set 5 m with banana plugs\*
- Analog channels cable set 8 x 5 m 2,5 mm<sup>2</sup> with banana plugs
- Current cables 2 x 5 m 50 mm<sup>2</sup> with battery clips
- Sense cables 2 x 5 m with alligator clips
- Cable plastic case - large size (2x)
- Cable bag

### Optional

- Thermal printer 112 mm (built-in)
- Thermal paper roll
- Main contact cable extensions 5 m
- Main contact cable extensions 15 m
- Digital rotary transducer with 5 m connection cable
- Linear analog transducer with 5 m connection cable
- Coil control cable set 10 m with banana plugs
- Auxiliary contact cable set 10 m with banana plugs
- External trigger cable 10 m with banana plugs
- Current cables 2 x 10 m 50 mm<sup>2</sup> with battery clips
- Sense cables 2 x 10 m with alligator clips
- Current cables 2 x 15 m 70 mm<sup>2</sup> with battery clips
- Sense cables 2 x 15 m with alligator clips
- Universal transducer mounting kit
- Test shunt 600 A / 60 mV
- Current clamp 30/300 A
- Cable plastic case with wheels - medium size
- Cable plastic case with wheels - large size



Main contacts cables 5 m with TTA clamps\*



Main contacts extensions cables 10 m\*



Coil control cable set 5 m with banana plugs\*



Auxiliary contacts cable set 5 m with banana plugs\*



External trigger cable 5 m with banana plugs\*



Analog channels cable set 8 x 5 m 2,5 mm<sup>2</sup> with banana plugs\*



Linear analog transducer with 5 m connection cable\*



Digital rotary transducer with 5 m connection cable



Universal transducer mounting kit



Current clamp 30/300 A



Cable plastic case - large size



Current & Sense cables

\*The above cables are also available in several lengths and terminations.

\*The above linear analog transducers are available in several lengths.

Please contact DV Power for more information

## Technical Data

### Main contact inputs

- Number of contact inputs: 12 (3 x 4), 4 per phase.
- Each channel detects main and pre-insertion resistor contacts.  
 Closed  $\leq 10 \Omega$ ,  
 Resistor contacts range 10  $\Omega$  to 10 k $\Omega$ ,  
 Open  $\geq 10 \text{ k}\Omega$   
 Open circuit voltage: 20 V DC  
 Short circuit current 50 mA
- Each channel measures resistance of pre-insertion resistors

### Coil driver

- Number of channels: 4 (3 Open and 1 Close coil)
- Four separate outputs for coil triggering
- Driver characteristics: 300 V DC max, 35 A DC max
- Electronic drivers: it provides superior timing control
- Overcurrent and overvoltage protection

### Breaker operation

- Close (C),
- Open (O),
- Close-Open (C-O),
- Open-Close (O-C),
- Open-Close-Open (O-C-O)
- First trip test

User can select any desired test sequence

### Universal transducer inputs

- 3 digital travel transducer channels  
 Digital rotary transducers: 2500ppr
- 3 analog travel transducer channels  
 Analog transducer input measurement resolution: 16 bit.  
 Internal supply for linear transducer: 5 V DC

### Analog inputs

- 4 channels – Coil current measurement
- 4 Voltage channels, each channel has four measurement ranges:  $\pm 0.5 \text{ V}$ ,  $\pm 2.5 \text{ V}$ ,  $\pm 60 \text{ V}$  and  $\pm 300 \text{ V AC/DC}$

The analog inputs are isolated with respect to all other circuits

### Static resistance measurement

- Built-in Micro Ohmmeter 500 A
- Current range 5 A - 500 A
- Max. load voltage 6.2 V
- Resistance range 0,1  $\mu\Omega$  - 999,9 m $\Omega$
- Resolution 0,1  $\mu\Omega$
- Accuracy  $\pm (0,1 \% \text{ rdg} + 0,1 \% \text{ FS})$

### Auxiliary inputs

- Number of channels: 6, galvanically isolated (external trigger input can be used as a sixth auxiliary input)
- User selectable: dry or wet
  - Contact sensing (dry):  
 Open circuit voltage 24 V DC,  
 Short circuit current 5 mA
  - Voltage sensing (wet):  
 Working voltage 300 V DC, 250 V AC  
 Low activation mode  $\pm 5 \text{ V}$   
 High activation mode  $\pm 10 \text{ V}$
- Overcurrent and overvoltage protection

### Time measurement

Time measurement resolution:

- 0,05 ms for 1 s test duration (sampling rate 20 kHz);
  - 1 ms for 20 s test duration (sampling rate 1 kHz);
  - 10 ms for 200 s test duration (sampling rate 100 Hz);
- Time accuracy 0,05% of the reading  $\pm$  resolution

### Current measurement

- Current measurement for Open and Close coil, 4 channels, Hall-Effect sensor
- Range  $\pm 35 \text{ A DC}$  to 5 kHz
- Accuracy  $\pm (0,5 \% \text{ rdg} + 0,1 \% \text{ FS})$
- Graphic presentation: currents waveform is displayed with resolution of 0,1 ms

### Time measurement triggers

- External trigger: 2 channels, input voltage: 10 V – 300 V AC/DC
- Coil currents: threshold level user selectable
- Auxiliary inputs
- Analog inputs: threshold level user selectable, positive or negative

### DC output

9 V / 0,1 A supply for current clamps

### Dynamic resistance measurement

- Voltage and current measuring channels
- DRM sampling rate 20 kHz (0,05 ms time resolution)
- Resolution 16 bit
- Breaker operations available for DRM test:  
 Open (O)

**Printer (optional)**

- Thermal printer
- Graphic and numeric printout
- Paper width 112 mm / 4.4 in

**Dimensions and weight**

- Dimensions: 480 mm x 197 mm x 395 mm (W x H x D)  
18.89 in x 7.75 in x 15.55 in
- Weight: 12,9 kg / 28.4 lbs

**Mains power supply**

- Connection according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 V - 264 V AC
- Frequency: 50/60 Hz
- Input power: 3900 VA
- Fuse 15 A / 250 V, Fast blow, but not user replaceable

**Applicable Standards**

- Installation/overvoltage: category II
- Pollution: degree 2
- Safety: LVD 2006/95/EC (CE Conform)  
Standard EN 61010-1
- EMC: Directive 2004/108/EC (CE Conform)  
Standard EN 61326-1:2006
- CAN/CSA-C22.2 No. 61010-1, 2nd edition, including Amendment1

**Environmental conditions**

- Operating temperature: -10 °C - + 55 °C / 14 °F - +131 °F
- Storage & transportation: -40 °C - + 70°C / -40 °F - +158 °F
- Humidity 5 % - 95 % relative humidity, non condensing

*All specifications herein are valid at ambient temperature of + 25 °C and recommended accessories.  
Specifications are subject to change without notice.*