

# Circuit Breaker Analyzer & Timer **CAT-P**

- Compact and ergonomic design - only 1,4 kg (3.1 lbs)
- Internal battery power supply (user replaceable)
- Battery operation for up to 8 hours
- Offline and Online (First trip test) measurement
- DC voltage and DC current measurement
- Coil control (via external module) for OPEN and CLOSE coil
- Touch screen color display 145 mm (5.7 in)
- On-site analysis of test results  
(overlay up to 4 records in graphical form)
- Test results analysis and comparison with  
results obtained from other CAT instruments using DV-Win software



## Description

Handheld Circuit Breaker Analyzer & Timer CAT-P is a digital instrument for circuit breakers condition assessment. CAT-P records timing graphs of main arcing contacts, DC substation battery voltage, Trip and Close coil currents. Main contacts operating time in on-line mode is calculated based on AC secondary CT's currents. The timing channels record closing and opening of the main contacts.

CAT-P provides an easy selection of different operating modes:

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

Before the start of the test, the current clamp needs to be connected to the auxiliary circuitry of the circuit breaker. The recording starts when the measured coil current reaches predefined threshold. The hooked DC current clamp measures the current through the auxiliary circuit, Trip or Close coil, depending on the initiated operation.

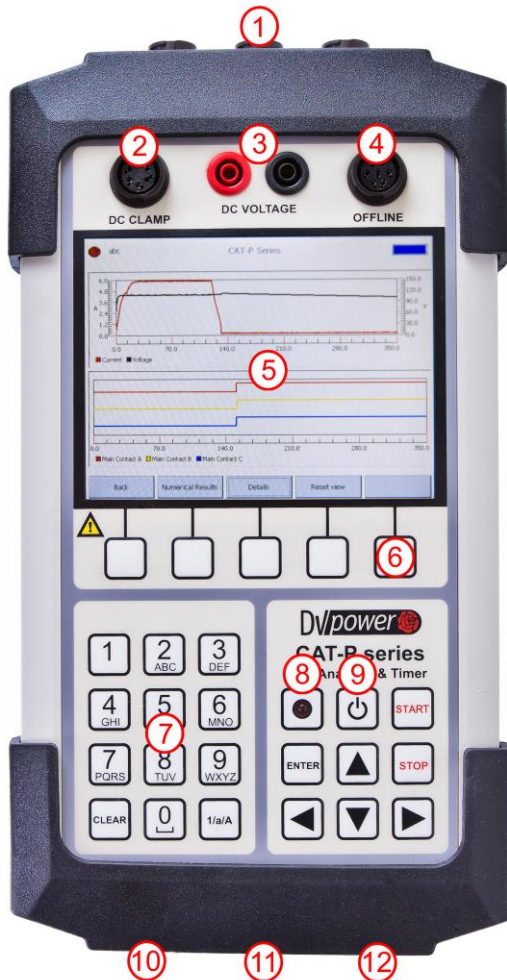
CAT-P is a powerful diagnostic tool for recording and analyzing:

- Trip/Close coils operation
- Main arcing contacts operation
- Auxiliary contact operation
- DC supply voltage
- Integrity of control circuit wiring

CAT-P displays numerical and graphical results (it can overlay up to 4 records in graphical form). This enables quick onsite analysis of potential defects by comparing the obtained test results.

**CAT Handheld series**  
**Circuit Breaker Analyzers & Timers**

## Features



### 1 - AC current clamp inputs

Used for recording AC current in Online mode.

### 2 - DC current clamp input

Used for a DC coil current recording and measurement.

### 3 - DC voltage channel input

Used for a voltage measurement of an analog signal.

### 4 - Main contacts input for offline measurement

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

### 5 - Touchscreen display

Touchscreen color display 5.7 in

### 6 - Soft keys

Used for selecting preferred (test) settings (options/menus) as an alternative to touchscreen.

### 7 - Alphanumeric keypad

Used for entering breaker data, test data and control functions.

### 8 - Power ON/OFF indicator

Indicates if the instrument is turned ON/OFF.

### 9 - Power ON/OFF button

Used for turning ON/OFF the instrument turning.

### 10 - DC power supply

12 V DC, 3 A

DC adapter 85-264 V AC (47-63 Hz) / 12 V DC

### 11 - Flash drive

Used for a direct download of test results on a USB memory stick.

### 12 - PC communication

USB interface for PC.



## CAT Handheld series Circuit Breaker Analyzers & Timers

## Application

The list of the instrument applications includes:

- Offline and online testing of circuit breakers - the onsite analysis of circuit breaker defects for immediate attention.
- Timing measurement of up to 3 main contacts (1 break per phase) including pre-insertion resistors (if present in the circuit breaker) and auxiliary contact.
- Resistance measurement of the pre-insertion resistors (if present in the circuit breaker).
- Main contacts bounce time measurement.
- Pre-trigger time measurement.
- A measurement and graphical display of the coil currents.
- Coil control (via external module – Coil Control Module) for actuation of circuit breaker's OPEN and CLOSE coil.
- Evaluating the state of the substation's battery (or other types of analog signals that may be relevant) by presenting the voltage value numerically and graphically.
- Online measurement (First trip test) as a fast and simple online test which can be performed by a single operator in around 10 minutes. The capture of the vital First trip operation through non-invasive connections while in the energized state.

### “First trip” test (Online test)

“First trip” test is important to determine a condition of the coil operating mechanism and give us information how would the circuit breaker perform in a real-life fault situation. Therefore capturing the first trip operation is essential to effective circuit breaker condition monitoring.

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 operation.

When 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, AC, DC current clamps and voltage sense cables are used. The AC current clamps show current flowing through the secondary side of the current transformer in each phase. They can indicate when the current flowing in the main circuit has been interrupted, which gives main contact time. The DC clamps are intended for measuring the DC coil current in auxiliary control circuit and can provide analysis of both the trip coil and main mechanism operation. The voltage sense cables are used for control voltage measurement and can provide a clear indication about the condition of the DC battery and corresponding wiring.

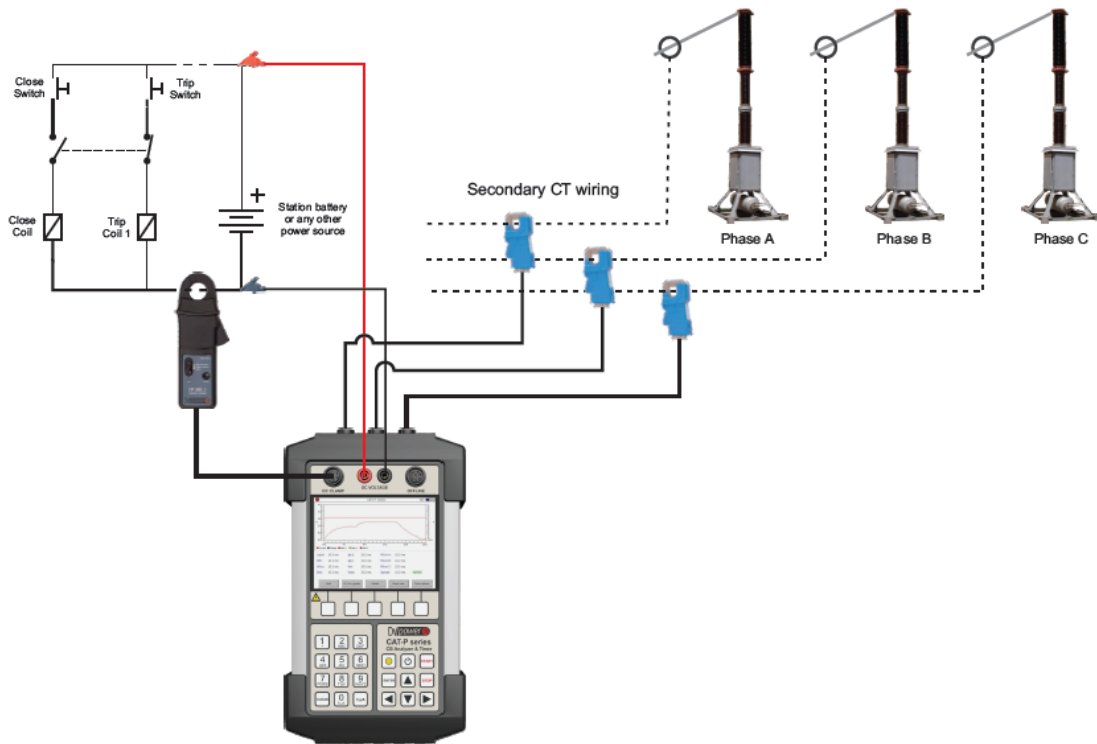


Figure 1. CAT-P connection to live tank circuit breaker with one breaking element per phase for Online testing

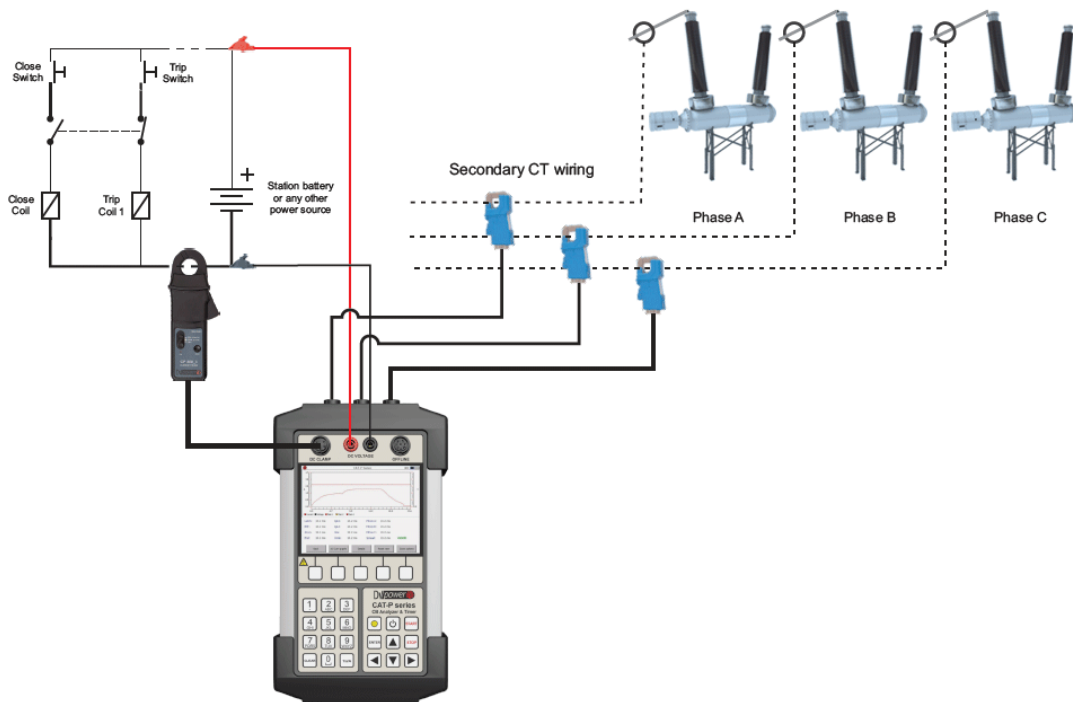


Figure 2. CAT-P connection to dead tank circuit breaker with one breaking element per phase for Online testing

## Timing Measurement (Offline test)

The CAT-P can be used in an Offline mode to measure the main arcing contact operating times when the circuit breaker is isolated from the power grid or is being tested at another location such as the manufacturer's premises or a maintenance workshop. When making Offline test connections circuit breaker needs to be disconnected or separated from its circuit on both sides of the breaker in accordance with the national safety regulations. The circuit breaker needs to be properly grounded to a protective ground.

Timing measurement tests fulfill all the requirements stipulated in IEC 62271-100 and ANSI C37.09.

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. However, in order to assess conditions of high-voltage circuit breakers, it is important to check their operation.

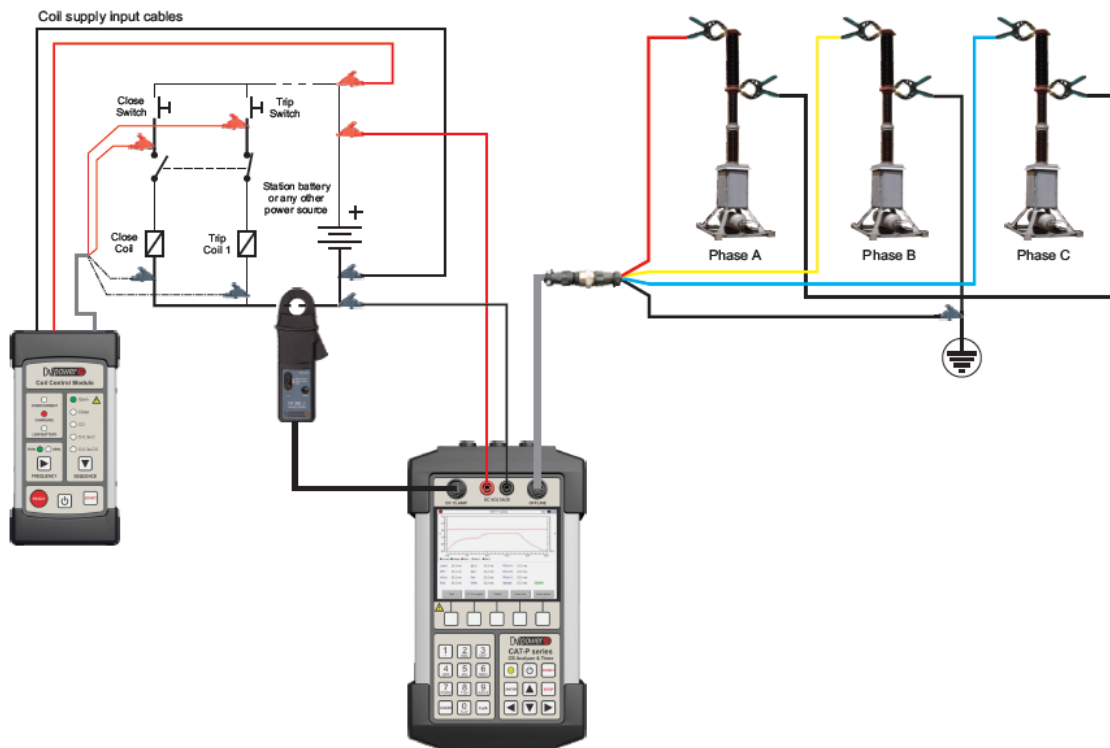


Figure 3. CAT-P and Coil Control Module connection to live tank circuit breaker with one breaking element per phase for Offline testing

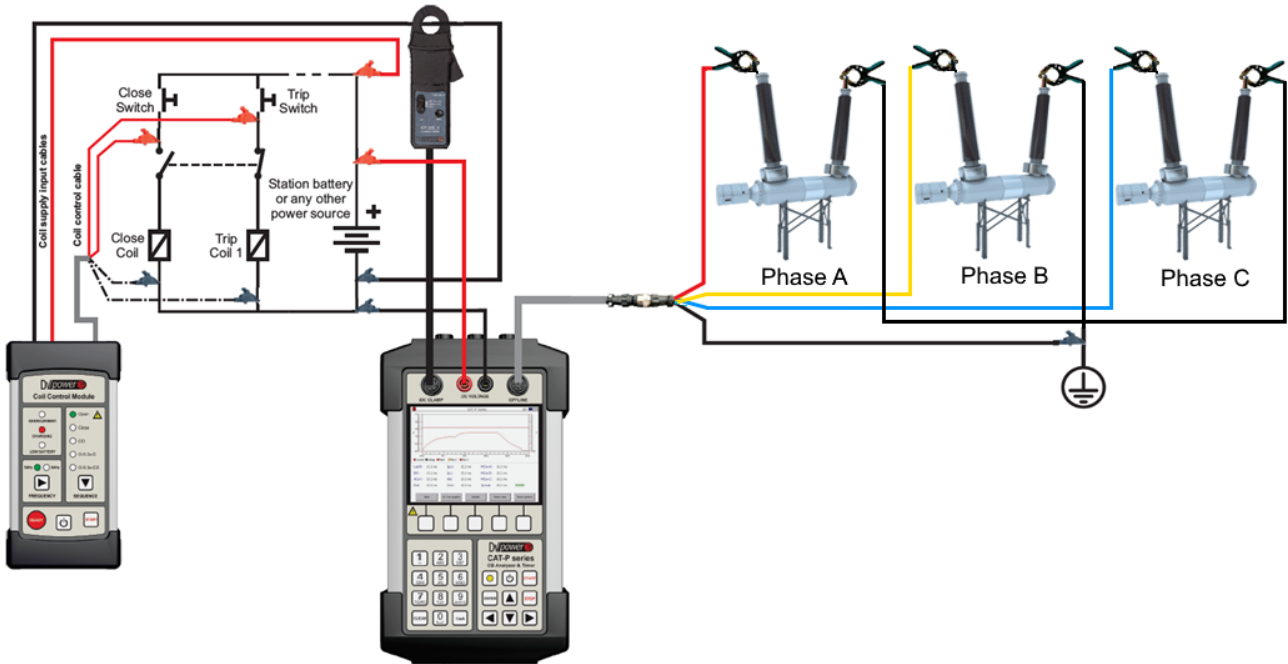
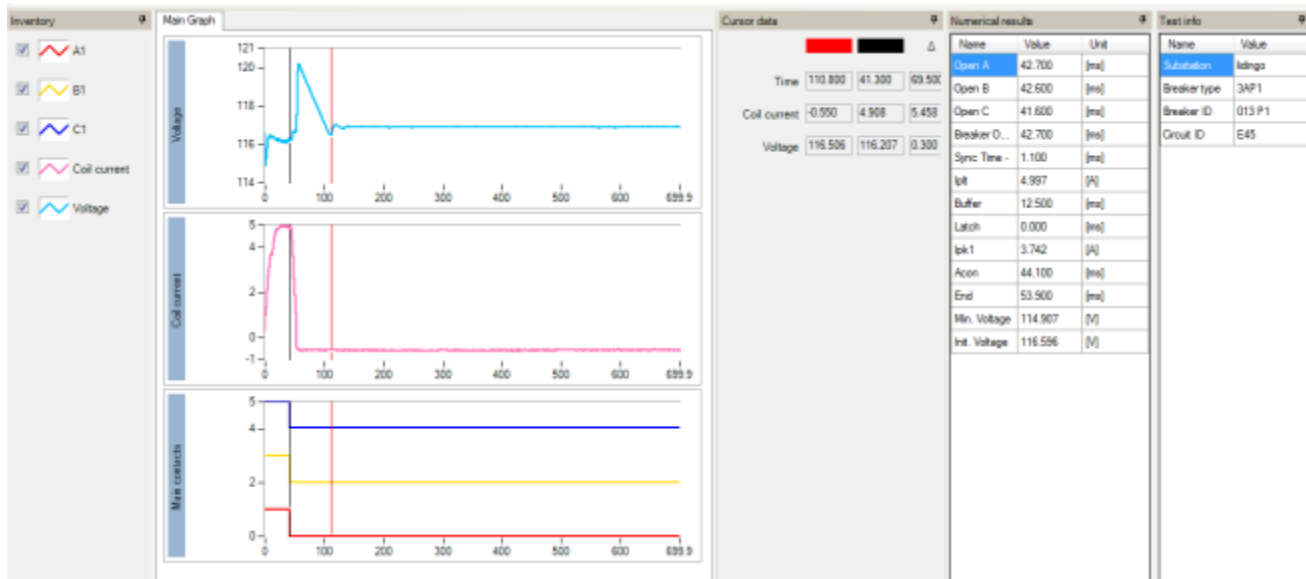


Figure 4. CAT-P and Coil Control Module connection to dead tank circuit breaker with one breaking element per phase for Offline testing

## DV-Win software

DV-Win software provides acquisition and analysis of the test results. 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 .catp file format for further analysis.



- Downloading the test results from the CAT-P to PC
- 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

## Technical data

### Main contact inputs

- Number of contact inputs: 3 (3 x 1), 1 per phase
  - Each channel detects Main contacts
    - Closed  $\leq 10 \Omega$
    - Resistor contacts range  $10 \Omega$  to  $5 \text{ k}\Omega$
    - Open  $\geq 5 \text{ k}\Omega$
- Open circuit voltage: 20 V DC  
Short circuit current 50 mA

### Time measurement

Time measurement resolution:

- 0,05 ms to 10 ms depending on test duration (sampling rate up to 20 kHz)

Time accuracy: 0,05% of the reading  $\pm$  resolution

### Breaker operation

- Close (C)
- Trip (O)
- Close-Trip (C-O)
- Trip-Close (O-C)
- Trip-Close-Trip (O-C-O)
- First trip test

### DC Current Clamps

- Nominal current: 300 A<sub>RMS</sub> or 450 A DC<sub>PK</sub>
- Measuring ranges: 30/300 A
- Frequency range: DC to 20 kHz (-3 dB)

### AC Current Clamps

- Measuring Range: 0,05 A to 5 A<sub>RMS</sub>
- Accuracy:  $\pm 3\% \pm 1 \text{ mV}$  (from 0,05 A to 0,5 A),  $\pm 1,5\% \pm 1 \text{ mV}$  (from 0,5 A to 1 A),  $\pm 1\%$  (from 1 A to 5 A)

### DC Voltage Measurement

- Range:  $\pm 300 \text{ V}$
- Typical accuracy:  $\pm 0,5\% \text{ RDG} \pm 0,5\% \text{ FS}$
- Guaranteed accuracy:  $\pm 1\% \text{ RDG} \pm 1\% \text{ FS}$

### Handset and inline power supply

- 12 V DC, 3 A
- Input: 90 – 264 V AC, 50/60 Hz

### Internal battery supply

- 2 x 3,7 V, 2900 mAh rechargeable and user replaceable Li-ion battery
- 8 hours under normal usage

### Display

- Touch screen color display 145 mm (5.7 in)
- Graphic and numeric results

### Applicable standards

- Safety:
  - Low Voltage Directive: Directive 2014/35/EU (CE conform)
  - Applicable standards, for a class I instrument, pollution degree 2, Installation category II: IEC EN 61010-1
- Electromagnetic Compatibility:
  - Directive 2014/30/EU (CE conform)
  - Applicable standard: EN 61326-1
- CAN/CSA-C22.2 No. 61010-1

### 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

### Dimensions and weight

- Dimensions (L x W x H):
  - CAT-P  
310 x 170 x 58 mm / 12.21 x 6.69 x 2.28 in
  - Coil Control Module  
228 x 115 x 53 mm / 8.98 x 4.53 x 2.09 in
- Weight:
  - CAT-P: 1,4 kg / 3.1 lbs
  - Coil Control Module: 0,6 kg / 1.32 lbs

### Warranty

- 3 years

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

## CAT Handheld series

### Circuit Breaker Analyzers & Timers





**Main Contact Cables 8 m (26.3 ft) with alligator clamps (A1)\***



**Main contacts connection 3 x 1 m (3.3 ft) and ground 2 m (6.6 ft) cable with alligator clamps (A1)\***



**Voltage sense cable set 2 x 5 m 2,5 mm<sup>2</sup> (16.4 ft, 13 AWG) with banana plugs\***



**Current clamp 30/300 A power supplied from the instrument with extension 5 m (16.4 ft)\***



**AC Current clamp 1 A / 1 V with cable 5 m (16.4 ft)\***



**Coil Control Module**



**Coil control cable set 5 m (16.4 ft) with banana plugs\***



**Coil supply cable set 2 x 5 m 2,5 mm<sup>2</sup> (16.4 ft, 13 AWG) with banana plugs\***



**Test probe with grip jaws (red, black)**



**Dolphin clip (red, black)**



**Plastic transport case for CAT-P**



**Plastic transport case for accessories**



**Cable bag**



**Power supply adapter**

*\* The cables are also available in several lengths and terminations. Please contact DV Power for more information.*

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Circuit Breaker Analyzers & Timers**

## Order info

| Instrument with included accessories  | Article No   |
|---|--------------|
| Handheld Circuit Breaker Analyzer & Timer CAT-P with DV-Win software including USB stick and mini USB cable, Resistive touch pen and Plastic transport case | CATP000-N-00 |
| Power supply adapter  |              |
| Recommended accessories   | Article No   |
| Main contacts cable set 8 m (26.3 ft) with alligator clamps (A1)  | CMP-08-SETA1 |
| Main contacts connection 3 x 1 m (3.3 ft) and ground 2 m (6.6 ft) cable with alligator clamps (A1)  | MC-CG-0302A1 |
| Voltage sense cable set 2 x 5 m (16.4 ft) 2,5 mm <sup>2</sup> (13 AWG) with banana plugs  | S2-05-02BPBP |
| Dolphin clip (black)  | DOLPIN-CL-B0 |
| Dolphin clip (red)  | DOLPIN-CL-R0 |
| Current clamp 30/300 A power supplied from the instrument with extension 5 m (16.4 ft)  | CACL-0300-09 |
| AC Current clamp 1 A / 1 V with cable 5 m (16.4 ft) (x 3)   | CACL-AC00-05 |
| Plastic transport case for accessories  | PLAST-CAS-00 |
| Optional accessories  | Article No   |
| Coil Control Module   | COCON-MOD-00 |
| Coil control cable 5 m (16.4 ft) with banana plugs  | CO-05-00C5B1 |
| Coil supply cable set 2 x 5 m 2,5 mm <sup>2</sup> (16.4 ft, 13 AWG) with banana plugs   | C2-05-02BPBP |
| Voltage sense cable set 2 x 2 m 2,5 mm <sup>2</sup> (6.6 ft, 13 AWG) with banana plugs  | S2-02-02BPBP |
| Voltage sense cable set 2 x 10 m 2,5 mm <sup>2</sup> (32.8 ft, 13 AWG) with banana plugs  | S2-10-02BPBP |
| Coil control cable 10 m (32.8 ft) with banana plugs   | CO-10-00C5B1 |
| Coil supply cable set 2 x 10 m 2,5 mm <sup>2</sup> (32.8 ft, 13 AWG) with banana plugs  | C2-10-02BPBP |
| Test probe with grip jaws (black)   | TESTPR-GJ-B0 |
| Test probe with grip jaws (red)   | TESTPR-GJ-R0 |
| Test probe with split test clamps (black)   | TESTPR-SC-B0 |
| Test probe with split test clamps (red)   | TESTPR-SC-R0 |
| Extension cable 5 m (16.4 ft) for AC Current clamp 1 A / 1 V  | CACL-ACE-N10 |
| Main contacts cable set 10 m (32.8 ft) with alligator clamps (A1)   | CMP-10-SETA1 |
| Main contacts cable set 8 m (26.3 ft) with alligator clamps (A2)  | CMP-08-SETA2 |
| Main contacts cable set 10 m (32.8 ft) with alligator clamps (A2)   | CMP-10-SETA2 |
| Main contacts cable set 8 m (26.3 ft) with SCT clamps   | CMP-08-SETST |
| Main contacts cable set 10 m (32.8 ft) with SCT clamps  | CMP-10-SETST |
| Resistive touch pen   | RSTCH-PEN-00 |
| Plastic transport case for CAT-P  | HARD-CASE-PP |
| Plastic transport case for accessories  | PLAST-CAS-00 |
| Cable bag   | CABLE-BAG-00 |
| Power supply adapter EU 3 A   | PWR-ADP3A-EU |
| Power supply adapter NA 3 A   | PWR-ADP3A-NA |
| Power supply adapter UK 3 A   | PWR-ADP3A-UK |
| Power supply adapter AU 3 A   | PWR-ADP3A-AU |

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### CAT Handheld series

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