Circuit Breaker Analyzer & Timer CAT34

- Simple and easy to operate
- Robust design
- Timing and motion measurement
- 3 timing channels (3x1) for main and resistive contacts
- 3 timing channels for auxiliary inputs
- 1 transducer input channel supporting digital and analog transducers
- 2 additional analog input channels
- Test results analysis and reports using DV-Win software

Description

Circuit Breaker Analyzer & Timer CAT34 can be used as a standalone or a PC-controlled digital instrument for circuit breakers condition assessment. The timing channels record closing and opening of the main, resistor, and auxiliary contacts. CAT34 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 preinsertion resistors (if present in the circuit breaker). Test results are printed on the 80 mm thermal printer (optional accessory) in tabular and graphical form.

CAT34 provides an easy selection of different operational modes:

- Trip (O)
- Close (C)
- Reclose (O-0.3s-C)
- Tripfree (CO)
- O-0.3s-CO
- Trip-Close (O-C)
- Close-Trip (C-O)
- Trip-Close-Trip (O-C-O)
- First trip (O)

Multiple operations, such as Trip-Close and Trip-Close-Trip, 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 from the test device) depending on a testing condition. Various time-measurement triggers are available to record a measurement under different testing condition:

- external trigger
- analog channels
- auxiliary channels
- coil control channel

The auxiliary inputs are used to monitor dry and wet auxiliary contacts. The external trigger input can be used as the additional auxiliary input. The two coil control analog channels can measure and record the coil currents simultaneously (TRIP and CLOSE), up to 35 A AC/DC.

The two additional analog channels have four selectable voltage ranges available (±0.5 V, ±2.5 V, ±60 V and ±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 transducer channels 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 this universal channel.

Features

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

5 - Auxiliary inputs
Used for timing measurement of dry or wet auxiliary contacts

6 - Motion transducer inputs
Intended for measuring displacement of circuit breaker’s moving parts

8 – PC communication
USB interface

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

13 - Alphanumeric keypad
Used for entering breaker data, test data and control functions

14 - LCD display
20 characters by 4 Lines; LCD display with backlight, viewable in bright sunlight

2 - Thermal printer (optional)
(Built-in 80 mm wide) Graphic and numeric printout of contact and travel wave form

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

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

7 – Analog channels inputs
Used for a voltage measurement of an analog signal that may be relevant

11 - Coil control outputs
Used for operating the circuit breaker’s TRIP and CLOSE coil

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

10 - Coil supply input
Voltage supply input for coil control

Application

The list of the instrument applications includes:

- Simultaneous timing measurement of up to 3 main contacts (1 break per phase) including pre-insertion resistors (if present in the circuit breaker) and 3 auxiliary contacts
- Resistance measurement of the pre-insertion resistors (if present in the circuit breaker)
- Evaluation of synchronization between the circuit breaker poles
- A measurement of the coil currents, simultaneously for 2 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
**Timing Measurement**

Timing measurement tests fulfills all the requirements stipulated in IEC 62271-100 and ANSI C37.04-1999. Synchronization between the circuit breaker poles during opening shall not exceed 1/6 of the rated frequency cycle (3.33 ms at 50 Hz; 2.78 ms at 60 Hz) and during the closing shall not exceed 1/4 of the rated frequency cycle as well (5.0 ms at 50 Hz; 4.17 ms at 60 Hz). Auxiliary contacts are mechanically driven by the operating mechanism and are used for control and indication of the main contacts state. There are no general requirements, related to timing measurement of auxiliary contacts, described in IEC® and ANSI® standards. Anyway, in order to assess condition of high-voltage circuit breakers, it is important to check their operation.

Type "a" contact is opened/closed when the circuit breaker main contacts are opened/closed, while type "b" contact is opened/closed when the circuit breaker main contacts are closed/opened.

Type "a" contact is connected in series to the trip coil. It interrupts the trip coil circuit when the circuit breaker opens. Type "b" contact is connected in series to the closing coil, interrupting the closing coil circuit when the circuit breaker closes.

*Connecting the main contact timing cables and auxiliary timing cables to a test object.*
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. Since the breaker is in service, the conventional way of offline timing measurement with timing cables across the interrupter cannot be used. Instead of the main contact timing cables, current clamps are used. These current clamps show current flowing through the secondary side of the current transformer in each phase. An instant when the current stops flowing reveals the breaker trip time.
**DV-Win**

DV-Win application software suite provides acquisition and analysis of the test results, as well as control of all the CAT34 functions from a PC. Graphical presentation of a variety of measurement 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.

**DV-Win Main Features**

- 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
Technical Data

Main contact inputs
- Number of contact inputs: 3 (3 x 1), 1 per phase
- Each channel detects Main and pre-insertion resistor contacts
  - Closed ≤ 10 Ω,
  - Resistor contacts range 10 Ω to 5 kΩ,
  - Open ≥ 5 kΩ
- Open circuit voltage: 20 V DC
- Short circuit current 50 mA
- Each channel measures resistance of pre-insertion resistors

Auxiliary inputs
- Number of channels: 3, galvanically isolated (external trigger input can be used as a third 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 300V DC, 250V AC
    - Low activation mode ±5V
    - High activation mode ±10V
- Overcurrent and overvoltage protection

Time measurement
- Time measurement resolution:
  - 0.1 ms for 2 s test duration (sampling rate 10 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 ± resolution

Breaker operation
- Close (C)
- Open (O)
- Close-Open (C-O)
- Open-Close (O-C)
- Open-Close-Open (O-C-O)
- First trip test
The user can select any desired test sequence

Coil driver
- Number of channels: 2 (Trip and Close coil)
- Two separate outputs for coil triggering
- Driver characteristics: 300 V DC max, 35 A DC max
- Electronic drivers provide superior timing control
- Overcurrent and overvoltage protection
- Coil supply input: 300 V DC max, 35 A DC max

Current measurement
- Current measurement for Trip and Close coil, 2 channels, Hall-Effect sensor
- Range ±35A DC to 5 kHz
- Accuracy ± (0.5 % rdg + 0.1 % FS)
- Graphic presentation: currents waveform is displayed with a resolution of 0.1 ms

Analog inputs
- 2 channels – Coil current measurement
- 2 Voltage channels, each channel has four measurement ranges: ±0,5 V, ±2,5 V, ±60 V and ±300 V AC/DC
The analog inputs are isolated with respect to all other circuits
Printer (optional)
- Thermal printer
- Graphic and numeric printout
- Paper width 80 mm (3.15 in)

Transducer input
- Digital transducer inputs: 1
- Analogue transducer inputs: 1

Time measurement triggers
- External trigger: 2 channels (trigger input voltage: 10 V – 300 V AC/DC)
- Coil currents: threshold level user selectable
- Auxiliary inputs (change of contacts state)

Dimensions and weight
- Dimensions (W x H x D):
  405 mm x 170 mm x 335 mm
  15.9 in x 6.7 in x 13.1 in
- Weight: 7 kg / 15.4 lb

Mains power supply
- Connection according to IEC/EN60320-1;
  UL498, CSA 22.2
- Mains supply: 90 V - 264 V AC
  Frequency: 50/60 Hz
  Fuse 2 A / 250 V, Fast blow, not user replaceable
  Input power: 250 VA

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

Environmental conditions
- Operating temperature:
  -10 °C to + 55 °C / 14 °F to +131 °F
- Storage & transportation:
  -40 °C to + 70°C / -40 °F to +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.
<table>
<thead>
<tr>
<th>Product Description</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main contacts cables 5 m (16.4 ft) with TTA clamps*</td>
<td>Main contacts extensions cables 5 m (16.4 ft)*</td>
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<tr>
<td></td>
<td>Coil control cable set 5 m (16.4 ft) with banana plugs*</td>
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<tr>
<td></td>
<td>Auxiliary contacts cable set 5 m (16.4 ft) with banana plugs*</td>
</tr>
<tr>
<td>External trigger cable 5 m (16.4 ft) with banana plugs*</td>
<td>Analog channels cable set 4 x 5 m (16.4 ft) with banana plugs*</td>
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<tr>
<td></td>
<td>Coil supply cable set 2 x 5 m (16.4 ft) 2.5 mm² (13 AWG) with banana plugs</td>
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<td></td>
<td>Current clamp 30/300 A</td>
</tr>
<tr>
<td>Digital rotary transducer with 5 m (16.4 ft) connection cable</td>
<td>Linear analog transducer with 5 m (16.4 ft) connection cable**</td>
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<td></td>
<td>Cable plastic case - large size</td>
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<tr>
<td></td>
<td>Cable plastic case with wheels - large size</td>
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<tr>
<td>Doble transducer adapter</td>
<td>Linear to rotary converter</td>
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<tr>
<td></td>
<td>Universal transducer mounting kit</td>
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<tr>
<td></td>
<td>Universal transducer mounting kit (extended version) + digital rotary transducer with accessories</td>
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</tbody>
</table>

*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.
## Order info

### Instrument with included accessories

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Circuit Breaker Analyzer &amp; Timer CAT34</td>
<td>CAT3400-N-00</td>
</tr>
<tr>
<td>DV-Win PC software including USB cable</td>
<td></td>
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<tr>
<td>Mains power cable</td>
<td></td>
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<tr>
<td>Ground (PE) cable</td>
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</table>

### Recommended accessories

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<tr>
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<tbody>
<tr>
<td>Main Contact Cables 5 m (16.4 ft) with TTA clamps</td>
<td>CM-05-34MXWC</td>
</tr>
<tr>
<td>Coil control cable set 5 m (16.4 ft) with banana plugs</td>
<td>CO-05-00C5B1</td>
</tr>
<tr>
<td>Coil supply cable set 2 x 5 m (16.4 ft) 2.5 mm²(13 AWG) with banana plugs</td>
<td>C2-05-02BPBP</td>
</tr>
<tr>
<td>Auxiliary contacts cable 5 m (16.4 ft) with banana plugs</td>
<td>CA-05-00C4B1</td>
</tr>
<tr>
<td>External Trigger Cable 5 m (16.4 ft) with banana plugs</td>
<td>CE-05-00C4B1</td>
</tr>
<tr>
<td>Analog channels cable set 4 x 5 m (16.4 ft) with banana plugs</td>
<td>C4-05-02BPBP</td>
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<tr>
<td>Cable bag (x2)</td>
<td>CABLE-BAG-00</td>
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</table>

### Optional accessories

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<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Main Contact Cables 3 m (9.8 ft) with TTA clamps</td>
<td>CM-03-65MXWC</td>
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<tr>
<td>Main Contact Cables Extension 5 m (16.4 ft)</td>
<td>E3-05-65MXFX</td>
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<tr>
<td>Main Contact Cables Extension 7 m (23 ft)</td>
<td>E3-07-65MXFX</td>
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<tr>
<td>Main Contact Cables Extension 10 m (32.8 ft)</td>
<td>E3-10-65MXFX</td>
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<tr>
<td>Main Contact Cables Extension 12 m (39.4 ft)</td>
<td>E3-12-65MXFX</td>
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<tr>
<td>Main Contact Cables Extension 15 m (49.2 ft)</td>
<td>E3-15-65MXFX</td>
</tr>
<tr>
<td>Main Contact Cables Extension 17 m (55.8 ft)</td>
<td>E3-17-65MXFX</td>
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<tr>
<td>Coil Control Cable 10 m (32.8 ft) with banana plugs</td>
<td>CO-10-00C5B1</td>
</tr>
<tr>
<td>Coil supply cable set 2 x 10 m (32.8 ft) 2.5 mm² (13 AWG) with banana plugs</td>
<td>C2-10-02BPBP</td>
</tr>
<tr>
<td>Auxiliary Contact Cable 10 m (32.8 ft) with banana plugs</td>
<td>CA-10-00C4B1</td>
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<tr>
<td>External Trigger Cable 10 m (32.8 ft) with banana plugs</td>
<td>CE-10-00C4B1</td>
</tr>
<tr>
<td>Digital rotary transducer 5 m (16.4 ft) with accessories</td>
<td>DRT-SET-0005</td>
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<tr>
<td>Digital rotary transducer 10 m (32.8 ft) with accessories</td>
<td>DRT-SET-0010</td>
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<tr>
<td>Linear analog transducer 150 mm (5.9 in) with 5 m (16.4 ft) connection cable</td>
<td>LAT-150-C305</td>
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<tr>
<td>Linear analog transducer 225 mm (8.9 in) with 5 m (16.4 ft) connection cable</td>
<td>LAT-225-C305</td>
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<tr>
<td>Linear analog transducer 300 mm (11.8 in) with 5 m (16.4 ft) connection cable</td>
<td>LAT-300-C305</td>
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<tr>
<td>Linear analog transducer 500 mm (19.7 in) with 5 m (16.4 ft) connection cable</td>
<td>LAT-500-C305</td>
</tr>
<tr>
<td>Current clamp 30/300 A with internal battery supply and extension 5 m (16.4 ft)</td>
<td>CACL-0300-08</td>
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<tr>
<td>Thermal printer 80 mm (3.15 in) (built-in)</td>
<td>PRINT-080-00</td>
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<tr>
<td>Thermal paper roll 80 mm (3.15 in)</td>
<td>PRINT-080-RC</td>
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<tr>
<td>Cable plastic case - small size</td>
<td>CABLE-CAS-01</td>
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<tr>
<td>Cable plastic case - medium size</td>
<td>CABLE-CAS-02</td>
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<td>Cable plastic case - large size</td>
<td>CABLE-CAS-03</td>
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<tr>
<td>Cable plastic case with wheels - medium size</td>
<td>CABLE-CAS-W2</td>
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<tr>
<td>Cable plastic case with wheels - large size</td>
<td>CABLE-CAS-W3</td>
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<tr>
<td>Transport case</td>
<td>HARD-CASE-LC</td>
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<td>Product Description</td>
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<tr>
<td>Universal transducer mounting kit</td>
<td>UTM-KIT-0000</td>
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<tr>
<td>Universal transducer mounting kit - extended version</td>
<td>UTM-KIT-0001</td>
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<tr>
<td>Linear to rotary convertor</td>
<td>LTR-CON-0000</td>
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<tr>
<td>Doble transducer adapter</td>
<td>DTA-BOX-C002</td>
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