CIRCUIT BREAKER ANALYZER & TIMER

CAT Standard series

(models: CAT03, CAT31, CAT34, CAT61 & CAT64)

Manual

Manual Version: M-CATSTA-113-EN
This Manual refers to the firmware versions 3.xx and 5.xx
This Manual refers to CAT03, CAT31, CAT34, CAT61 and CAT64 models
Publishing date: 2022-11-02

Contents

1. Introduction

This Manual provides helpful instructions on how to use the CAT03, CAT31, CAT34, CAT61 and CAT64 (hereafter referred as CAT) instruments safely, properly, and efficiently.

The following instructions will help the user avoid dangerous situations, reduce maintenance costs and will ensure reliability and durability of the CAT instrument.

The CAT must be used in accordance with all existing safety requirements and regulations based on national/local standards for accident prevention and environmental protection. In addition, the relevant international standards are listed in the “Technical Data” section of this document.

1.1. Safety Instructions

Safety is the responsibility of the user. Before operating the CAT, please read the following safety instructions carefully.

It is not recommended to operate any CAT instrument (or even turn on) without careful observation of the instructions listed in this Manual. The CAT should only be operated by trained and authorized personnel.

1.1.1. Safety Terms and Symbols

Terms in this Manual

These terms may appear in the Manual:
WARNING: Warning statements identify conditions or practices that could result in injury or loss of life.
CAUTION: Caution statements identify conditions or practices that could result in damage to this product or to other property.

Terms on the Device

The following warning terms used in this document may appear on the device:
WARNING- indicates that potential hazard may occur.
CAUTION- indicates that potential damage may occur to the instrument or to the test object connected to the instrument.

Symbols on the Device

The following symbols may appear on the device:

Refer to Manual

Protective Earth Terminal

1.1.2. Terms of Use

- The CAT shall be used only if it is in a good technical condition. Its use shall be in accordance with the local safety and industrial regulations. Adequate precautions must be taken to avoid any risks related to high voltages associated with this equipment and nearby objects.
- The CAT shall be used only for the application purposes described in the ”Intended Use” section. The manufacturer and distributors are not liable for damage resulting from wrong usage. The user bears responsibility for not following the instructions defined in this document.
- Do not remove the protective casing of the CAT.
- All service and maintenance work must be performed by qualified personnel only.

1.1.3. Orderly Practices and Procedures

- The Manual shall always be available on the site where the CAT is used.
- Before using the CAT, all personnel (even personnel who only occasionally, or less frequently, work with the CAT) assigned to operate the CAT should read the operations Manual.
- Do not make any modifications, extensions, or adaptations to the CAT.
- Use the CAT only with the original accessories provided by the manufacturer.
- Use the CAT and its original accessories for the device’s intended use only.

1.1.4. Instrument Maintenance

The device should be kept clean in order to prevent excessive cases of dust or other contaminants from affecting its operation. It should be cleaned with water/isopropyl alcohol after any dirt/contaminants are noticed on its surfaces.

1.1.5. Battery Maintenance

Due to the presence of lithium in the Li-ion batteries, improper handling can lead to ignition or even explosion of the battery. With proper handling of DV Power devices during operation and storage, and proper disposal of worn batteries used in DV Power devices, the possibility of a negative outcome is minor.

- The battery must be charged only through the instrument IEC power socket with a power supply input of 90 V – 264 V AC; 50 / 60 Hz.
- The battery should only be charged while the ambient temperature is between 0°C to 40°C.
- Do not remove the Li-ion battery from the device. The battery may only be removed by DV Power Authorized Service Center.
- Avoid storing the battery-operated CAT Standard Series device in temperatures below freezing. Storing the unit within a location that is both dry and cool may improve the battery life.

The battery-operated CAT Standard Series devices contain a Li-ion battery pack.

- Do not try to remove the Li-Ion Battery Pack.
- Do not heat the battery, nor dispose the battery in a fire.
- Do not damage, disassemble, nor modify the battery. If the battery is tampered with, it may cause the battery to ignite or heat excessively.
- Do not expose the battery to any form of liquid.
- Avoid exposing the battery to mechanical shocks and excessive heat.

1.1.6. Operator Qualifications

- Testing with the CAT should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction or education on the CAT should remain under the constant supervision of an experienced operator while working with the test set and the test object.

1.1.7. Safe Operating Procedures

- Hazardous voltages of up to 400 V can occur inside the CAT. Therefore, it is not permitted to remove the protective casing of the CAT.
- Before putting the CAT into operation, check the test set for any visible damage.
- Do not operate the CAT in wet or moist conditions (condensation).
- Do not operate the CAT if explosive gas or vapors are present.
- Only those external devices which meet the requirements for SELV equipment according to EN 60950 or IEC 60950 should be connected to the CAT through the serial interface.
- Removing the CAT protective casing will void the warranty. Any work inside the instrument without prior authorization from DV Power will also void the warranty.
- If the CAT seems to be malfunctioning, please contact the DV Power Support Team (refer to the “Manufacturer Contact Information” section) after previously checking the “Error Messages” section.
- Prior to connecting the CAT, ensure that the circuit breaker (object) to be tested is completely isolated from both the line and the load. Every terminal should be checked and verified before connecting the CAT.
- Do not use the CAT without the extra protective ground cables supplied with the device. It must never be operated in a non-grounded configuration as this may result in an electrical shock to the user or damage to the CAT. Always establish this connection first before establishing any other connections and remove this connection as the very last one.
- Cables between the CAT and any other equipment should be connected and disconnected from the CAT only while the instrument is switched off.

1.1.8. Disposal

DV Power instruments and its accessories are intended for professional use and are not intended for household use. As such they should not be disposed of with waste that was intended for household use.

For customers inside of the EU/EEA member states area
DV Power instruments and accessories are subject to the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE). When disposing DV Power instruments and accessories please use your local WEEE collection systems. Instruments and accessories can be returned to DV Power for disposition and treatment of WEEE.

For customers outside of the EU/EEA member states area
It is important to follow guidelines that are prescribed for disposal of WEEE in the according country. Dispose of DV Power instruments and accessories according to local legal requirements.

1.2. Power Supply

- Supply the CAT only from a power outlet equipped with the protective ground.
- Besides being supplied from phase – neutral (L1-N, A-N), the CAT may also be supplied from phase to phase (e.g., L1-L2; A-B). However, the voltage must not exceed 264 V AC. Please refer to the “Technical Data” section of this document.
- Take care to position the CAT in such a way that it is possible to safely disconnect it from the power supply at any moment.

WARNING / AVERTISSEMENT

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Il s'agit d'un produit de classe A. Dans un environnement domestique, ce produit peut provoquer des interférences radio, auquel cas l'utilisateur peut être amené à prendre des mesures adéquates.

1.3. Measurement Category

The CAT is intended to be used for measurements in Measurement Category I (CAT I) for voltages up to 300 V on analog inputs. The device is also designed to withstand occasional transient overvoltage up to 1000 Vpk.

WARNING / AVERTISSEMENT

This equipment is classified as measurement category I and must not be used within measurement category II, III and IV.

Cet équipement est classée dans la I catégorie de mesure, et ne doit pas être utilisé pendant les catégories de mesure II ,III et IV.

1.4. Intended Use

The CAT is designed for condition assessment of HV/MV circuit breakers in electric utilities and industrial facilities.

Typical applications are:

- Measurement of the operating time of up to 6 circuit breaker main contacts (two break per phase) and 3 auxiliary contacts, including pre-insertion resistor contacts (if present in the circuit breaker),
- Resistance measurement of the pre-insertion resistor contacts,
- Synchronization (simultaneity) evaluation between the circuit breaker poles and phases,
- Measurement of open and close coil currents (available with CAT31, CAT34, CAT61 and CAT64),
- Evaluating the state of the substation's power supply by graphically showing the voltage value profile (available with CAT34 and CAT64),
- Measurement of total travel, over-travel, rebound, contact wipe and average velocity of the breaker's moving parts (available with CAT34 and CAT64),
- Display and printing of test results, both numeric and graphical.

CAUTION: Any use of the CAT other than mentioned above is being considered improper and will void the warranty and exempt the manufacturer from its liability for repair or exchange.

2. Description

2.1. CAT Standard series instruments

CAT Standard series includes: CAT03, CAT31, CAT34, CAT61 and CAT64 instruments.

CAT03:

- 3 timing channels (3x1) for main and pre-insertion resistor contacts
- Resistance measurement of pre-insertion resistors
- Results printed on 58 mm thermal printer
- Detailed analysis of test results using DV-Win software
- Simple & easy to operate

CAT31, CAT61:

- 3 (CAT31) and 6 (CAT61) timing channels and for main and pre-insertion resistor contacts
- 3 timing channels for auxiliary inputs
- Trip & Close coils current measurement
- Resistance measurement of pre-insertion resistors
- Results printed on 58 mm thermal printer
- Detailed analysis of test results using DV-Win software
- Simple & easy to operate

CAT34, CAT64:

- 3 (CAT34) and 6 (CAT64) timing channels for main and pre-insertion resistor contacts
- 3 timing channels for auxiliary inputs
- Trip & Close coils current measurement
- Timing and motion measurement
- Resistance measurement of pre-insertion resistors
- 4 Analog Inputs + 1 Transducer Input
- Supports both digital and analog transducers
- Results printed on 58 mm thermal printer
- Detailed analysis of test results using DV-Win software
- Simple & easy to operate

2.2. Front Panel Components

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

2 – Battery charging Indicator (optional)
Indicates whether the battery is completely charged or being charged.

3 – On /Off LED Push button
Turn On/Off the CAT device.

4 – Thermal printer (optional)
(Built-in 58 mm wide) Graphic and numeric printout of contact and travel wave form.

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

6 – 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 – Auxiliary inputs
Used for timing measurement of dry or wet auxiliary contacts.

8 – Motion transducer inputs
Intended for measuring displacement of circuit breaker's moving parts.

9 – 24 V DC output
Used for current clamp supply.

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

11 – PC communication
USB interface.

12 – Flash drive
Used for a direct download of test results on a USB memory stick.

13 – Coil supply input
Voltage supply input for coil control.

14 – Coil control outputs
Used for operating the circuit breaker's TRIP and CLOSE coil.

15 – Breaker state indicator
Indicates CLOSE or OPEN breaker.

16 – Earth (ground terminal)

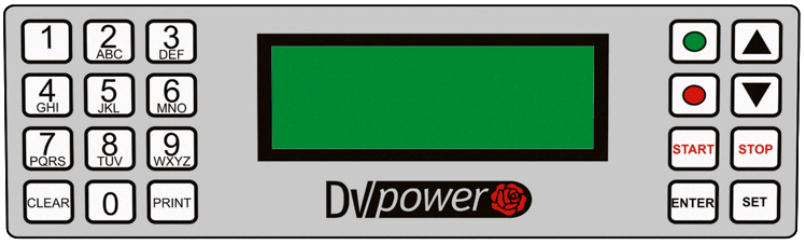
17 – Alphanumeric keypad
Used for entering breaker data, test data and control functions.

18 – LCD display
20 characters by 4 Lines; LCD display with backlight, viewable in bright sunlight.

19 – READY button
Prepares the instrument for the start of the test.

Alphanumeric Keypad

Allows users to make menu selections, enter alphanumeric data for Breaker Data, Test Data, define the timing test, initial setup, value of memory location, select and confirm operating sequences etc.



CLEAR button

Press to delete the selected memory location.

PRINT button

Test results can be printed using the ***PRINT*** button.

UP/DOWN buttons

Press the ***UP/DOWN*** buttons to navigate through the active menu and set test parameters.

SET button

The ***SET*** button is used to go to next page of settings.

STOP button

Press the ***STOP*** button to stop a test, stop the alarm buzzer, or return to the previous menu.

START button

Press the ***START*** button to start a test

Test parameters must be selected beforehand. To start a test the ***START*** must be pressed simultaneously with the ***READY*** button.

ENTER button

Use the ***ENTER*** button to confirm the edited values for the breaker data, test data, timing test parameters, time and date, time base, or to view the memory location.

READY button

Press and hold the ***READY*** button and then press ***START*** to start a test.
This is an additional safety feature.

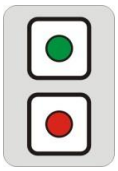
Signalization LEDs

Battery indicator LED

One LED indicator with interchangeable colors is used for indicating the battery status of the device.

- Turned OFF LED indicates that the device is not connected to the Mains power supply.
- Orange color indicates the battery is being charged (connected to the Mains power supply).
- Green color indicates the battery is completely charged.
- Red color indicates that there is a problem with the battery charger and/or that the device is not charging properly.

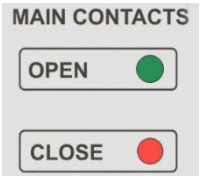
CAT Status LEDs



Two LED indicators are used to indicate the status of the CAT device, and its test progress:

- Green LED – Lights continuously when the CAT is turned on.
- Red LED – Flashes when the test is started and lights continuously in case of an operational error.

Breaker State Indicator LEDs



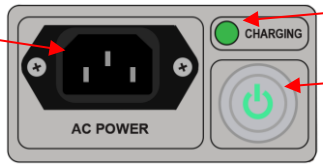
• Green LED is continuously ON to indicate the OPEN state of the circuit breaker.
• Red LED is continuously ON to indicate the CLOSE state of the circuit breaker.

Both Green and Red LED are ON continuously when the CAT cannot determine the state of the breaker.

Mains Power and Connectors

Note: To turn ON /OFF the CAT device (battery-operated), **PRESS** and **HOLD** the push ON /OFF button on the front panel of the device for **two (2) seconds.**

Connector for the mains power supply and charging of the internal battery



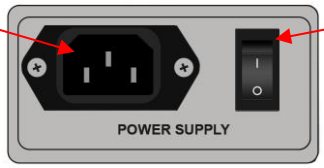
Battery charging LED indicator

Power switch ON /OFF

LED ON The device is turned ON.
LED OFF The device is turned OFF.

Figure 2-1: Mains power connector and device switch on CAT Standard Series (battery operated)

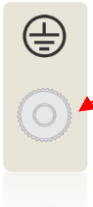
Connector for the mains power supply



Power switch ON /OFF

0 In this position, the CAT is separated from the mains power supply with both poles.
I In this position, the CAT is connected to the mains power supply.

Figure 2-2: Mains power connector and device switch on CAT Standard Series (without internal battery power supply)



Earth/ground connector

For protection against parasitic currents or voltages, always connect the CAT earth/ground connector to protective ground (PE). Use only the originally provided cable.

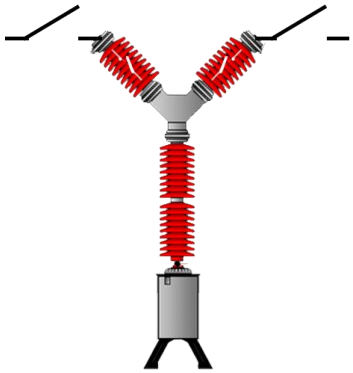
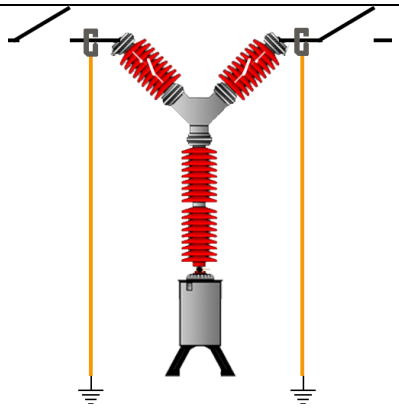
WARNING: For safety reasons, always establish earth/ground connection as the first step before establishing any other connections and disconnect it as the very last one.

3. Getting Started

3.1. Connecting CAT Standard Series Instrument to Test Object

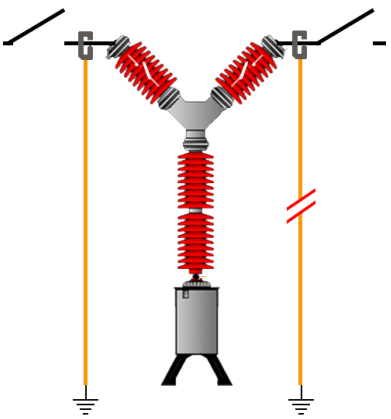
Before connecting the CAT to a circuit breaker, make sure that:

- The circuit breaker is disconnected or separated from its circuit on both sides of the breaker in accordance with the national safety regulations; **always comply with local safety regulations when using the CAT.**
- The breaker is properly grounded to a protective ground (PE).
- CAT itself is properly grounded. To do this, connect the grounding screw of the CAT to a PE using only the originally provided grounding cable.

		
1	**2**	**3**

Note: If BSG timing measurement feature is not available, conventional method for ground connection (figure below) must be applied:

- Circuit breaker must be grounded on both sides when the measuring leads are being attached.
- The ground must be removed on one side of the breaker for the test.
- The ground connection should always remain in place on the side on which there is the greatest danger of capacitive or inductively coupled voltages.



With the CAT turned off, connect it to the circuit breaker with its appropriate cables.

CAUTION: ***Cables between the CAT and other equipment should be connected and removed ONLY when the CAT is switched off.***

WARNING: ***Always connect the measuring cables to the CAT first and then to the test object; and when disconnecting always disconnect the cables from the test object first and after that from the CAT. The grounding wire PE should be disconnected last. Failure to do this may result in serious injury or even loss of life.***

3.1.1. Main Contacts Cable Connections

To simplify on-site hookup of the main contact timing cables, the CAT series instrument comes with a convenient cable set. Cable set for two breaks per phase is described first. This cable set comes with **CAT61** and **CAT64** devices.

	Cable set for the Phase A is labeled with a red colored connector mark (red ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of two breaks per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**A1**), red clamps with blue label (**A2**) and black clamps with black label (**N**).
	Cable set for the Phase B is labeled with a yellow colored connector mark (yellow ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of two breaks per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**B1**), red clamps with blue label (**B2**) and black clamps with black label (**N**).
	Cable set for the Phase C is labeled with a blue colored mark (blue ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of two breaks per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**C1**), red clamps with blue label (**C2**) and black clamps with black label (**N**).

		
Red clamp	**Blue clamp**	**Black clamp**

Same color code is used for the extension cables:

		
Phase A	**Phase B**	**Phase C**

The typical cable connection to a circuit breaker with two breaking elements per phase is shown in the Figure 3-1. To simplify on-site hookup, the CAT instrument comes with convenient cable sets. The main contact cables and clamps are painted in red, yellow and blue color.

Red marked cables and clamps are connected to the phase A terminals of the circuit breaker. Phase A connection clamps are also marked with A1 and A2 corresponding to their timing measurement channels.

The black cable and the clamp (marked N) are connected to the ground or to the common side of the terminal.

Yellow marked cables and clamps are connected to the phase B terminals of the circuit breaker. Phase B connection clamps are also marked B1 and B2 corresponding to their timing measurement channels.

Blue marked cables and clamps are connected to the phase C terminals of the circuit breaker. Phase C connection clamps are also marked C1 and C2 corresponding to their timing measurement channels.

The CAT measures both, the main contacts and pre-insertion resistor contacts operating times using the same channel (**Figure 3-1**).

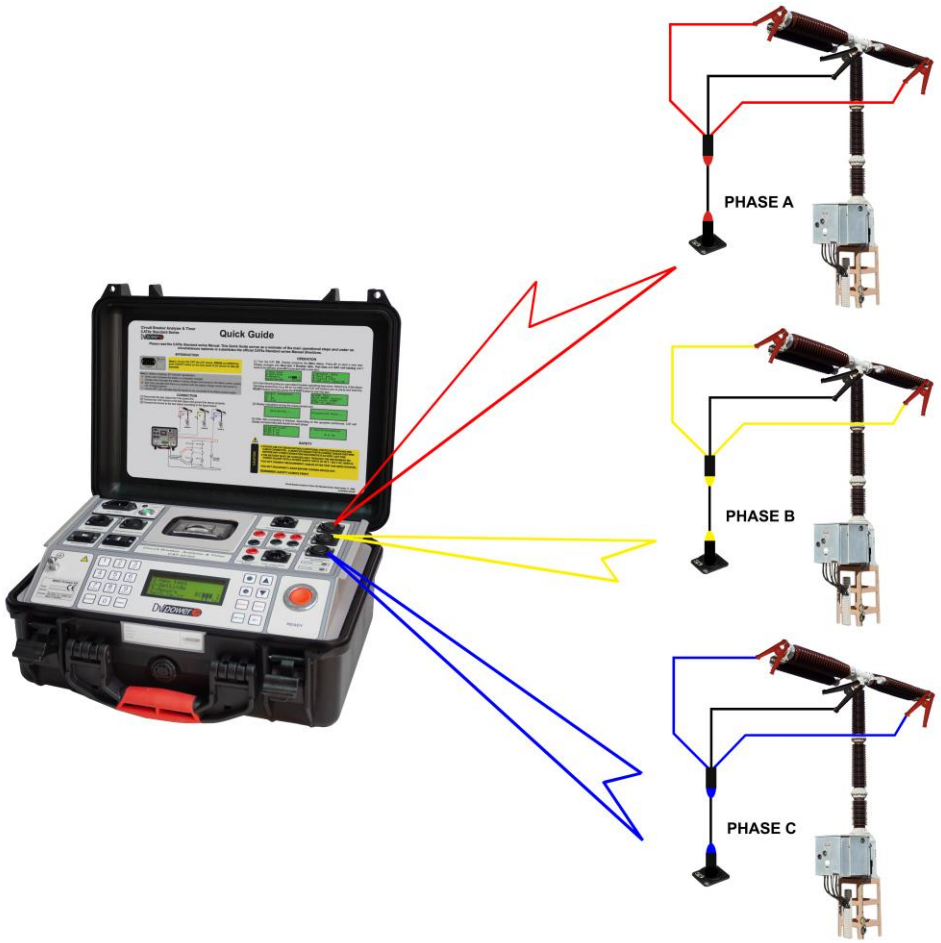
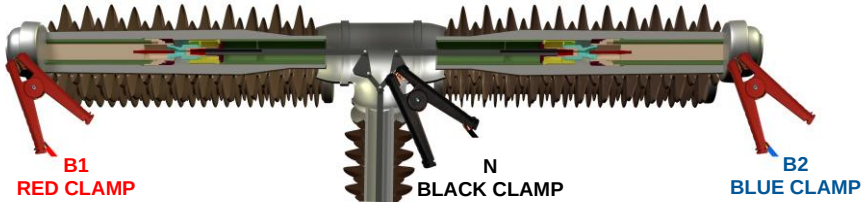
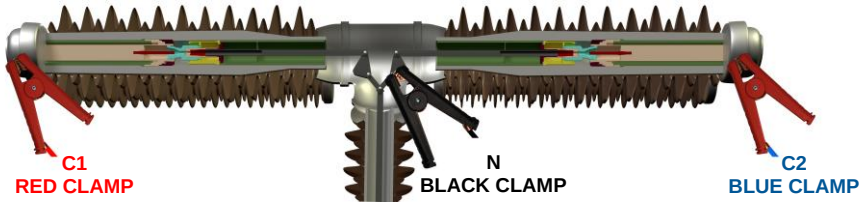


Figure 3-1: Connecting main contact timing cables to circuit breaker with two breaking elements per phase

PHASE A



PHASE B

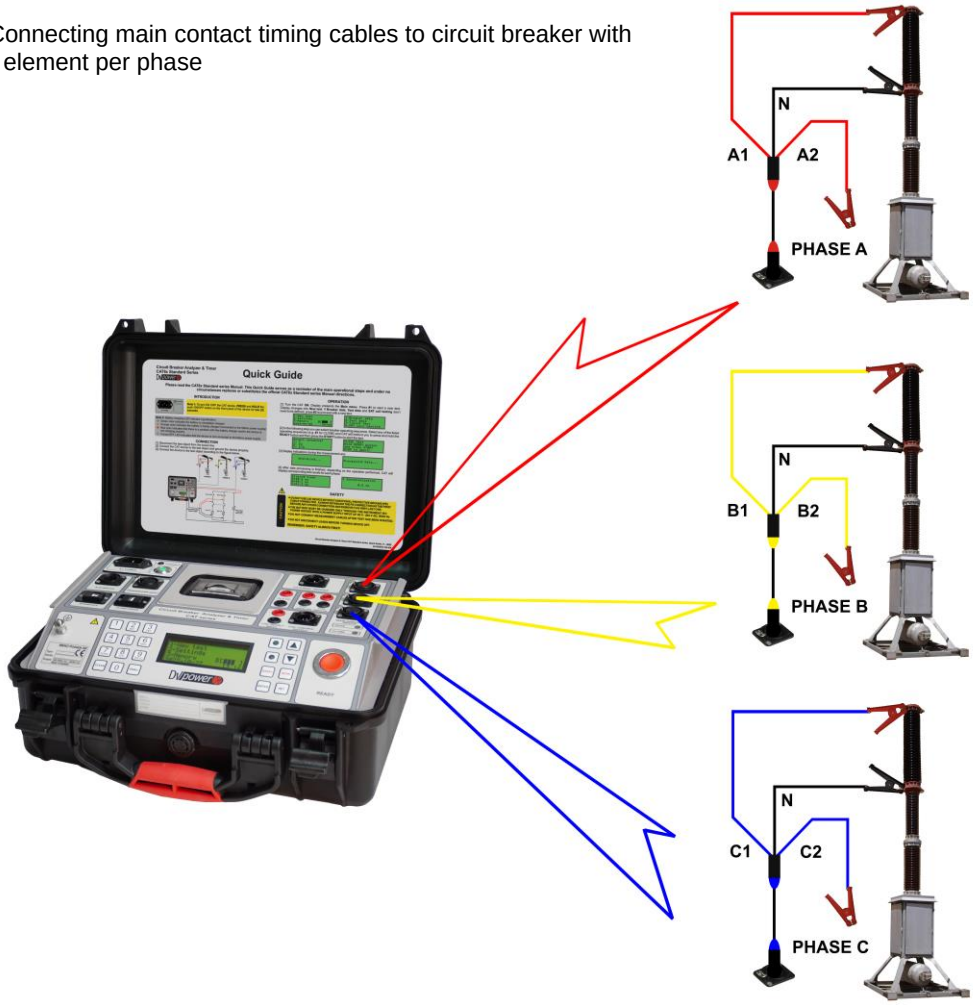


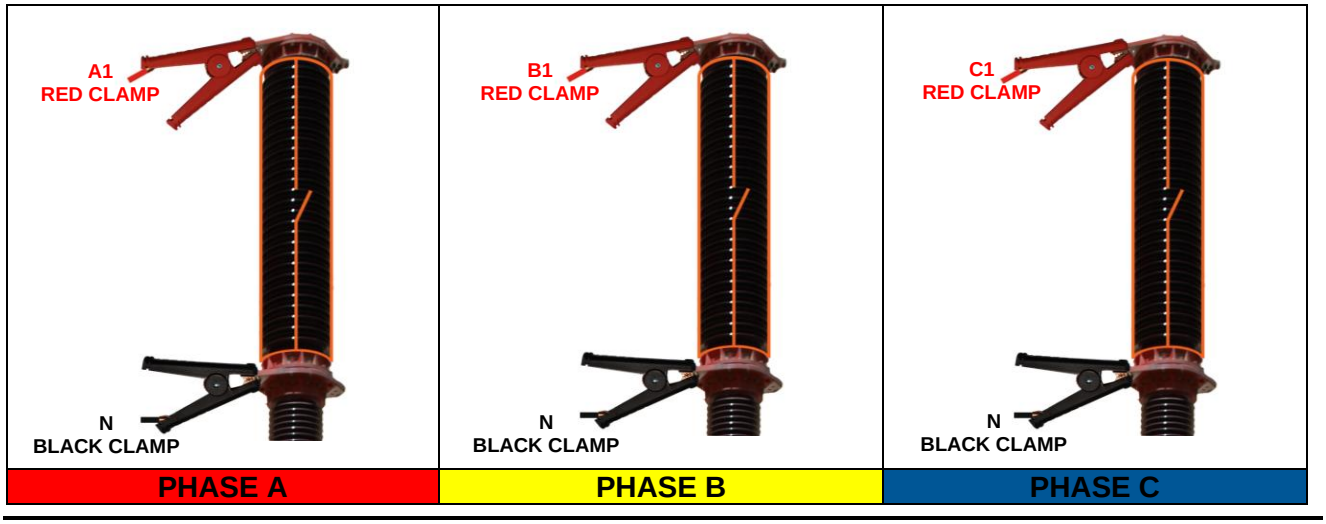
PHASE C

The typical cable connections to a circuit breaker with one breaking element per phase are shown in the **Figure 3-2**. Each main contact cable's phase clamp (red, yellow and blue) is connected to the appropriate phase of the circuit breaker terminals. The black clamps are connected to the ground or to the common side of the terminal.

Note: While performing measurements on a circuit breaker with one breaking element per phase, only the main contact timing channels A1, B1 and C1 are active and is not necessary to connect clamps with labels A2, B2 And C2.

Figure 3-2: Connecting main contact timing cables to circuit breaker with one breaking element per phase





Cable set for one break per phase is described below. This cable set comes with **CAT03, CAT31** and **CAT34** device. Color code for the extension cables is same like for cable set for two breaks per phase.

	Cable set for the Phase A is labeled with a red colored connector mark (red ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of one break per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**A1)** and black clamps with black label (**N**).
	Cable set for the Phase B is labeled with a yellow colored connector mark (yellow ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of one break per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**B1)** and black clamps with black label (**N**).
	Cable set for the Phase C is labeled with a blue colored mark (blue ring over the connector). Cables are equipped with specially designed SCT clamps. Cable set is intended for timing measurement of one break per phase. Phase connecting cables of the cable set are terminated with red clamps with red label (**C1)** and black clamps with black label (**N**).

	
Red clamp	**Black clamp**

Same color code is used for the extension cables:

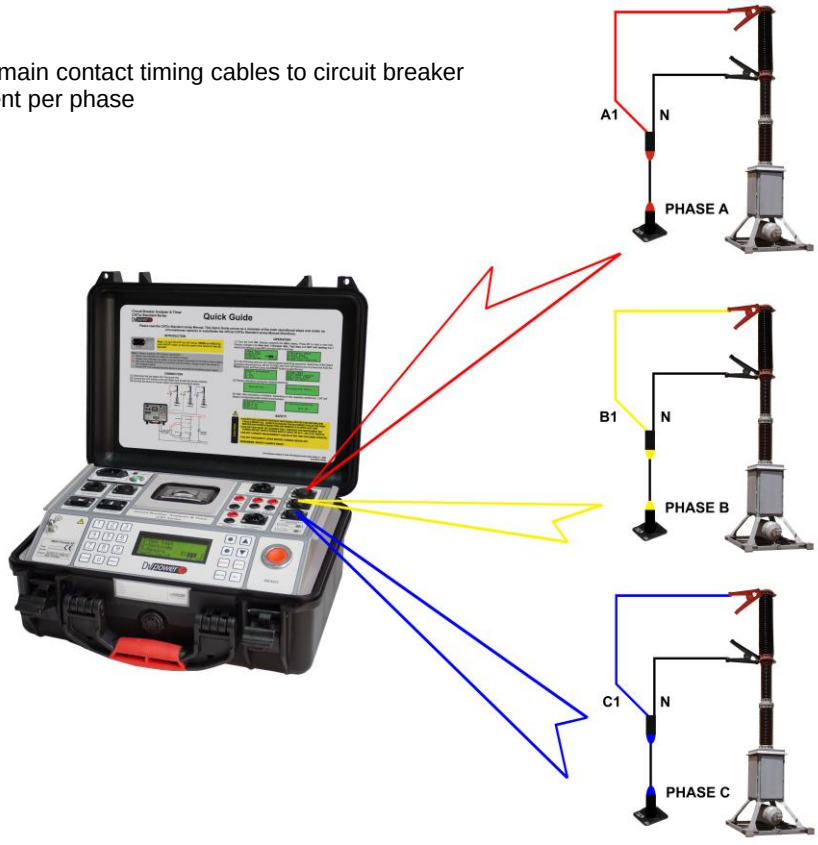
		
Phase A	**Phase B**	**Phase C**

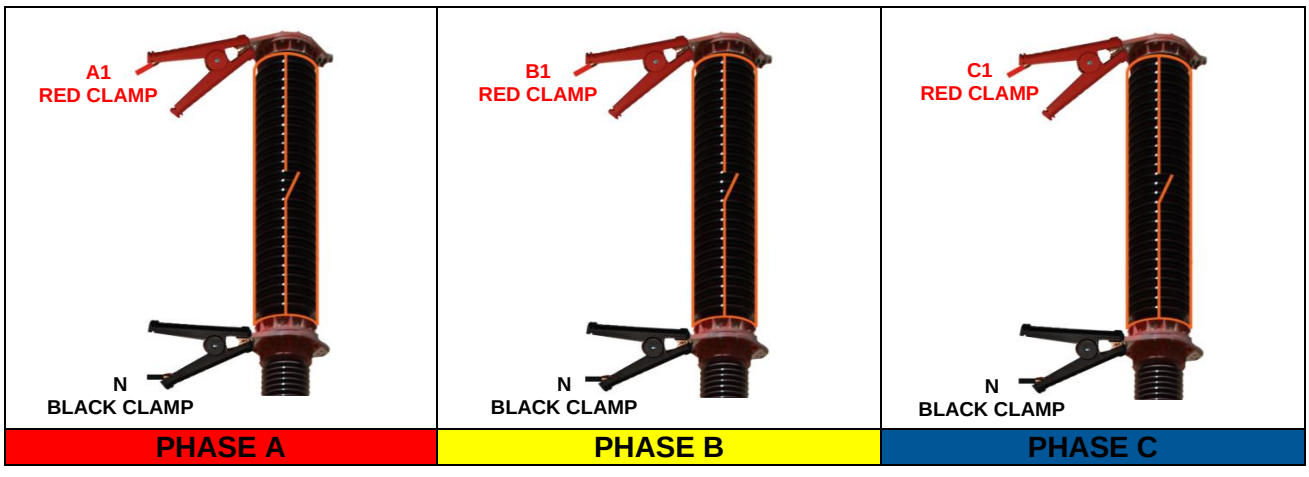
The typical cable connection of the main contact cable set for CAT03, CAT31 and CAT34 to a circuit breaker with one breaking element per phase is shown in the **Figure 3-3**. To simplify on-site hookup, the CAT instrument comes with convenient cable sets. The main contact cables and clamps are painted in red, yellow and blue color.

Red marked cables and clamps are connected to the phase A terminals of the circuit breaker. Phase A connection clamp is also marked with A1 corresponding to its timing measurement channel. Yellow marked cables and clamps are connected to the phase B terminals of the circuit breaker. Phase B connection clamp is also marked with B1 corresponding to its timing measurement channel. Blue marked cables and clamps are connected to the phase C terminals of the circuit breaker. Phase C connection clamp is also marked with C1 corresponding to its timing measurement channel. The black cable and the clamp (marked N) are connected to the ground or to the common side of the terminal.

The CAT measures both, the main contacts and pre-insertion resistor contacts operating times using the same channel (**Figure 3-3**).

Figure 3-3: Connecting main contact timing cables to circuit breaker with one breaking element per phase

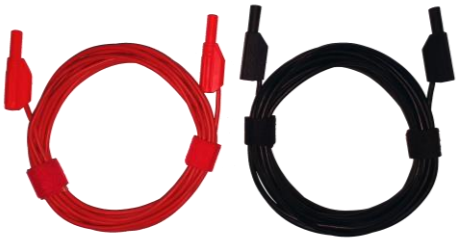




3.1.2. Coil Control Cable Connections

The CAT coil control circuit can actuate any AC or DC open or close coil. The internal electronic driver can control any voltage ranging from 10 V to 300 V DC (250 V AC).

Coil control cable set is used for closing and opening coil and is labeled as CLOSE and OPEN, respectively. Label corresponds to front panel coil control connectors.

	
Coil control cable set	**Coil supply input cables**

The connection diagram of the coil control cables for three-pole operated circuit breakers are shown in the **Figure 3-4**. It can be noted the Coil supply input is connected to a substation battery or another power supply intended for the control circuit supply.

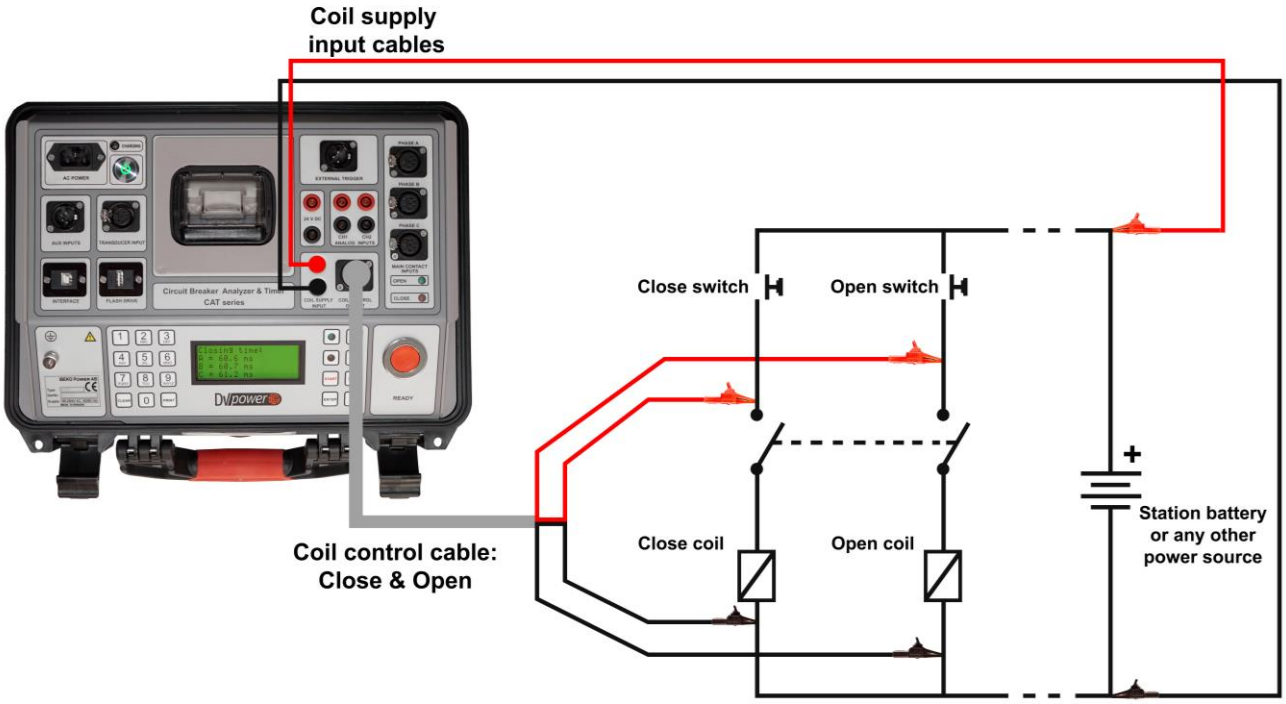


Figure 3-4: Connection diagram of the coil control cables for three-pole operated circuit breakers

When connecting to three-pole operated circuit breaker, where a substation power voltage supply is used as a power source, the minus line is common for both coils as well as for the substation battery. In this case, there is no need to connect black wire of the Coil Control cable to the corresponding open and close coils. Also, it is not necessary to connect black (minus) coil supply input from substation voltage supply source (**Figure 3-5**).

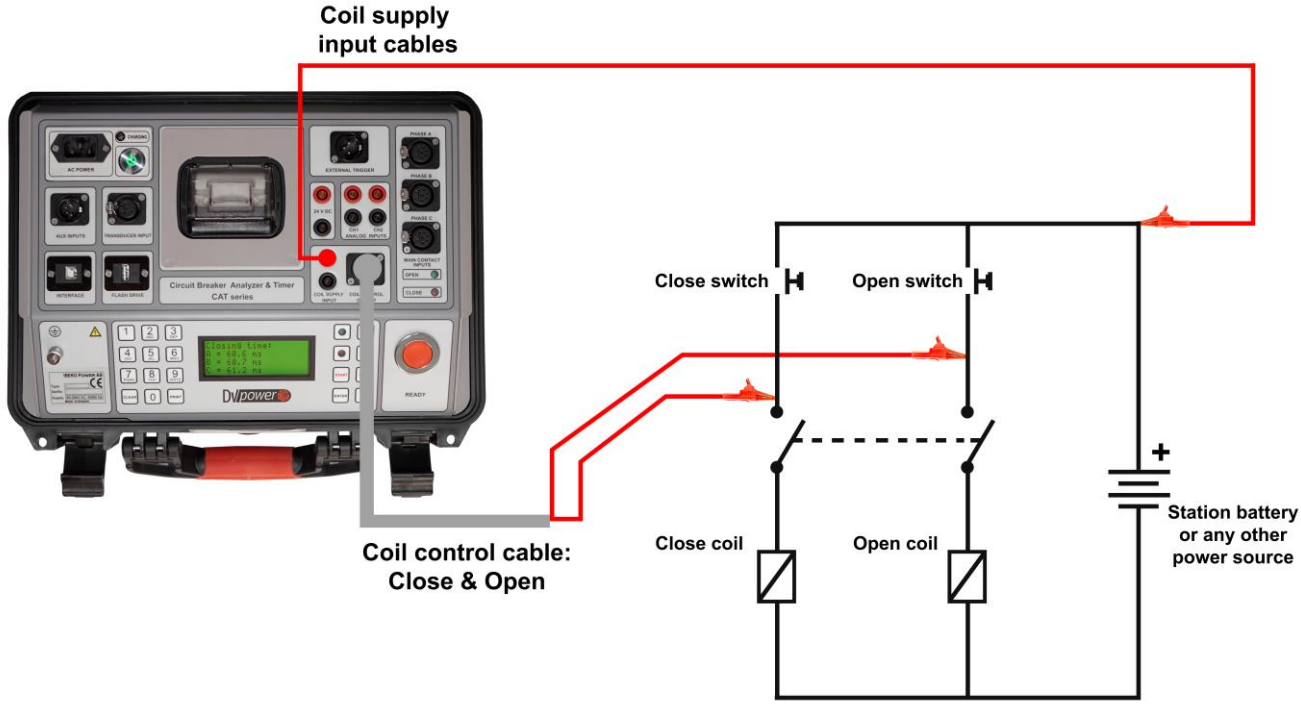


Figure 3-5: Connection diagram of the coil control cables for three-pole operated circuit breakers with substation power voltage supply used as a power source

3.1.3. External Trigger Cable Connection

The external trigger enables the start of recording when the CAT detects a voltage (**Figure 3-6**). Two red banana plugs of the external trigger cable should be connected to the positive pole of the circuit breaker coils (closing and opening coil), while the black banana plug should be connected to the negative pole of the circuit breaker coil.

External trigger cable set

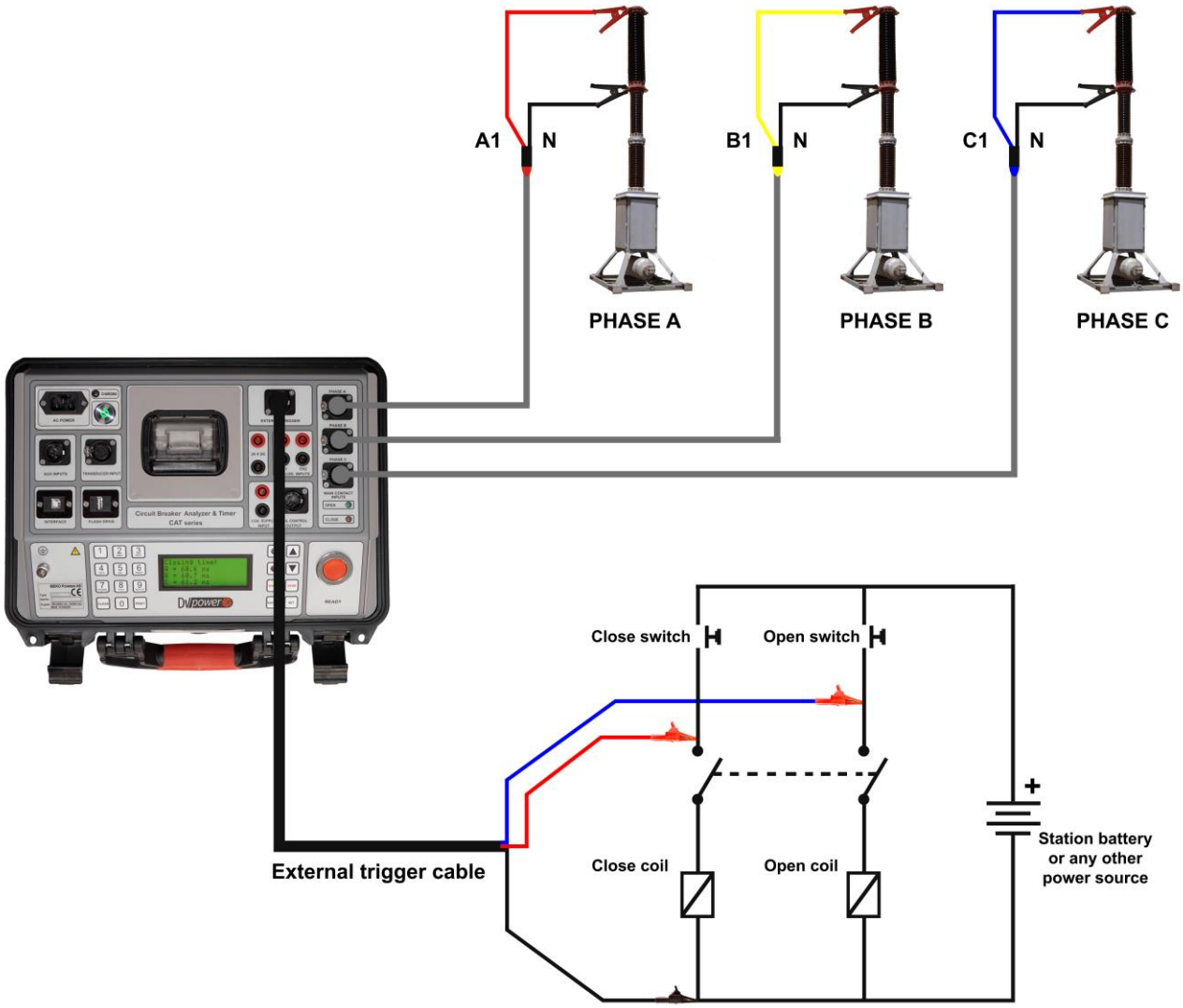


Figure 3-6: Connecting the external trigger cable to circuit breaker coils

3.1.4. Auxiliary Contacts Cable Connection

Auxiliary contacts cable set

There are three separate timing channels to measure the auxiliary contacts (**Figure 3-7**). Auxiliary inputs are used to monitor the auxiliary (52a and 52b) contacts. The external trigger input can be used as a third auxiliary input.

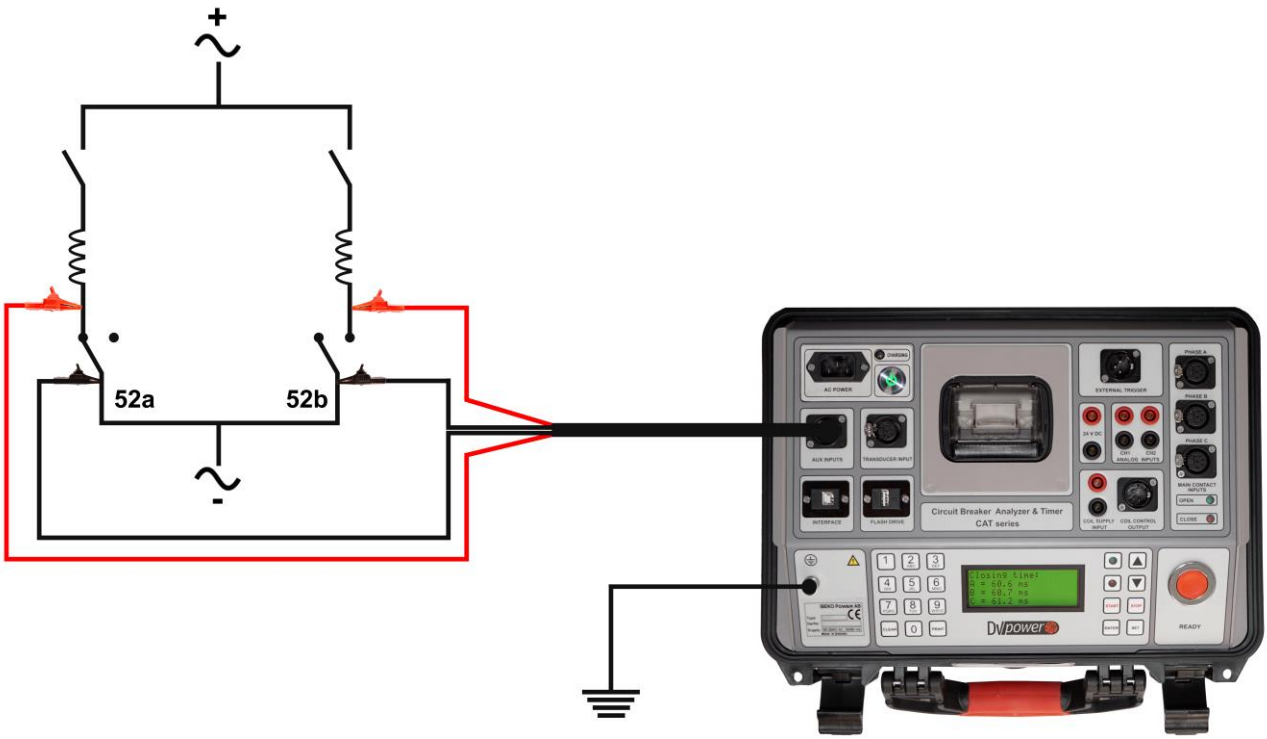


Figure 3-7: Connecting the auxiliary cable to circuit breaker AUX contacts (52a and 52b)

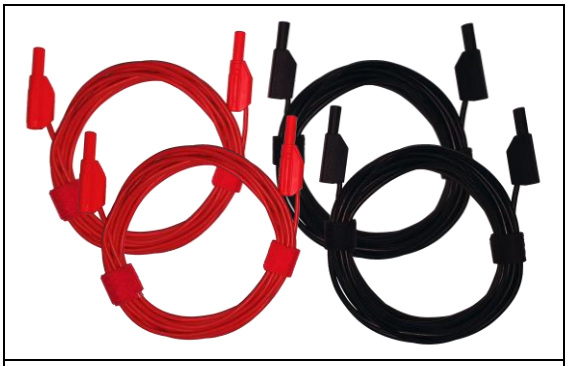
3.1.5. Analog Channels Cable Connection

Cable set for analog channels is available with CAT34 and CAT64 devices**.**

The two 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,
- Motor current (using current probes) and voltage,
- Other types of analog signals that may be relevant.

The analog inputs are isolated with respect to all other circuits.



Analog channels cable set

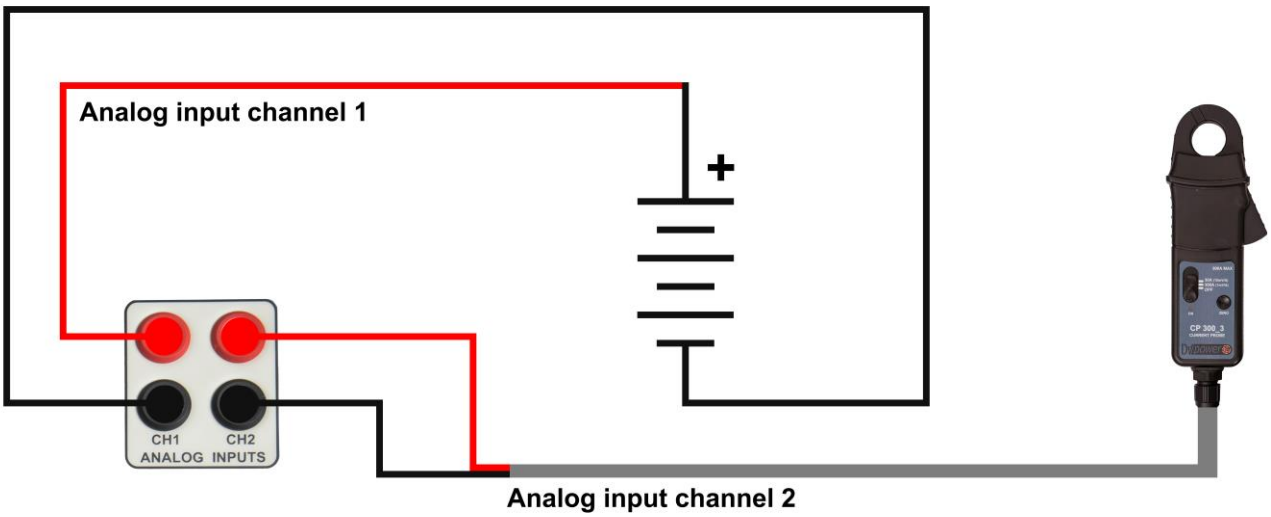


Figure 3-8: Connecting the analog input channel cables to a battery and a current probe

3.1.6. Transducer Connection

The transducer channel is 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 transducer channels. This option is available with CAT34 and CAT64 devices.

The CAT supports both analog (**Figure 3-9**) and digital (**Figure 3-11**) transducers.

Figure 3-9: Connecting a linear analog transducer to the CAT

Figure 3-10: Analog linear transducer mounted on *Mitsubishi SF6 138 kV 120-SFMP-40HE*

Figure 3-11: Connecting a rotary digital transducer to the CAT

Figure 3-12: Digital rotary transducer mounted on *ABB LTB 245 kV SF6 circuit breaker*

3.2. Settings menu

Turn the CAT power switch ON. The display shows the notification that the memory card initialization has started. (**Figure 3-13**)

Figure 3-13: Memory card initialization

After the memory card initialization is completed, the display shows the **Main** menu (**Figure 3-14**).

Figure 3-14: The **Main** menu

To define initial settings, timing test parameters, transducer settings, analog channels and auxiliary timing channels parameters use the **Settings** menu. Press ***#2*** and CAT will enter in the **Settings** menu (**Figure 3-15**).

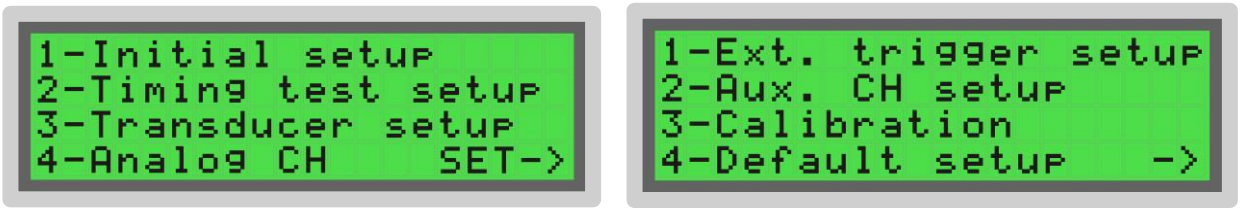


Figure 3-15: The **Settings menu** (Page 1 and Page 2)

Press ***1, 2, 3*** or ***4*** to enter desired setup menu or press SET (►) to go to the next page of the **Settings** menu.

3.2.1. Initial Setup

Initial setup menu enables to define a language, internal time and date, time base, operating frequency, number of timing channels (depending on a breaker design) and location for the test results storage. Initial setup menu is also used to activate Auto sequence feature.

Select **#1** in the Settings menu to enter **Initial setup** menu. It brings the language selection display (see the **Figure 3-16** below).

Figure 3-16: The **Initial setup** menu – Language selection

Selecting **#1** defines that English language will be used. Pressing ***STOP*** always cancels a selection and returns operation to the previous screen at any test settings stage.

After choosing the language, in the following screen time and date can be defined (see **Figure 3-17** below).

Figure 3-17: The **Initial setup** menu – Date & Time

Pressing ***ENTER*** the CAT goes to the next page of the **Initial setup** menu.

In the following screen the measurement time base unit is defined. User is allowed to select among milliseconds, seconds or cycles (1 cy = 20 ms at 50 Hz and 16,67 ms at 60 Hz) (see the **Figure 3-18** below).

Figure 3-18: The **Initial setup** menu – Time Base

Press ***#1***, ***#2*** or ***#3*** to select the time unit (milliseconds, seconds of cycles) of the measurement. After this selection the CAT offers the following **Initial setup** menu screen to select frequency (50/60 Hz).

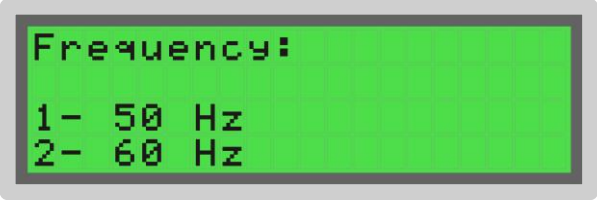


Figure 3-19: The **Initial setup** menu – Frequency

Press either ***#1*** (*50 Hz*) or ***#2*** (*60 Hz*) to set the frequency to the corresponding value

Auto Sequence feature can be activated in the following screen of the **Initial setup** menu.

Figure 3-20: The **Initial setup** menu – Auto Sequence

Press ***#1*** or ***#2*** to activate or deactivate Auto Sequence function. When activated, the Auto sequence function will attempt to detect the state of the breaker and indicate it by the main contacts LEDs - the appropriate red (CLOSE) or green (OPEN) LED will be lit on. If the state is detected, user is allowed to select a possible breaker operation in the **Sequence** menu (e.g., if the breaker is in OPEN state, available operations are C, CO (trip free) and C-O).

In the following screen (**Figure 3-21**) of the **Initial setup** menu a **number of breaking elements per phase** of the test object can be defined (this setup is available only for CAT61 and CAT64 devices). The number of the breaking elements per phase depends on the breaker design (**Figures 3-1**, **3-2** and **3-3**).

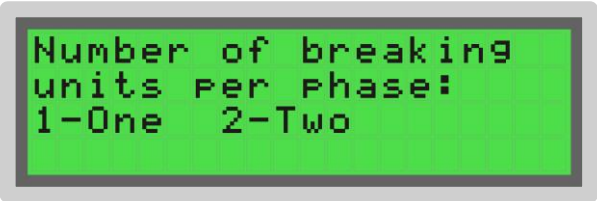


Figure 3-21: The **Initial setup** menu – Number of breaking units per phase

Press **#1** or **#2** to define the number of breaking elements per phase depending on the design of a circuit breaker that will be tested.

Note:

The format of the test results will be automatically adjusted depending on the number of existing breaking elements per phase.

- *If #**1** is selected (one break per phase), only A1, B1 and C1 timing channels will be activated.*
- *If #**2 is** selected (two breaks per phase), all main contact timing channels will be activated (A1, A2, B1, B2, C1 and C2).*

The following screen (**Figure 3-22**) provides a selection of the test results storage location. User is allowed to select between USB Flash Drive and internal memory of the CAT instrument itself.

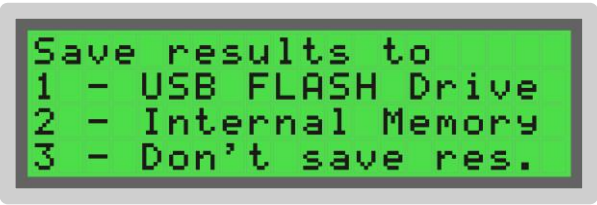


Figure 3-22: The **Initial setup** menu – Save results to

If one does not want to save test results, **#3** should be selected.

Once the Initial setup is completed, defined settings are stored in the CAT internal memory. The user will be returned to the **Settings** menu.

3.3. Running the Test

In **Figure 3-14,** select ***#1*** on the keypad to start a new test. The display will show the **New test** menu (**Figure 3-23**).

Figure 3-23: The **New test** menu

Press ***#1*** to edit "**Breaker data**" details (*Breaker ID, Station name, Department, Manufacturer, Serial number, Breaker type*). Edit the required details for "Breaker data" using the alphanumeric keypad. Press ***ENTER*** to confirm.

Note: *Typing is similar to that using a mobile phone keypad. Each number, beginning with 2, has a set of letters underneath. Hit the button with the letter you would like to type several times until the letter you want appears. For example, if you would like to type the letter "B" press the button "2" three times (2 – A – B; numbers appear before letters). Wait until the cursor moves to next position to type a new letter.*

Select ***#2*** to edit "**Test data**" details (*Type of a test, Company name, Operator*). Edit the required details for using the alphanumeric keypad. Press ***ENTER*** to confirm.

If *Breaker data* and *Test data* do not need to be defined, press ***#3*** to proceed with "Timing **test".**

In **Figure 3-24** a selection of the breaker operating sequences is presented. Press **#6** to go to the next page and select other operating sequences. To go back to the previous page press **#4.**

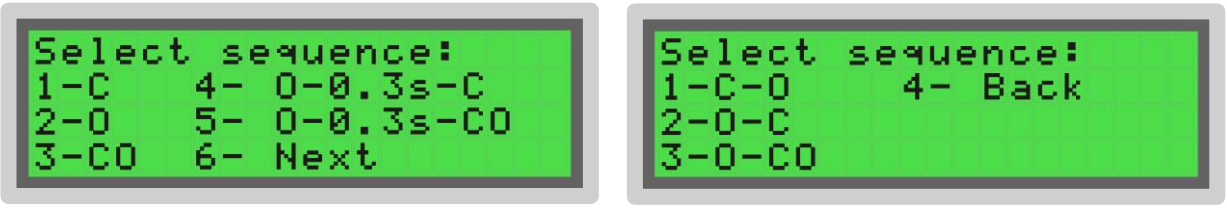


Figure 3-24: **Select sequence** menu (Page 1 and Page 2)

The CAT can initiate any of the following breaker operating sequences:

C – Close
O – Open
CO - Trip free
O-0,3s-C - Reclose
O-0,3s-CO
C-O
O-C
O-CO

Note: *In case the Auto Sequence function has been activated, the CAT will automatically detect the state of the breaker (e.g. if the breaker is in OPEN state the green LED is ON) and offer the adequate operating sequences (e.g. if the breaker is in OPEN state, the available operations are C, CO (trip free) and C-O). (**Figure 3-25** below)*

Figure 3-25: **Select sequence** menu (Breaker in OPEN state)

3.3.1. CLOSE Test

Make sure the breaker is in the open position. Press **#1** on the keypad to select the "Close" operation. The following notification will appear:

Figure 3-26: Close test initiation menu

Press and hold the ***READY*** button and then press ***START*** to initiate the test.

The CAT will initiate Close pulse using coil control channel (not available with CAT03). The default duration for Close command pulse is **160 ms** (50 Hz). The Close pulse length can be changed to a desired value.

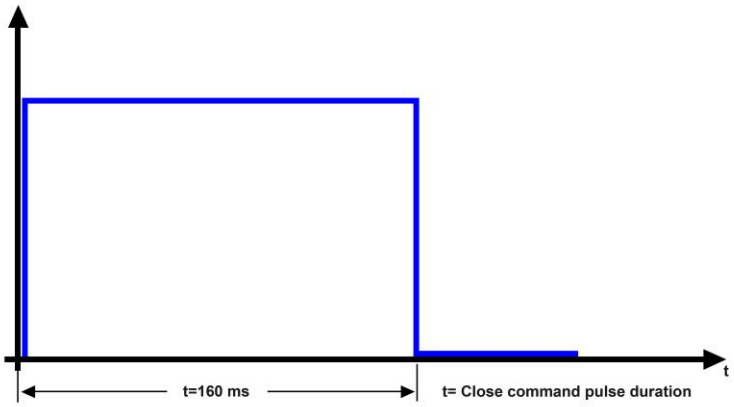


Figure 3-27: CLOSE command pulse

During the operating process, the following message appears on the display window (**Figure 3-28**) and the Red LED blinks:

Figure 3-28: Operating message and LED indication

After the operating process is finished, the CAT will start processing the data. (**Figure 3-29**)

Figure 3-29: Operating message and LED indication

After data processing completion, the CAT will display ***Results*** menu for the CLOSE test. Results are classified in sub-menus, as illustrated in **Figure 3-30** below.

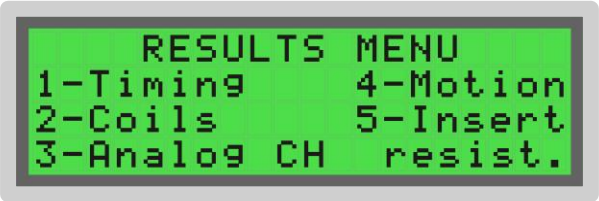


Figure 3-30: **Results** menu

Timing Channels Results for selected one break per phase

Press **#1** in the ***Results*** menu to see the Closing time results. CAT calculates the Closing time on 3 main contact timing channels (3x1) (see the figures on the left side of the table below and the **Figure 3-30**). Use the ▲ ▼ buttons to navigate between the screens.

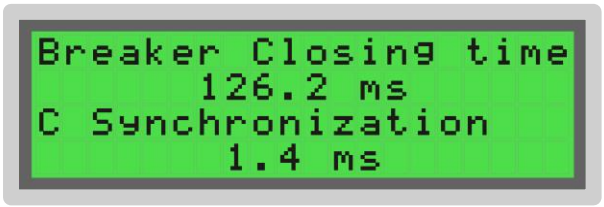
Figure below shows contact closing time (time between a test initiation and the last contact to close).

Closing time

A, B and **C** are closing times of the main contacts in the phases A, B and C.

Phase A Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in the phase A.
Phase B Closing time is the interval of time between the initiation of closing operation and a moment when metallic continuity is established in the phase B.
Phase C Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in the phase C.

Breaker Closing Time & Close Synchronization:



Breaker Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in all poles.

Close synchronization is the time difference between the first and the last contacts touching during a CLOSE operation (see the figure on the left and **Figure 3-30**).

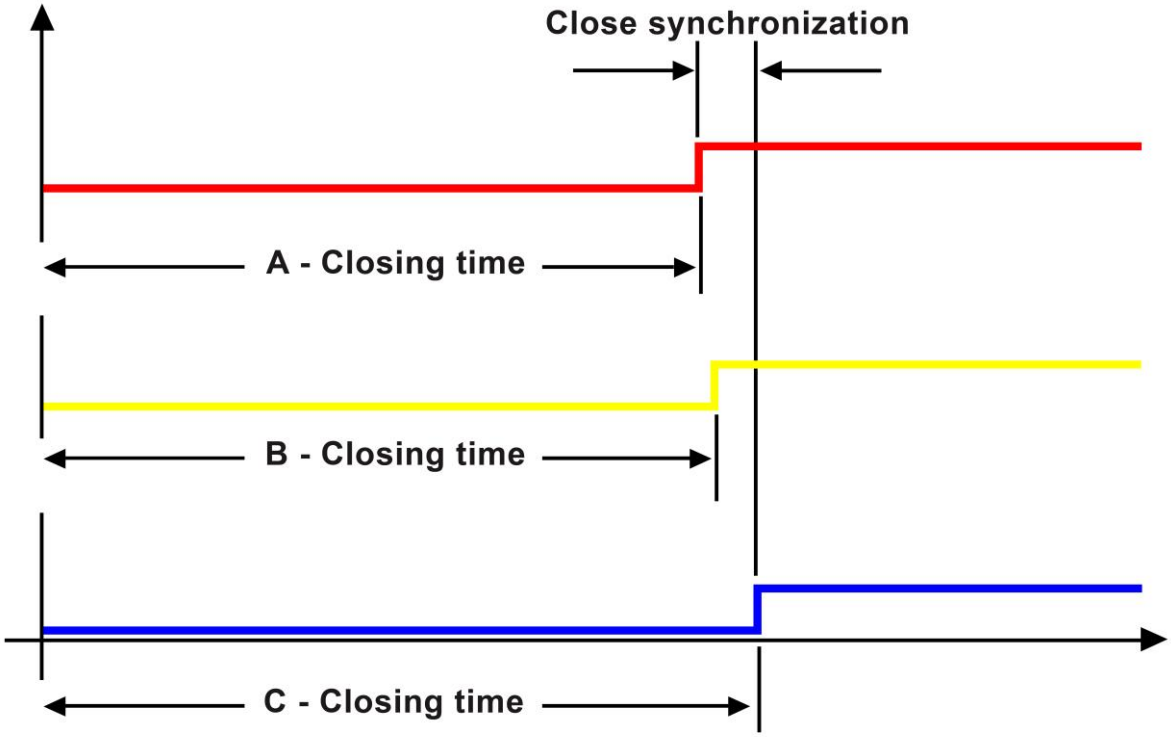
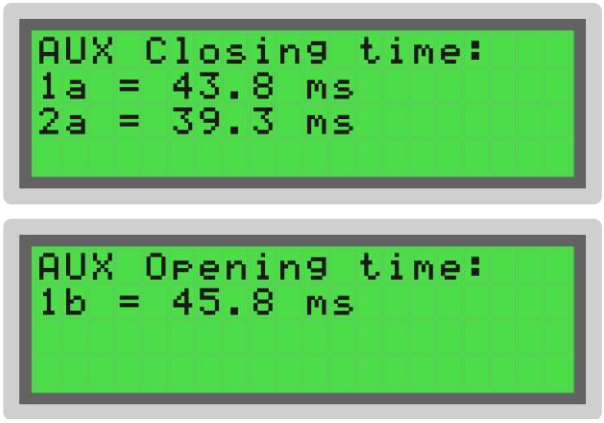


Figure 3-31: Closing time & Close synchronization

AUX Contacts Closing Time



The time interval between a moment when the actuating quantity of the release circuit reaches the operating value and a moment in time the state of the auxiliary contacts (52a and 52b) changes during a CLOSE operation.

Press the ***STOP*** to go back to the **Results** menu.

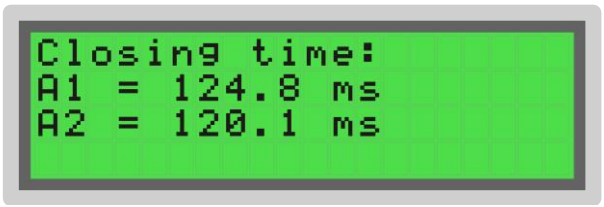
Timing Channels Results for selected two breaks per phase

Press **#1** in the ***Results*** menu to see Closing time results. CAT calculates the Closing time on 6 main contact timing channels (3x2) (see the figures on the left side of the table below and the **Figure 3-32**).

Use ▲▼buttons to navigate between the screens.

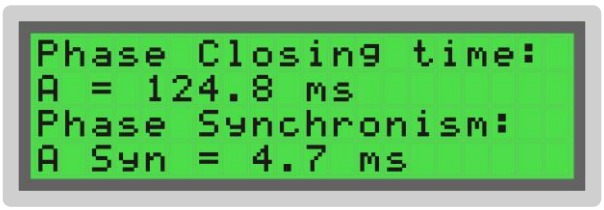
Figure below shows contact closing time (time between a test initiation and the last contact to close).

Phase A



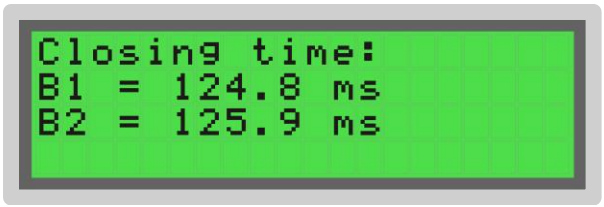
A1 and **A2** are closing times of the main contacts in the phase A.

Phase A Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in the phase A.



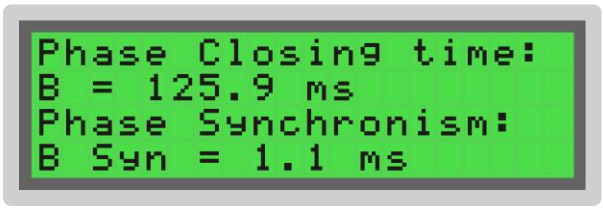
Phase A Synchronization is the time difference between the first and the last main contacts to close in the phase A during a CLOSE operation.

Phase B



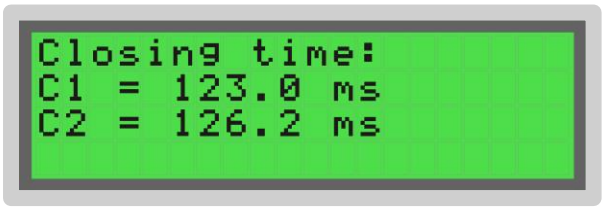
B1 and **B2** are closing times of the main contacts in the phase B.

Phase B Closing time is the interval of time between the initiation of closing operation and a moment when metallic continuity is established in the phase B.



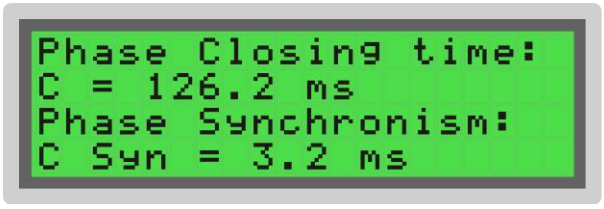
Phase B Synchronization is the time difference between the first and the last main contacts to close in the phase B during a CLOSE operation.

Phase C



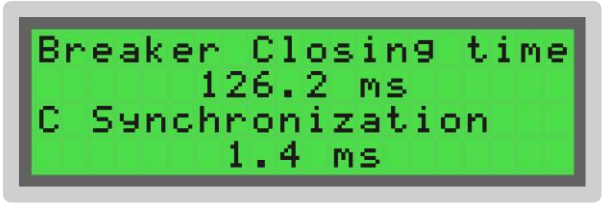
C1 and **C2** are closing times of the main contacts in the phase C.

Phase C Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in the phase C.



Phase C Synchronization is the time difference between the first and the last main contacts to close in the phase C during a CLOSE operation.

Breaker Closing Time & Close Synchronization:



Breaker Closing time is the interval of time between the initiation of the closing operation and a moment when metallic continuity is established in all poles.

Close synchronization is the time difference between the first and the last contacts touching during a CLOSE operation (see the figure on the left and **Figure 3-32**).

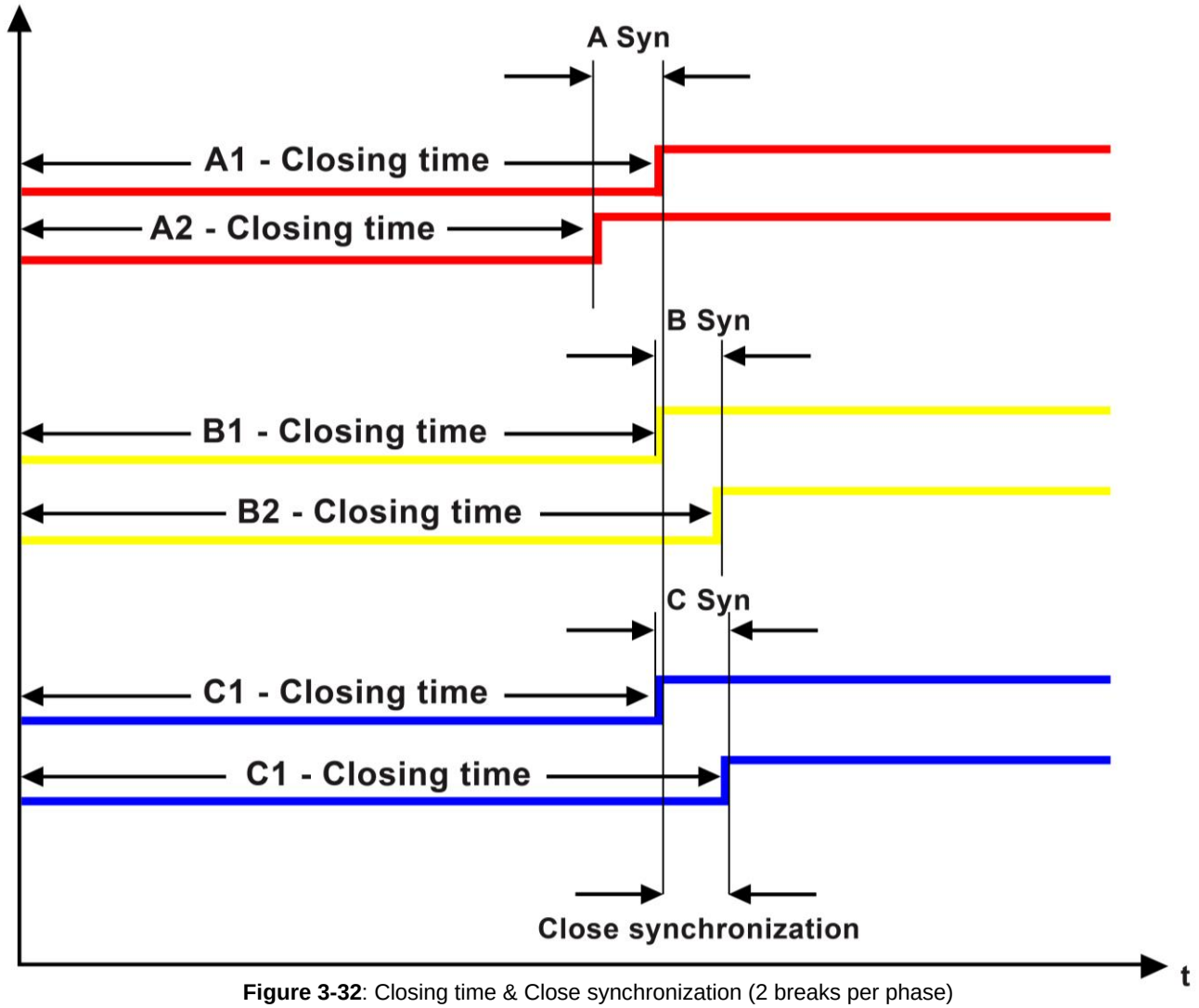


Figure 3-32: Closing time & Close synchronization (2 breaks per phase)

Closing Coil Current

Press **#2** in the ***Results*** menu to see the closing coil current results. The device calculates and displays the peak value of the closing coil current (in this case 2,086 A) and the time interval that was reached (see the **Figure 3-33** below).

Figure 3-33: Maximum closing coil current

Press the ***STOP*** to go back to the **Results** menu.

Analog Channels Results (available with CAT34 and CAT64)

Press **#3** in the ***Results*** menu to see results obtained with analog channels. Use ▲ ▼ buttons to navigate between the screens.

Note: ***Each analog channel has 4 selectable ranges ±0,5 V, ±2,5 V, ±60 V and ±300 V AC/DC.***

Analog Channel 1:

Analog channel 1 (range selected 0,5 V; Current clamps output 10 mV/A) indicates the maximum and minimum current detected on the current clamps during a CLOSE operation.

Analog Channel 2:

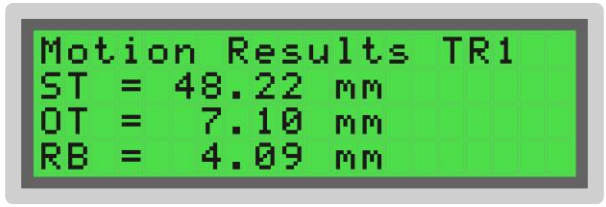
Analog channel 2 (range selected 2,5 V) indicates the maximum and minimum voltage detected during a CLOSE operation.

Press the ***STOP*** to go back to the **Results** menu.

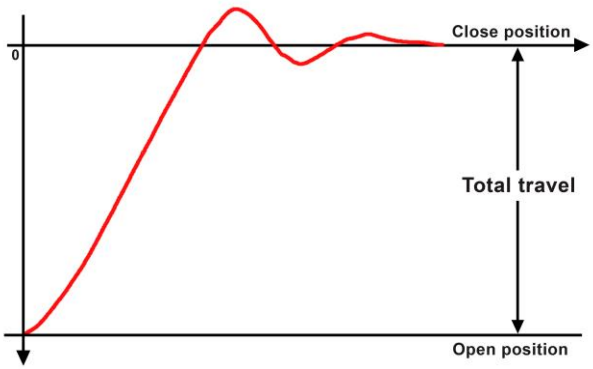
Motion Results (available with CAT34 and CAT64)

Press **#4** in the ***Results*** menu to see measurement results obtained with transducer channels. Use ▲ ▼ buttons to navigate between the screens.

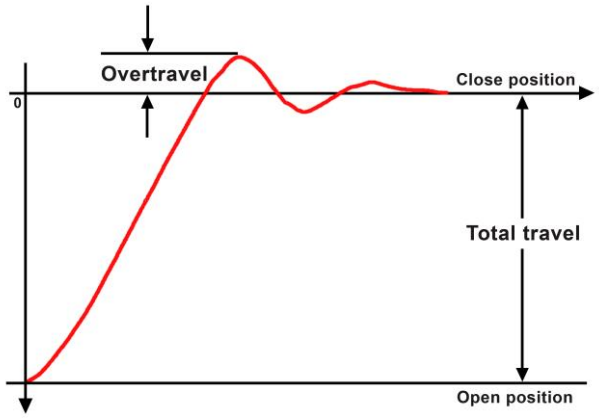
Transducer channel



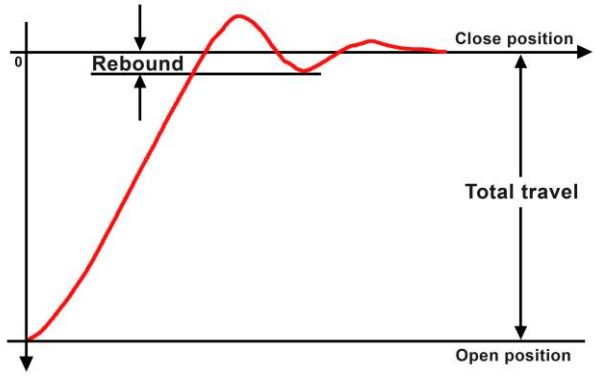
ST - Stroke
OT - Over travel
RB – Rebound



STROKE (during a CLOSE operation) is the distance between the open position of the circuit breaker and the final close position.



OVETRAVEL (during a CLOSE operation) is the distance between the maximum temporary displacement of the circuit breaker main contacts beyond the final close position.

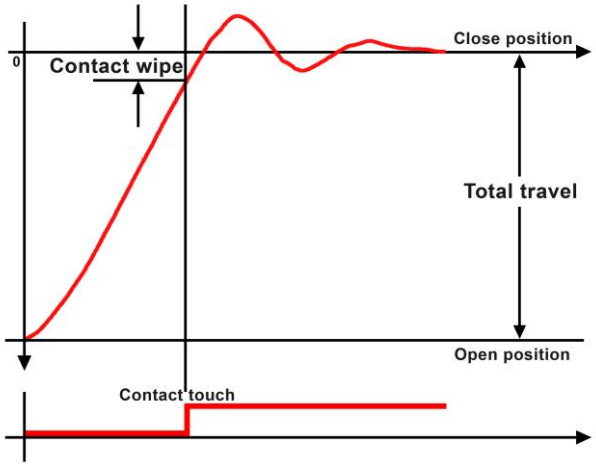


REBOUND (during a CLOSE operation) is the distance between the lowest measured position that occurs directly after the overtravel and the breaker's final close position.

Contact wipe on Phase A:

Contact wipe on phase B:

Contact wipe on phase C:



Contact wipe is the distance measured from the contacts touching position to the fully close position during a CLOSE operation.

Note: *If the circuit breaker is single-pole controlled, the contact wipe is calculated only for the phase where the transducer is installed. If circuit breaker is three-pole controlled, contact wipe is calculated for all phases based on the transducer on the mounted phase.*

Press the ***PRINT*** button to print test results on the (optional) built-in printer.

Press the ***STOP*** to go back to the **Results** menu.

Pre-insertion resistors results

Press **#5** in the ***Results*** menu to see Pre-insertion resistors closing time. Use ▲▼buttons to navigate between the screens.

Pre-insertion resistor closing time is the time interval between the initiation of the CLOSE operation and the instant when the pre-insertion resistor contact closes in each phase.

The CAT calculates the Pre-insertion resistor closing time on up to 6 main contact timing channels (3x2) (see the figures below and the **Figure 3-34**).

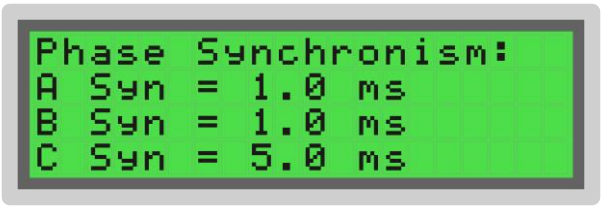
Pre-insertion resistor closing time (Phase A)

Pre-insertion resistor closing time (Phase B)

Pre-insertion resistor closing time (Phase C)

Pre-insertion Resistor Synchronization

The time difference between the first and the last pre-insertion resistor contacts touching during a CLOSE operation (see the figure on the left and **Figure 3-34**).



A Syn – Pre-insertion resistor synchronization time in Phase A

B Syn – Pre-insertion resistor synchronization time in Phase B

C Syn – Pre-insertion resistor synchronization time in Phase C

Pre-insertion resistor synchronization time for the breaker.

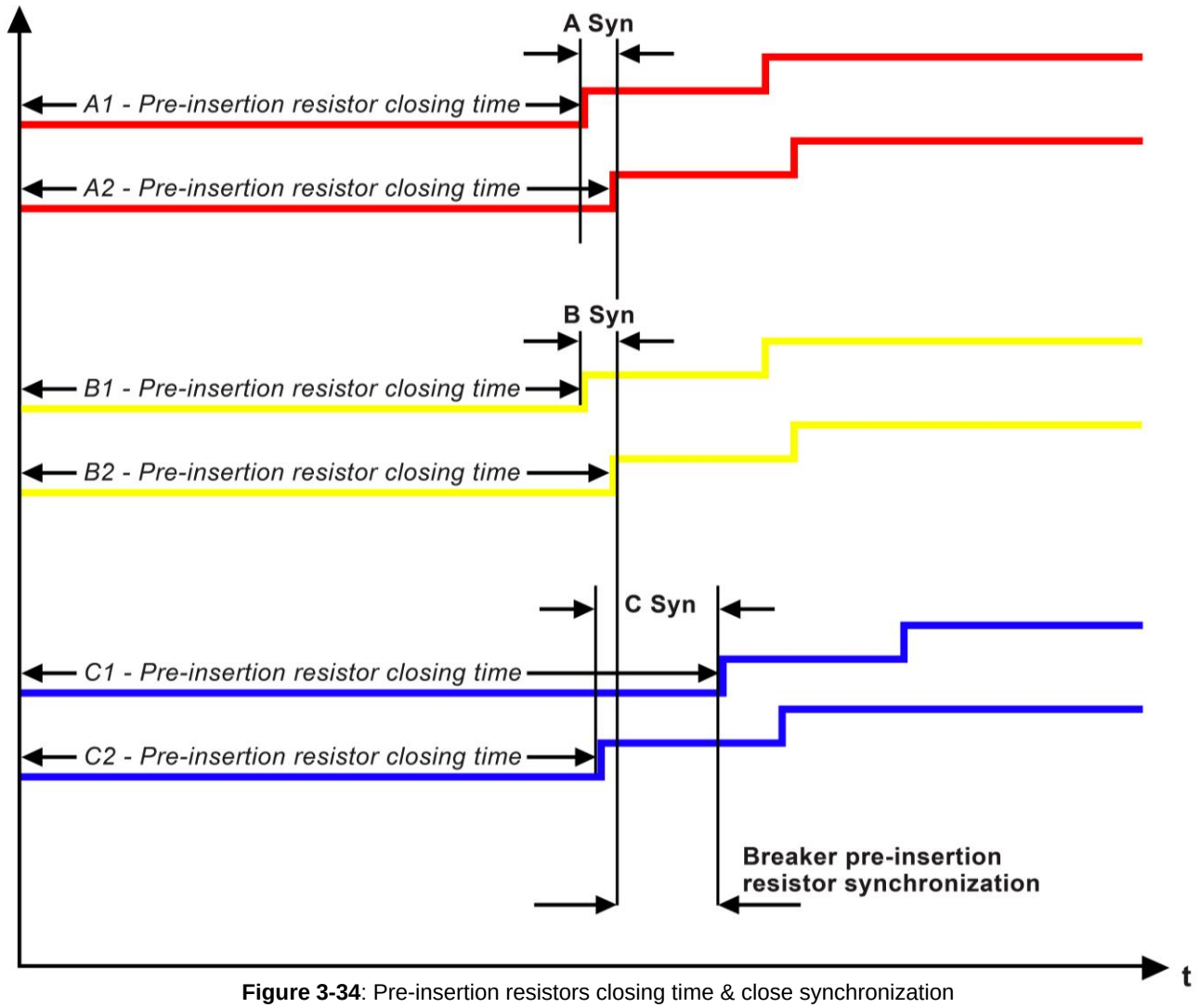


Figure 3-34: Pre-insertion resistors closing time & close synchronization

Note: *If no pre-insertion resistors are present, the CAT will indicate the pre-insertion resistor is not detected:*

Pre-insertion Resistor ON Time:

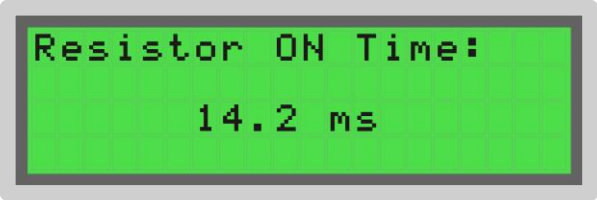
The time interval between the instant when the pre-insertion resistor contact is activated and the instant the contacts touch during a CLOSE operation (see the figures below and the **Figure 3-35**).

Phase Resistor ON Time:

The interval of time between the instant when the first pre-insertion resistor contact is activated and the instant of the last contact touch in each phase during a CLOSE operation (see the figure on the left and the **Figure 3-35**).

Total Breaker Pre-insertion Resistor ON Time:

The time interval between the instant when the first pre-insertion resistor contact is activated in any phase and the instant of time the last contact touch during a CLOSE operation (see the display screen below and the **Figure 3-35**).



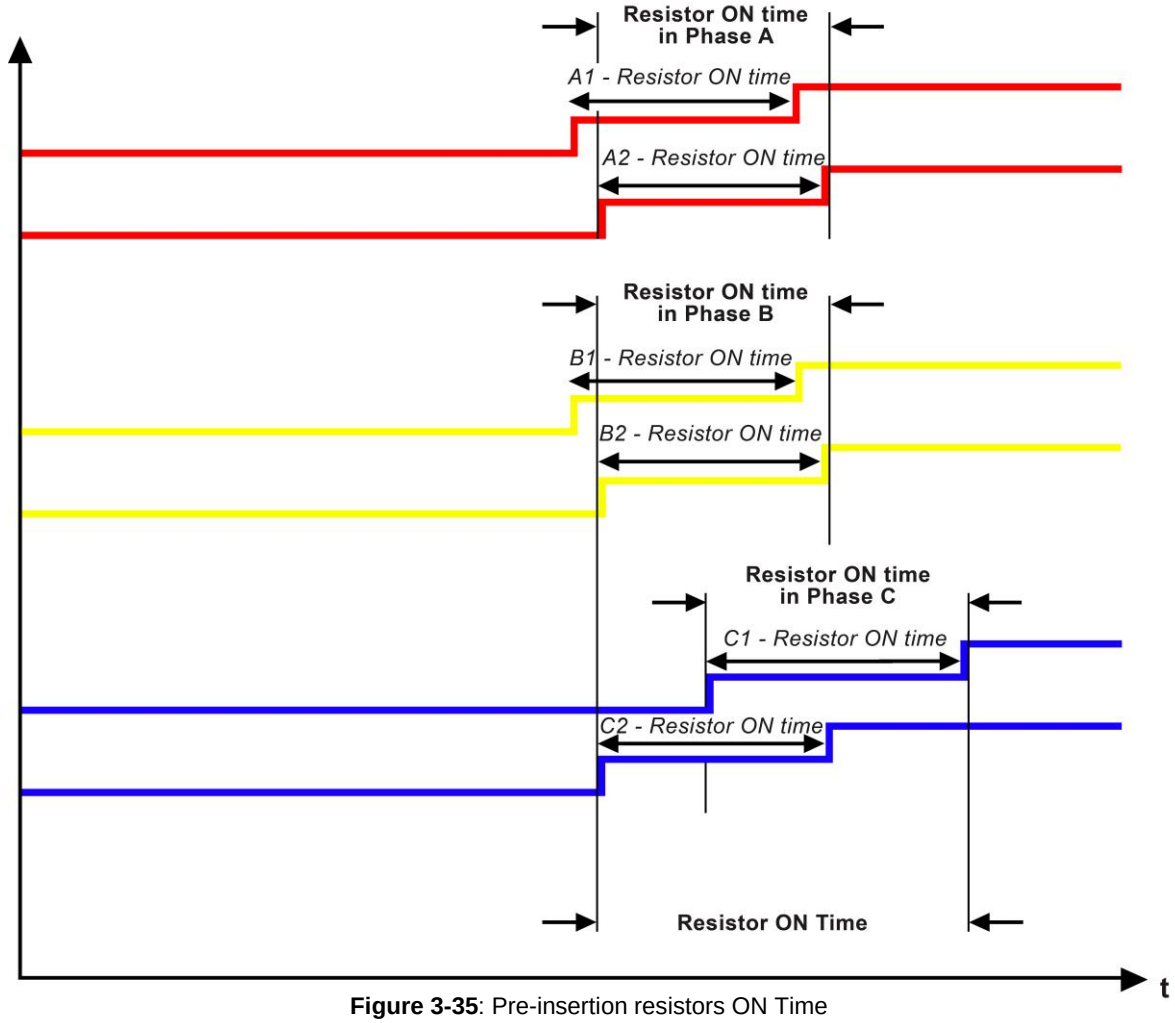


Figure 3-35: Pre-insertion resistors ON Time

Resistance Value
CAT measures the resistance of the pre-insertion resistor contacts in each phase.

RA = RA1+RA2 **RB=RB1+RB2** **RC=RC1+RC2**

3.3.2. External Trigger

The External trigger feature enables a start of data recording as soon as the CAT series instrument senses a voltage in the range between 10 V and 300 V AC/DC on the External trigger input. The External trigger cables are connected to the breaker coils using the voltage drop across the circuit breaker coils as a trigger signal.

External trigger mode can be used to start timing of the breaker operation when the user opens or closes the circuit breaker by the local switch or remotely from a control room.

To start the test in the External trigger mode the cables should be connected as described in the Section 3.1.3 (**Figure 3-6**).

3.3.2.1. External Trigger Setup

Select the **Settings** menu in the **Main** menu (**Figure 3-14**). Press #***2*** and the CAT will enter in the **Settings** menu (**Figure 3-15**). Press ***SET*** to go to the second page of the **Settings** menu

Press #***1*** to select the External trigger setup.

External trigger setup menu is used to activate the trigger source measurement mode (see the figure below) and to define trigger source.

Press #***1*** or #***2*** to activate or deactivate the External trigger mode.

If **#1** is selected, a pre-trigger time out has to be defined (see the figure below).

Press #***1***, #***2*** or #**3** to select between **10 s**, **20 s** or **unlimited** pre-trigger time out.

After the external trigger mode is activated, a trigger source type needs to be defined. Beside the External trigger, the **Figure 3-36**, illustrates, several other measurement triggers available to record a measurement in a various testing conditions: coil current channels, analog channels and auxiliary channels.

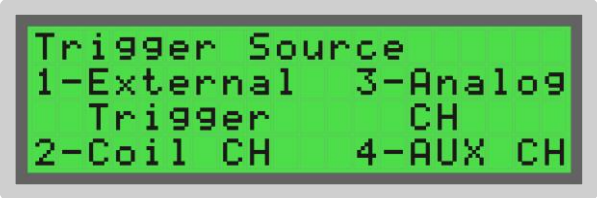


Figure 3-36: **Trigger Source** menu

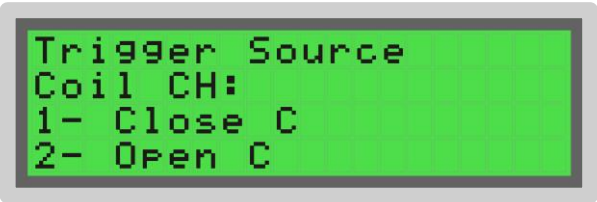
Press ***#1***, ***#2, #3*** *or* ***#4*** to select a corresponding trigger source.

External Trigger Mode

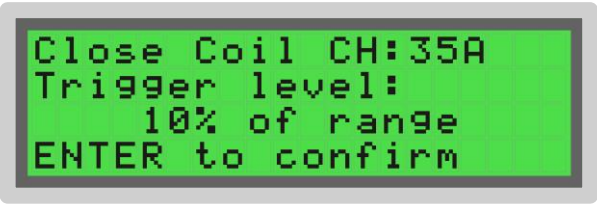
Press #**1** to select External Trigger mode. External trigger enables start of recording when the CAT senses a voltage. Trigger input voltage range: 10 V – 300 V AC/DC.

Coil Current Trigger Mode

Press #**2** in Trigger Source menu (figure below) to select Coil current trigger mode. The following screen will be displayed:



Press ***#1*** or ***#2*** to select corresponding coil current channel as a trigger source. Threshold level is a user selectable. Default threshold level is 10% of the coil current maximum range (35 A).



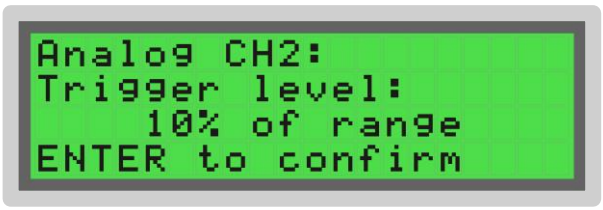
Press ***ENTER*** to confirm.

Analog Input Trigger Mode

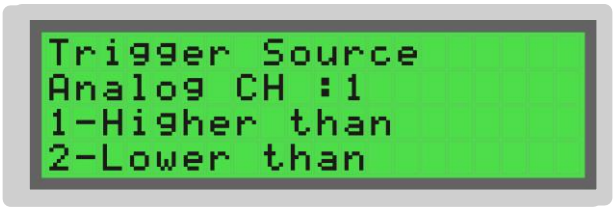
Press #**3** in the Trigger Source menu (**Figure 3-36**) to select analog channel as a trigger input. The following screen will be displayed:

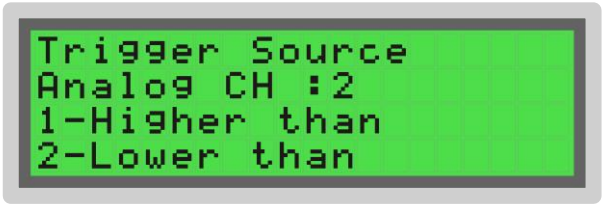
Press ***#1***, or ***#2*** to select a corresponding analog channel as a trigger source.

Threshold level is a user selectable. Default threshold level is 10% of the previously selected measurement range for analog channel.



Press ***ENTER*** to confirm. The following screen will be displayed:





User can choose desired Analog channel (Analog CH 1 or Analog CH 2) as a Trigger source. User is allowed to select between “Higher than” or “Lower than” threshold level. Press either ***#1*** *or* ***#2*** to select corresponding option.

Auxiliary Input Trigger Mode

Press #**4** in the Trigger Source menu (**Figure 3-36**) to select auxiliary channel as a trigger input. The following screen will be displayed:

Press ***#1*** or ***#2*** to select a corresponding auxiliary channel as a trigger source. CAT will start the measurement process when it senses the change of auxiliary contacts state during Open/Close operation.

3.3.2.2. External Trigger – Running the Test

Select one of the breaker operating sequences (**Figure 3-37**).

Figure 3-37: **Select sequence** - **External trigger** menu

The CAT measures timing for the following operating sequences in the External trigger mode:

1 – OPEN (O)
2 – CLOSE (C)
3 - C-O
4 - O-C
5 - O-CO

For example, if button **#2** is pressed which selects the CLOSE operation, the following notification will appear:

Hold the **READY** button and then press **START** to start the test.
The CAT will start waiting for the external trigger voltage and the following notification will appear:

The external trigger voltage needs to be detected by the CAT within 10 seconds (pre-trigger time out can be set to 20 s or unlimited time value - please refer to the **Page 39**) after the sequence initiation has begun. The CAT will display the following notification if no voltage is detected:

Note: *Trigger input voltage is in the range from 10 V to 300 V AC/DC.*

After the external trigger voltage is detected, the CAT will start the operating process and the following messages will appear on the display of the instrument where the red LED will start to blink:

After the operating process is finished, the CAT starts processing data.

CAT will display the CLOSE test results after the processing of data is completed. The same procedure is used for all other sequences.

3.4. Saving Test Results to USB Flash Drive

The obtained test results can be saved directly to a USB flash drive. This feature can be activated in the **Initial setup** menu. After data processing is finished and CAT displayed the test results, pressing the STOP button will initiate connection with the USB memory device.

To save the results, please insert the USB memory device and press the **ENTER** button. Press **STOP** to exit and the CAT will go back to the **Main Menu**.

In the example above, the actual test results are from a performed CLOSE operation. If **ENTER** is selected, the CAT will proceed with saving the results to an inserted USB Flash Drive.

After the **ENTER** button is pressed, the CAT will start saving the test results. The progress bar indicates the process of transferring data from the CAT to a memory device.

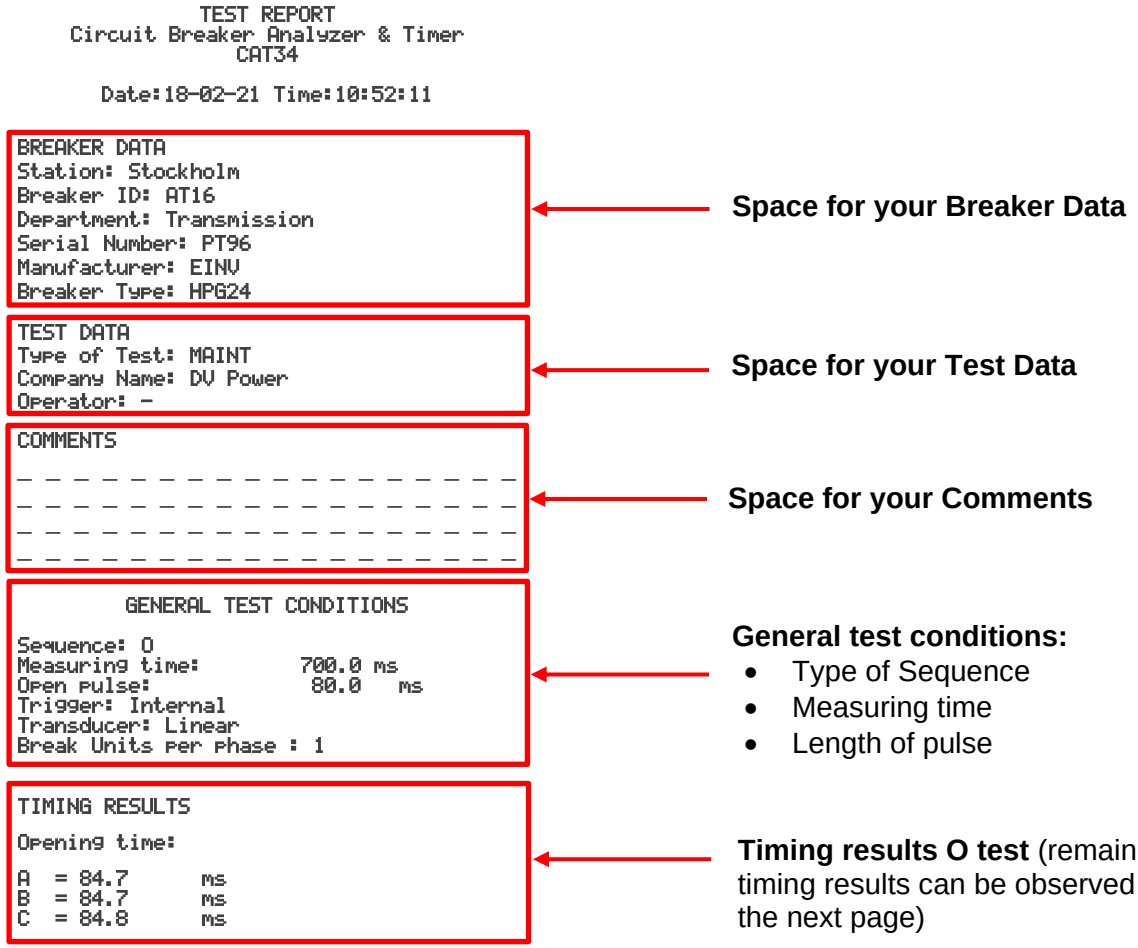
When the test results (for CLOSE test in this case) are saved, the CAT will display the following notification:

The CAT saves the results in the **DV Data** folder **on the** USB memory device.

If the USB Memory device is not connected to the Flash Drive connector, CAT will display the following message:

3.5. Printing the Test Results

The results can be printed using the ***PRINT*** button. The measurement results can be printed from the **Memory** menu or from the **Result** menu immediately after the test has been completed.



Space for your Breaker Data

Space for your Test Data

Space for your Comments

General test conditions:

- Type of Sequence
- Measuring time
- Length of pulse

Timing results O test (remaining timing results can be observed on the next page)

```
Breaker Opening time:

      84.8    ms

O Synchronization:

       0.1    ms

AUX Opening time:

1a  = 86.3     ms
2a  = 0.0      ms

AUX Closing time:
1b  = 84.6     ms
```

Timing results O test

```
CURRENT RESULTS

Maximum Current
Trip Coil 1

Imax  =   4.481    A
tmax  =   58.9     ms
```

Coil current results – O tests

```
ANALOG CH. RESULTS

Analog CH1
Range 60 V

Umax  =   0.12 V
Umin  =  -0.02 V

Analog CH2   10
Range 1.0 V  mV/A

Imax  =    5.46 A
Imin  =    0.35 A
```

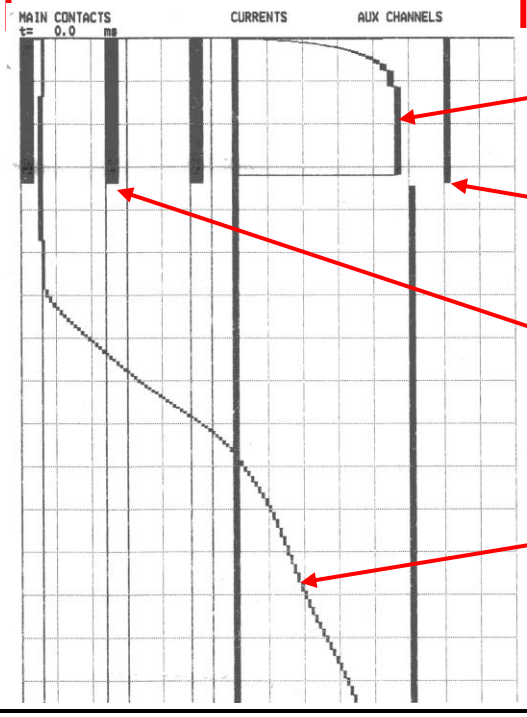
Analog channels results – O tests

```
TRANSDUCER RESULTS

Motion Results TR1

ST:    477.94 deg
OT:     0.00  deg
RB:    478.37 deg

Contact Wipe:

A   =  0.43   deg
B   =  101.38 deg
C   =  101.38 deg
```

Transducer results – O tests

```
GRAPH

Horizontal Scale:

          25. 0    ms/div

Vertical Scale:

Closing Coil Current: 2.00 A/div

Trip Coil 1 Current: 1.00 A/div
```

Graphical printout



Opening coil current

Auxiliary contacts

Main contacts

Motion graph

4. Memory Menu

Up to 499 test results can be stored in the CAT's internal memory. The Memory menu allows a user to manage test results. Press **#3** while in the **Main** menu (**Figure 3-14**) to enter the **Memory** menu. Memory menu displays the first free memory location (in this case, the first free memory location is 001).

Figure 4-1: The **Memory** menu

User is allowed to navigate between different memory locations by using alphanumeric keypad. If a test result exists on the selected memory location, the CAT will indicate the type of the test.

Press ***ENTER*** to view the test results of a selected memory location. **Result** menu will be displayed (in this case **Close** test).

If no test results exist on the selected memory location, the CAT will indicate the message: ***No results!***

In order to delete the selected memory location press ***CLEAR***. The following screen will be displayed:

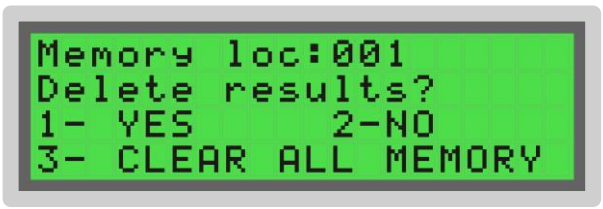


Figure 4-2: The **Memory** menu showing an option to delete all saved measurements from the memory positions

Press ***#1*** to delete the test results on the selected memory location, or press **#2** if the test results shall be kept.

Press **#3** to delete all test results from the memory.

5. Error Messages

Any operational error is indicated by a continual light on the Red LED followed by a buzzing sound alarm. Furthermore, the display shows an error status message.

To stop the alarm buzzer, remove the status message on the display, and return to the **Main** menu, press the ***STOP*** button.

5.1. Error MOD: 05

This message is displayed in case of a mod 05 (Main contacts CH1) malfunction. It usually indicates power loss at the specified mode or a communication malfunction.

- Mod 01 – Closing current measurement channel
- Mod 02 – Breaking current measurement channel
- Mod 03 – Digital transducer channel
- Mod 04 – Analog channels
- Mod 05 – Main contacts channel 1
- Mod 06 – Main contacts channel 2
- Mod 07 – Main contacts channel 3

5.2. Error Message "ERROR GIB: 011"

This message is displayed in case of a communication error inside the device. The GIB error indicates an unsuccessful command reception.

5.3. Error Message "PRINTER ERROR"

This message occurs in case of problems with the printing process on the thermal printer (optional accessory).

5.4. Error Message "MEMORY CARD ERROR"

This message occurs in case of problems with saving the results onto the memory card.

5.5. Error Message "OPERATING ERROR"

This message is displayed in case of communication problems while running the test.

5.6. Error Message "OPERATING ERROR – COIL OVERCURRENT"

This message appears when the current through coil control circuitry exceeded 35 A. The CAT coil control circuit is protected for IGBT drivers to prevent their damage caused by an overcurrent. To solve the problem, check the Coil control cable connections to the circuit breaker coils. Connections should be established as described in the **Figure 3-4** and **3-5**.

6. Troubleshooting Guide

If experiencing problems with the Circuit Breaker Analyzer and Timer, it is recommended to reset the device to default settings (**Settings** -> **Default setup**) and choose the appropriate frequency (50 Hz or 60 Hz).

6.1. Main Contacts Test

1. Connect all Main Contact cables to the device, short circuiting the clamps, as shown in the **Figure 6.1**.
2. Set time settings (**Settings** -> **Timing test setup**): set *Measuring Resolution* **1 ms** and *Measuring Time* **20 s**.
3. Return to the **Main** menu, choose ***New test*** (**New test** -> **Timing test**). At this point of the test, red LED should be light ON and green LED OFF. Select Open test ***(O)*** and press the ***READY*** and ***START*** buttons at the same time. After starting the test disconnect all the red, yellow and blue clamps from the black clamps. After the test is finished (after 20s) the "opening" times corresponding to the timing of disconnecting clamps should be shown on the device display.

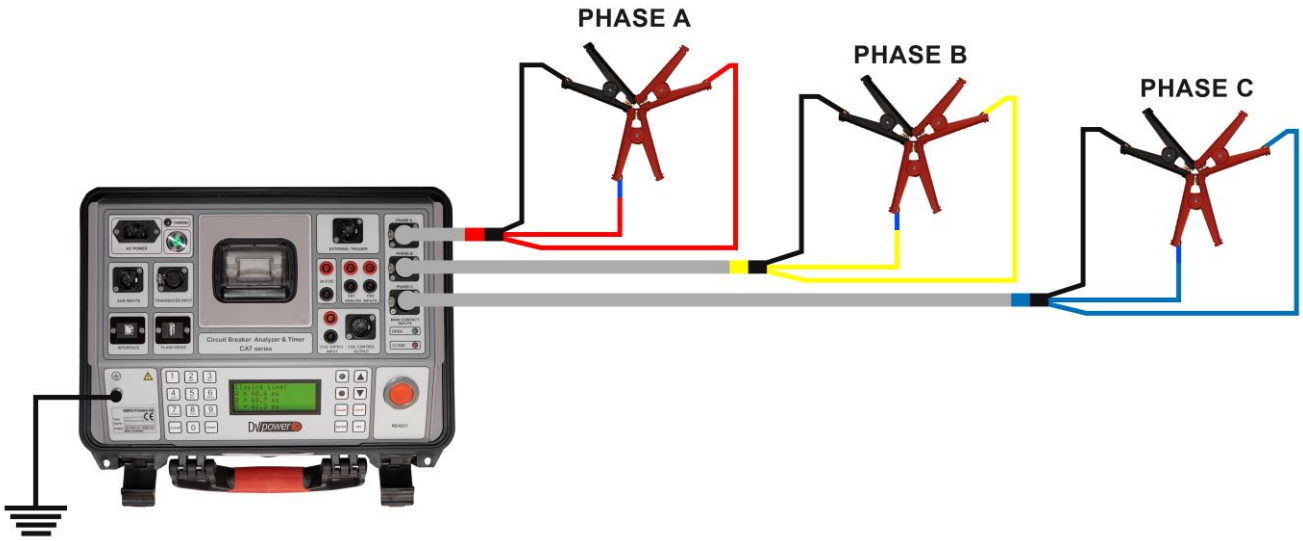


Figure 6-1: Main Contacts test

Note: *In the **Figure 6.1** the two breaks per phase test is selected as an example.*

6.2. Coil Control Test

Coil Control test can be performed in two ways, with and without the use of the DV Win software.

6.2.1. Coil Control Test without using DV Win Software

1. Connect Coil Control cable to the CAT device and switch ON the device.
2. Check the resistance between red and black wires of the Coil Control cable – CLOSE pair and the Coil Control cable – OPEN pair. If there is no short circuit between these wires please continue to the next step. Otherwise, if there is short circuit between these wires, please contact the DV Power Support Team.
3. Connect an external voltage source to the Coil supply input as shown in the **Figure 6-2**. Connect the Coil Control cable – CLOSE pair to the resistor as shown in the **Figure 6-2**. The resistance R of resistor used and voltage V should be chosen so the current in the circuit is limited within the range 1 A – 10 A.
4. After turning ON the device set time settings (**Settings** -> **Timing test setup**): set *Measuring Resolution* to **0,1 ms** and *Measuring Time* to **700 ms**.
5. Return to the **Main** menu, select *New test* (**New test** -> **Timing test**). Select Close test ***(C)*** and press ***READY*** and ***START*** buttons at the same time. Read the maximal current value from the CAT display. Measured current should be proportional to the used resistance and voltage: $I = \frac{V}{R}$

Repeat steps 3-5 using the Coil Control Cable – OPEN pair and selecting the *OPEN test (O)* in the step 5.

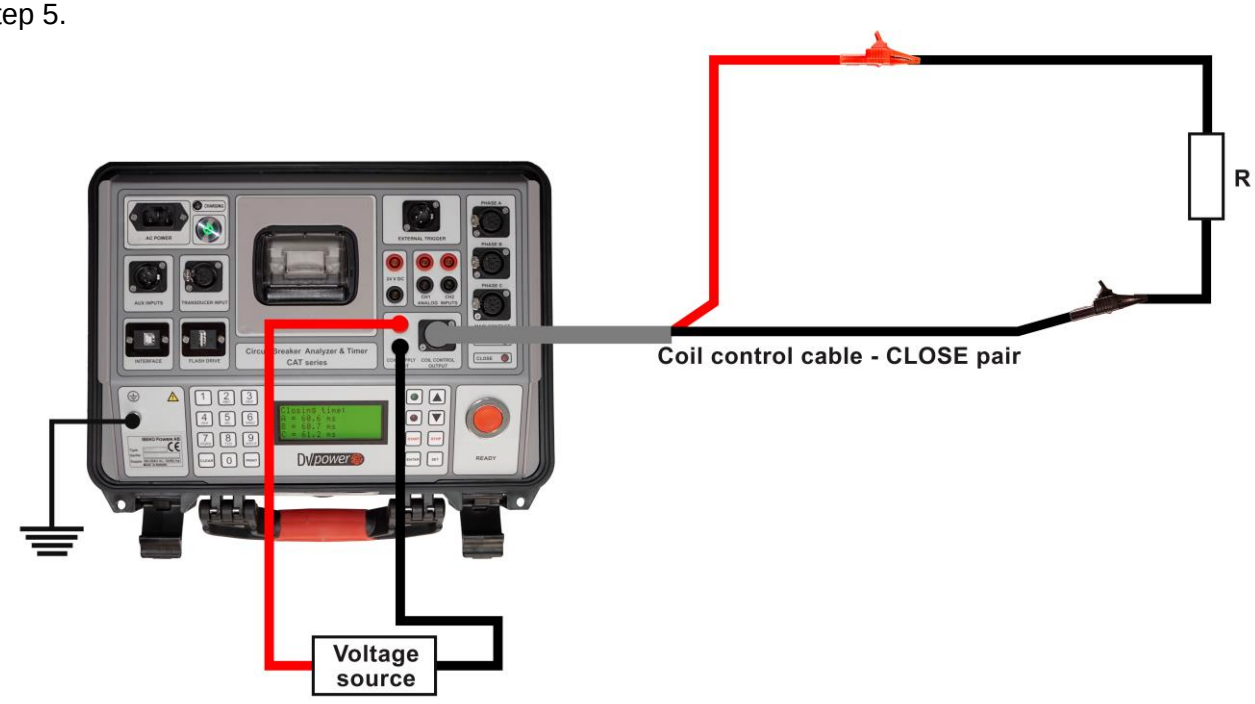


Figure 6-2: Coil Control test – Close pair of Coil Control Cable

6.2.2. Coil Control Test using DV Win Software

1. Connect the CAT device to the PC. Connect Main Contact cables and Coil Control cable – CLOSE pair, as shown in the **Figure 6.3**.
2. After starting the new test in the DV Win software, please select the *Test Settings* tab and define parameters for the *CLOSE* test. It is recommended to define the *Close pulse length* as 160 ms.
3. Start the test by pressing the *START* button and confirming the defined parameters.
4. When the test is finished, a *CAT Viewer* window should appear with the test results for active signals, as shown in the **Figure 6.4**.
5. Repeat the steps 1 - 4 using the Coil Control cable – OPEN pair and defining the parameters for the *OPEN* test in the step 2. It is recommended to define the *Open pulse length* as 80 ms.

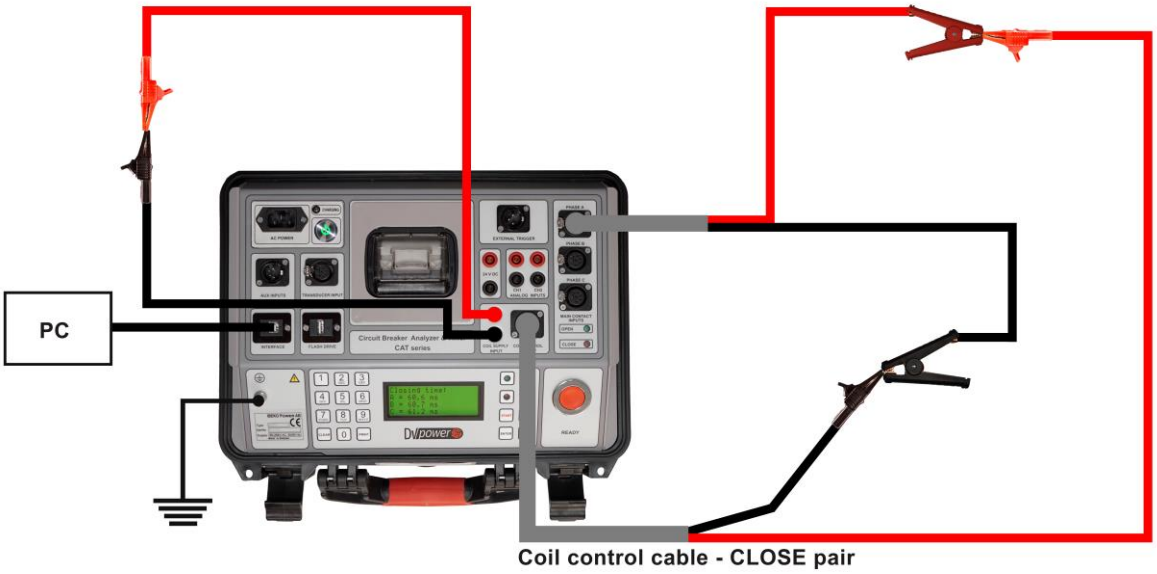


Figure 6-3: Coil Control test – Connection

Figure 6-4: Coil Control test – DV-Win test results

7. Technical Data

Main contact inputs

- Number of contact inputs:
  - 3 (3 x 1), 1 per phase – CAT03, CAT31, CAT34
  - 6 (3 x 2), 2 per phase – CAT61, CAT64
- 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

Time measurement

Time measurement resolution:

- 0,1 ms for 2 s test duration;
- 1 ms for 20 s test duration;
- 10 ms for 200 s test duration;

Typical accuracy: ± (0,05% rdg + resolution)
Guaranteed accuracy: ± (0,1% rdg + resolution)

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
- Overcurrent and overvoltage protection
- Coil supply input: 300 V DC max, 35 A DC max

Analog inputs (CAT34 and CAT64)

- 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
- Voltage measurement:
  - Typical accuracy: ± (0,5% rdg + 0,1% FS)
  - Guaranteed accuracy: ± (1% rdg + 0,2% FS)

The analog inputs are isolated with respect to all other circuits.

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

Breaker operation

- Close (C),
- Open (O),
- Close-Open (C-O),
- Open-Close (O-C),
- Open-Close-Open (O-C-O)

The user can select any desired test sequence

Current measurement

- Current measurement for Open and Close coil, 2 channels, Hall-Effect sensor
- Range ±35A DC to 5 kHz
- Resolution: 10 mA
- Typical accuracy: ± (0,5% rdg + 0,1% FS)
- Guaranteed accuracy: ± (1% rdg + 0,2% FS)
- Graphic presentation: currents waveform is displayed with a resolution of 0,1 ms

Printer (optional)

- Thermal printer
- Graphic and numeric printout
- Paper width 58 mm
- Printer operating temperature:
  - 20 ºC - + 70 ºC / - 4 ºF - + 158 ºF

The print density is guaranteed within range: 5°C to 40°C, 20 to 85% relative humidity, non-condensing

Transducer input (CAT34 and CAT64)

- Digital transducer inputs: 1
  Digital rotary transducers: 2500ppr
- Analogue transducer inputs: 1
  Analog transducer input measurement resolution: 16 bit.
- Internal supply for linear transducer: 5 V DC

Dimensions and weight

- Dimensions: 405 mm x 170 mm x 335 mm
  15.9 in x 6.7 in x 13.1 in
- Weight: 5.5 - 7 kg / 12.1- 15.4 lbs

Applicable standards

- Safety:
  Low Voltage 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

External trigger

- Trigger input voltage: 10 V – 300 V AC/DC
- Coil currents: threshold level user selectable
- Auxiliary inputs
- Analog inputs: threshold level user selectable (available with CAT34)

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: 250 VA

Internal battery supply (optional)

- Built-in rechargeable battery
- Li-Ion 14,4 V Cell – 6800 mAh 98 Wh

Environmental Conditions

- Operating temperature: - 20 ºC to + 55 ºC / - 4 ºF to + 131 ºF
- Storage & transportation: - 40 ºC to + 70ºC / - 40 ºF to + 158 ºF
- Humidity 0 % - 95 % relative humidity, non-condensing

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

8. Instruments and Accessories

CAT03

	**Main contact inputs** Number of Main contact inputs: 3 (3 x 1), 1 per phase

CAT31

	**Main contact inputs** Number of Main contact inputs: 3 (3 x 1), 1 per phase **Coil control outputs:** 2 (1 Open & 1 Close) **Auxiliary contact inputs:** 3

CAT34

	**Main contact inputs** Number of Main contact inputs: 3 (3 x 1), 1 per phase **Coil control outputs:** 2 (1 Open & 1 Close) **Auxiliary contact inputs:** 3 **Analog input channels:** 2 **Transducer input channels**: 1 (digital and analog channel)

CAT61

	**Main contact inputs** Number of Main contact inputs: 6 (3 x 2), 2 per phase **Coil control outputs:** 2 (1 Open & 1 Close) **Auxiliary contact inputs:** 3

CAT64

	**Main contact inputs** Number of Main contact inputs: 6 (3 x 2), 2 per phase **Coil control outputs:** 2 (1 Open & 1 Close) **Auxiliary contact inputs:** 3 **Analog input channels:** 2 **Transducer input channels**: 1 (digital and analog channel)

Order info

Instrument	Article No.
Circuit Breaker Analyzer & Timer CAT03	CAT0300-N-03
Circuit Breaker Analyzer & Timer CAT03 (Battery operated)	CAT0300-B-03
Circuit Breaker Analyzer & Timer CAT31	CAT3100-N-03
Circuit Breaker Analyzer & Timer CAT31 (Battery operated)	CAT3100-B-03
Circuit Breaker Analyzer & Timer CAT34	CAT3400-N-03
Circuit Breaker Analyzer & Timer CAT34 (Battery operated)	CAT3400-B-03
Circuit Breaker Analyzer & Timer CAT61	CAT6100-N-03
Circuit Breaker Analyzer & Timer CAT61 (Battery operated)	CAT6100-B-03
Circuit Breaker Analyzer & Timer CAT64	CAT6400-N-03
Circuit Breaker Analyzer & Timer CAT64 (Battery operated)	CAT6400-B-03

Included accessories	Article No.
Plastic transport case - small size	PLCAS-P00-01
Windows based DV-Win PC software including USB cable	
USB Memory Stick	
Mains power cable	
Ground (PE) cable	

Standard accessories	Article No
Main contact cables 5 m (16.4 ft) with SCT clamps (*for CAT03, CAT31, CAT34*)	CM-05-34MXST
Main contact cables 5 m (16.4 ft) with SCT clamps (*for CAT61, CAT64*)	CM-05-65MXST
Main contact cables extension 5 m (16.4 ft) (*for CAT61, CAT64*)	E3-05-65MXFX
Coil control cable 5 m (16.4 ft) with banana plugs (*for CAT31, CAT34, CAT61, CAT64*)	CO-05-00C5B1
Coil supply cable set 2 x 5 m 2,5 mm^2 (16.4 ft, 14 AWG) with banana plugs (*for CAT31, CAT34, CAT61, CAT64*)	C2-05-02BPBP
Auxiliary contact cable 5 m (16.4 ft) with banana plugs (*for CAT31, CAT34, CAT61, CAT64*)	CA-05-00C4B1
External trigger cable 5 m (16.4 ft) with banana plugs	CE-05-00C4B1
Analog channels cable set 4 x 5 m (16.4 ft) with banana plugs (*for CAT34, CAT64*)	C4-05-02BPBP
Cable bag (*for CAT03, CAT31, CAT61*)	CABLE-BAG-00
Cable bag (x2) (*for CAT34, CAT64*)	CABLE-BAG-00

Optional accessories	Article No.
Main contact cables 3 m (9.8 ft) with SCT clamps*	CM-03-34MXST
Main contact cables 3 m (9.8 ft) with SCT clamps)**	CM-03-65MXST
Main contact cables 3 m (9.8 ft) with alligator clamps (A2)*	CM-03-34MXA2
Main contact cables 3 m (9.8 ft) with alligator clamps (A2)**	CM-03-65MXA2
Main contact cables 5 m (16.4 ft) with alligator clamps (A2)*	CM-05-34MXA2
Main contact cables 5 m (16.4 ft) with alligator clamps (A2)**	CM-05-65MXA2
Main contact cables extension 10 m (32.8 ft)	E3-10-65MXFX
Main contact cables extension 15 m (49.2 ft)	E3-15-65MXFX
Coil control cable 10 m (32.8 ft) with banana plugs ***	CO-10-00C5B1
Coil control cable 15 m (49.2 ft) with banana plugs ***	CO-10-00C5B1
Coil supply cable set 2 x 10 m (32.8 ft) 2,5 mm^2 (14 AWG) with banana plugs ***	C2-10-02BPBP
Analog channels cable set 4 x 5 m with alligator clamps (A1)****	S4-05-02BPA1
Analog channels cable set 4 x 5 m with alligator clamps (A2)****	S4-05-02BPA2
Auxiliary contact cable 10 m (32.8 ft) with banana plugs ***	CA-10-00C4B1
External trigger cable 10 m (32.8 ft) with banana plugs	CE-10-00C4B1
Current clamp 30/300 A with internal battery supply and extension 5 m (16.4 ft)****	CACL-0300-07
Current clamp 30/300 A with internal battery supply and extension 5 m (16.4 ft)****	CACL-0300-08
Small current clamp 10/100 A with internal battery power supply and extension 5 m (16.4 ft)****	CACL-0100-01
Digital rotary transducer 5 m (16.4 ft) with accessories****	DRT-SET-0005
Digital rotary transducer 10 m (32.8 ft) with accessories****	DRT-SET-0010
Linear analog transducer 150 mm (5,9 in) with 5 m (16.4 ft) connection cable****	LAT-150-C305
Linear analog transducer 225 mm (8,9 in) with 5 m (16.4 ft) connection cable****	LAT-225-C305
Linear analog transducer 300 mm (11.8 in) with 5 m (16.4 ft) connection cable****	LAT-300-C305
Linear analog transducer 500 mm (19.7 in) with 5 m (16.4 ft) connection cable****	LAT-500-C305
Universal transducer mounting kit****	UTM-KIT-0000
Universal transducer mounting kit - extended version****	UTM-KIT-0001
Linear to rotary convertor****	LTR-CON-0000
Doble transducer adapter with 5 m (16.4 ft) connection cable****	DTA-005-C602
Thermal printer 58 mm (2.28 in) (built-in)	PRINT-058-01
Thermal paper roll 58 mm (2.28 in)	PRINT-058-RC
Cable plastic case - small size	CABLE-CAS-01
Cable plastic case - medium size	CABLE-CAS-02
Cable plastic case - large size	CABLE-CAS-03
Cable plastic case with wheels - medium size	CABLE-CAS-W2
Cable plastic case with wheels - large size	CABLE-CAS-W3
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
Dolphin clip (black)	DOLPIN-CL-B0
Dolphin clip (red)	DOLPIN-CL-R0

* *Optional accessories for CAT03, CAT31 and CAT34*
** *Optional accessories for CAT61 and CAT64*
*** *Optional accessories for CAT31, CAT34, CAT61 and CAT64*
**** *Optional accessories for CAT34 and CAT64*

9. Members Area

DV Power customer can create account to get access to DV Power Members Area. By creating an account with DV Power you get access to:

- Application Notes
- Published Articles

To create an account please visit DV Power register on page: dv-power.com/register/.

If you register a valid DV Power instrument you will get access to:

- DV-Win Software
- Manuals
- Troubleshooting Guides

To register an instrument please log in and visit dv-power.com/register-new-product/. Your access will be granted after a verification process for which is normally one working day required.

If you require additional help during the process of registration, please contact us via e-mail support@dv-power.com.

10. Customer Service

Before calling or sending an e-mail to the DV Power Customer Service for assistance, please perform the following steps:

- Check all cable connections.
- If possible, try testing on another instrument of the same type
- Perform the troubleshoot procedure as described above in the Section “Troubleshooting Guide”.
- Provide following information: instrument serial number, instrument's installed software revision number, details about a PC configuration used and operating system installed.
- As comprehensive as possible description of the problem, including DUT (Device under Test), error messages and the sequence of events before the problem appeared.

The DV Power Customer Service can be reached at:

Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-mail: support@dv-power.com

Note: The preferred contact is via e-mail. In this way the case is documented and traceable. Also time zone problems and busy telephone lines do not delay the response.

11. Packing the Instrument for Shipment

Prior to sending the instrument to DV Power for servicing, please contact the DV Power Customer Service at:

Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-mail: support@dv-power.com

for the return instructions.

Note: DV Power is not responsible for any damage during shipping. Please carefully protect each instrument from shipping and handling hazards. Ensure the protective covers are securely in place.

Instrument has to be sent to DV Power as freight pre-paid, unless other arrangements have been authorized in advance by the DV Power Customer Service.

To prepare an instrument for shipment, please follow these instructions:

1. Disconnect and remove all external cables. Do not include manuals, cables, and transducer connecting rods unless recommended by the DV Power Customer Service.

2. Reuse the original packing material if it is available.

If it is not available:

Pack the instrument following a practice used for fragile electronic equipment. It has to include a 2-wall minimum corrugated cardboard box with minimum 5 cm (2 inch) thick poly foam padding, or a wooden crate with minimum of 5 cm (2 inch) thick poly foam pads wrapping the instrument completely.

IBEKO Power AB 2022

Manufacturer Contact Information

IBEKO POWER AB

Box: 1346, 181 50 Lidingö, Sweden
Fax: +46 8 731 77 99
Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-Mail: support@dv-power.com
Website: http://www.dv-power.com