CBA 3000

All-In-One Circuit Breaker Analyzer

ICS SCHNEIDER MESSTECHNIK

isa ALTANOVA GROUP

ICS Schneider Messtechnik GmbH
Briesestraße 59
D-16562 Hohen Neuendorf / OT Bergfelde

Tel.: 03303 / 504066
Fax: 03303 / 504068

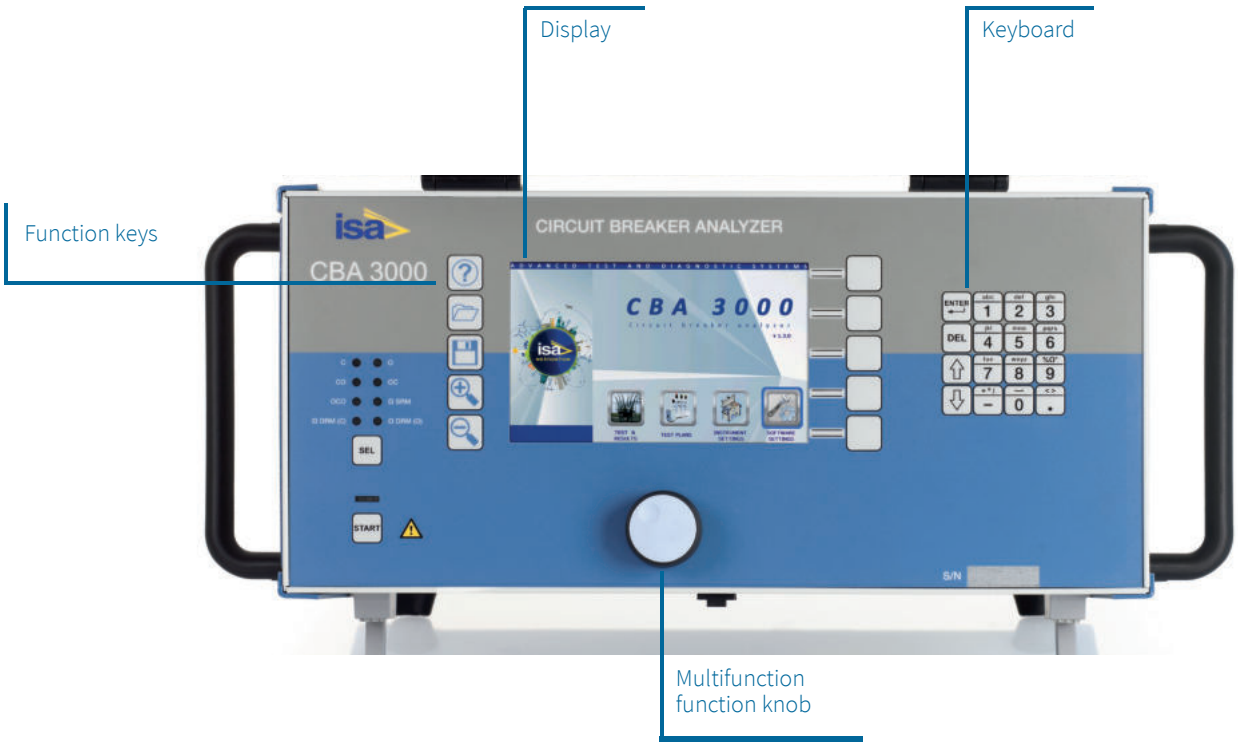
info@ics-schneider.de
www.ics-schneider.de

All-in-one circuit breaker analyzer

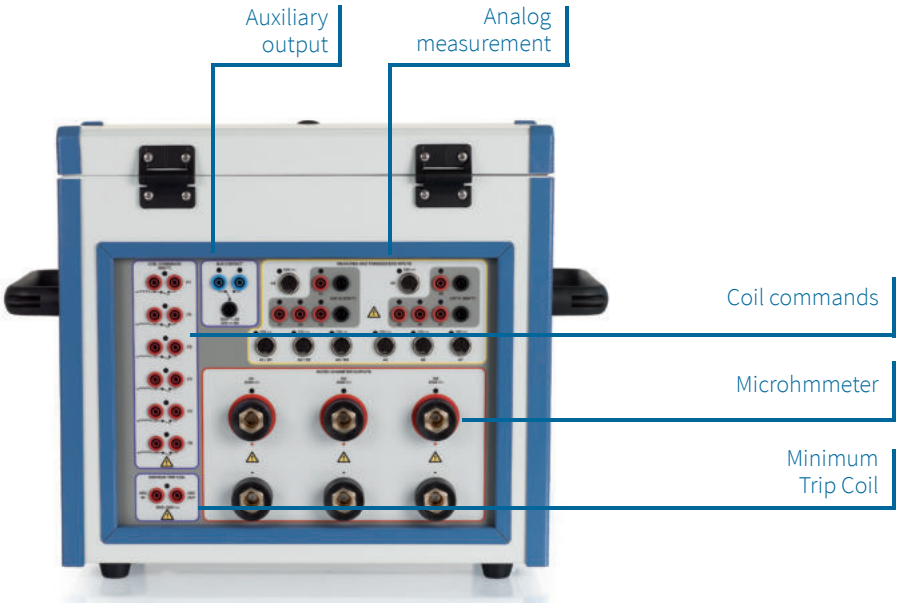
The ultimate all-in-one circuit breaker analyzer: safer, faster and more accurate than ever.
It allows any timing test, motion and speed analysis, multiple contemporary static and dynamic contact resistance measurements, Both Sides Grounded (BSG) tests, undervoltage condition test and more. All these functions are integrated in a single lightweight device, without the need of connecting additional external modules.

- Faster: one single connection set up to perform automatically all possible circuit breaker tests
- Safer: both sides grounded feature without any additional external modules
- It performs tests on GIS breakers with both sides grounded (BSG)
- Fully configurable
- 3 micro-ohmmeters (200 A DC output each) performing up to 6 static and dynamic contact resistance measurement
- Three phase first trip measurement
- 16 or 24 fully user configurable Main/PIR and auxiliary input contacts
- 2, 4 or 6 Open / Close coil commands
- 3 analog linear/rotary transducers and 3 digital transducers inputs for travel/ speed analysis
- 8 analog input measurements including, battery voltage, motor current, pressure transducers and many others
- Minimum voltage trip coil test, fully automatic
- On-screen control and test results evaluation
- TDMS software suitable for test executions, results analysis, archiving and test report
- Library of standard test plans are available with the test set

CBA 3000 - Front Panel



CBA 3000 - Back Panel



CBA 3000 - Side Panels

Description

Circuit Breaker Analyzer allows the off-line testing of MV and HV circuit breakers. The test set measures circuit breaker operation times as they are defined in the IEC standard 62271-100.

CBA 3000 is also **up to six breaks micro-ohmmeter**. It allows measuring the Static Contact Resistance (SCRM) of the circuit breaker contact and the Dynamic Contact Resistance (DCRM), that is how the breaker contacts resistances change while the breaker is closing or opening. This leads detecting hidden defects, that are otherwise impossible to be diagnosed.

• **Test set control:** via large 7 " colour display. In this way it's possible to select the test plan, perform all tests, analyze the results, zoom in and out the graph. A number of function keys and keypad, plus selection encoder, give full control of the test set. USB and Ethernet interface for communication with the PC are provided. Capability to transfer results directly to an USB pen drive. Huge recording capability: more than 256 Mbytes (typically 1000 results).

• All possible **Test Plans** are programmable. A Test Plan Editor is available and a Test Plan Library is supplied with the test set. The selected test plan includes all the operations that must be executed on a circuit breaker: Timing, Travel, Motor Current and Static and Dynamic Contact Resistance tests.

• **16 contact inputs (optionally 24)** totally configurable. Each contact can be programmed as main breaker contact / PIR (Pre Insertion Resistor) or Auxiliary Contact. In this way it's possible to verify a breaker with up to 8 breaks per phase. If a contact is programmed as Main, the measurement of the time delay it is provided as well as the value of the Pre Insertion Resistor (optionally).

• **Two, four or six coil (Open / Close) commands** are available, in order to control each phase (Open or Close) independently. Three different current ranges can be used to measure the coil current of each circuit.

• **Up to three micro-ohmmeters,** equipped with high current generators up to 200 A (each), are available in order to perform up to six static and dynamic resistance measurements of a breaker contact at the same time.

• **Safe test with Both Sides Grounded:** CBA 3000 can perform Both Sides Grounded test (BSG) of a breaker, measuring the main contacts timing even if both ends of the CB are connected to ground in order to enhance the safety.

• **Eight analog input measurement circuits** totally configurable. Every input can be configured as :
. generic AC or DC analog input up to 300V AC (or 420 V DC peak) for measuring standby battery or motor supply
. low voltage measurement for motion analysis with transducers
. low voltage measurement for pressure transducers
. very low voltage measurement for current clamps with voltage output
. very low voltage measurement for micro-ohmmeter function
. generic voltage input for other purposes

• **One auxiliary relay output,** programmable.

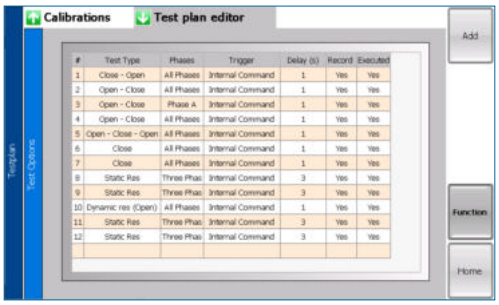
• **Optional external thermal printer,** 112 mm paper wide.

• **Optional internal thermal printer,** 58 mm paper wide.

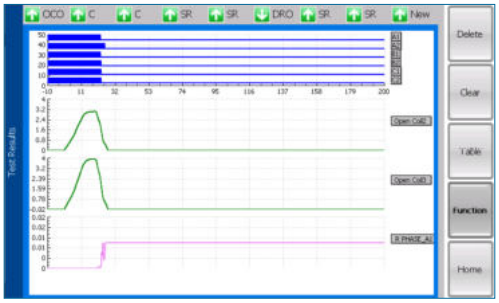
• **Optional Minimum Voltage Trip coil module** to verify the functionality of the coil commands circuitry when under voltage supplied.

TDMS software test suite included. TDMS allows to execute tests, analyze test results, add notes, save into a database, create a test report and create, store and recall Test Plans.

CBA 3000 is housed in a transportable aluminium box, that is provided with a cover and handles for a compfortable transportation.



Test plan



Test result

Features

Timing test

The following time measurement trigger options are user selectable:

• Internal: the time measurement starts as the first Open or Close coil command is issued by the driving circuit. Timing accuracy: ± 20 µs

• Coil current: the time measurement starts as soon as the first Open or Close coil current exceeds the selected current limit

• Auxiliary input: the time measurement starts when the selected auxiliary input turns ON or changes its state. The trigger can be performed also on a logical combination of auxiliary inputs

• Analog input: the time measurement starts when the analog input level crosses (greater than, lower than) the selected threshold.

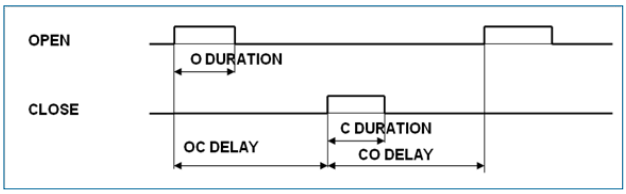
Programmable sequences

The user can select the following individual operations which can all be included in one test plan:

- Open: the selected open coil phase is driven (all the combinations: all phases, phase1, phase 2, phase 3)
- Close: the selected close coil phase is driven (all the combinations as Open coil)
- OC: In sequence, the Open and Close coils are driven (all the combinations)
- CO: In sequence, the Close and Open coils are driven (all the combinations)
- O-CO: In sequence, the Open, the Close and then again the Open coils are driven. The first Open command is issued on the selected Open coil phase, while the second Open command is issued on all coil phases
- Static resistance: the instrument performs a breaker resistance contact measurement using the available micro-ohmmeters on the selected phase (or on all the phases together)
- Dynamic resistance: the instrument measures dynamically the resistance profile during an open or close operation: the result of the test will be a diagram and the breaker time delay based on the profile analysis

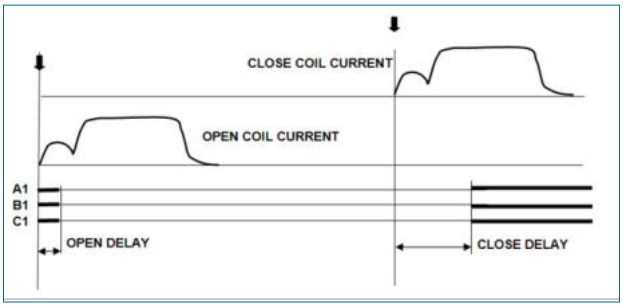
These sequences are also selected by means of a dedicated pushbutton. The selected sequence is confirmed by an LED.
In this way the user defines the sequences (i.e. CO-CO, O-CO-CO and so on) that can be executed.
For all the above sequences, the user can program the following time delays:

- Open command duration: range 1 ms to 10 s
- Close command duration: range 1 ms to 10 s
- Open to Close delay: delay range 1 ms to 199.990 s
- Close to Open delay: delay range 1 ms to 199.990 s
- Dynamic open or close : range from 30 ms to 1 s
- Recording duration: range 10 ms to 199.990 s



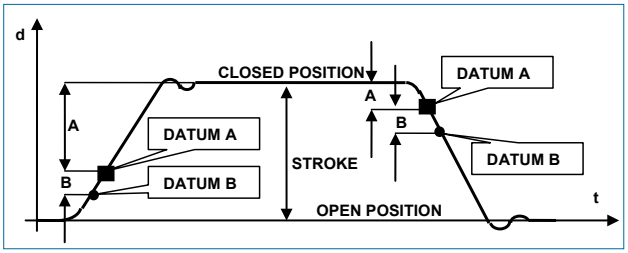
Coil currents

CBA 3000 calculates internally the maximum current of any coil command and at the meantime the current profile is recorded. The following figure shows the recording with an Open – Close command: delays are referred to coil commands.

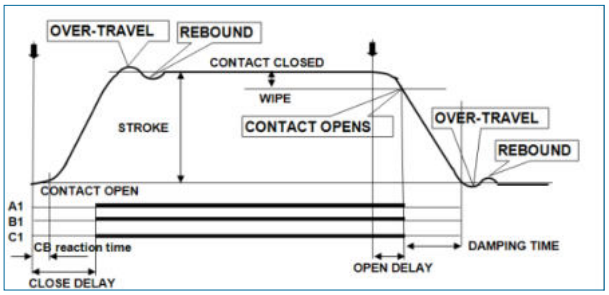


Motion measurements

Using analog or digital transducers connected to the CBA 3000 inputs, it is possible to perform the motion analysis of a circuit breaker. All typical measurements, such as speed, acceleration, overtravel and rebound, are executed.



The breaker speed and acceleration are calculated between two datum points defined on the curve described by the transducer.



Static resistance measurement

This measurement is performed connecting CBA 3000 to the circuit breaker main contacts.
Main contacts resistance is measured in the closed position.

Micro-ohmmeters and current generator:

- Output current : 200A , 150 A, 100A , 50A, 25 A
- Resistance measurement ranges: 250μΩ, 1mΩ, 10mΩ, 50mΩ, 500mΩ
- Minimum resolution: 0.1μΩ
- Contact resistance accuracy : 0.2% of the reading ± 0.2% of the range (for ranges 250μΩ and 1mΩ)
- Contact resistance accuracy : 0.3% of the reading ± 0.3% of the range (for ranges 10mΩ, 50mΩ and 500mΩ)
- Maximum test voltage: 5 V

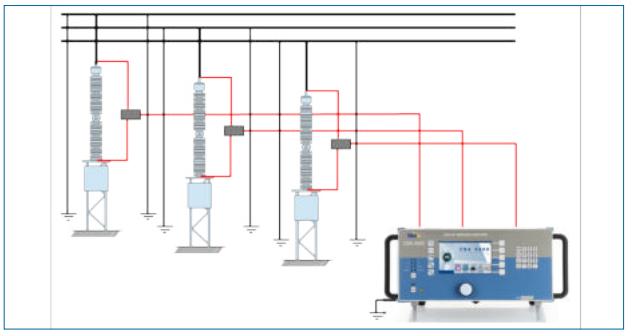
Dynamic resistance measurement

With this measurement it is possible to record the main contact resistance during the CB Close or Open. The test current flows through the breaker contact and CBA 3000 measures the contact resistance variations during the close or open operation.
Test current, resistance ranges and other characteristics: as for the static resistance measurement.

Both sides grounded tests

Using the three micro-ohmmeters of CBA 3000 it is possible to perform breaker time delay tests even if both sides of the circuit breaker are grounded.

The **cable kit extension** allows to extend the micro-ohmmeter lenght up to 20 m. The cable kit is composed of:
• 6 extensions of section 50mm^2 and 7m lenght
• 12 extensions for measuring cables, 5m lenght, terminated on one side with a clamp and on the other side with a connector for micro-ohmmeter measuring amplifier
•Transport case



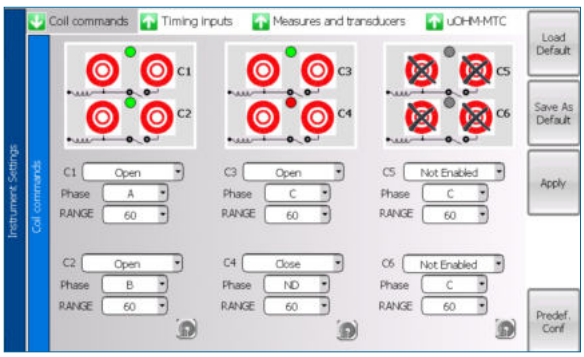
Both Sides Grounded (BSG)

First trip test

In addition to the standard offline timing mode, CBA 3000 also features three-phase first trip test using optional AC or DC current clamps. The first time detection is important because, if the CB has been in service for a long period in close position, the first trip time can be considerably slow because of friction. In the normal test conduction, the circuit breaker is opened before connecting to the poles, so the first movement friction is lost.

Test set control

- The local control is by keypad, selectors and display: no PC control is necessary
- Keypad: 16 keys (numeric and alphabet): it allows inputting all test references. The arrangement is the same as portable phones
- Two dedicated pushbuttons for test start and sequence selection
- Encoder with pushbutton for menu selection
- Five dedicated keys for main functions as Load, Save etc. plus five pushbuttons that have different functions depending upon the active menu
- The graphical display has the following main features:
  - Type: Color LCD
  - Pixels: 800x 480
  - View area: 152 x 92 mm
  - Memory size: 256 Mbytes (approx. 1000 results)
  - Capability of saving and re-calling up to 256 Test Plans



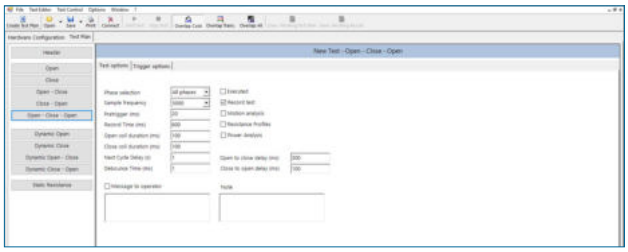
Instrument settings

Data management

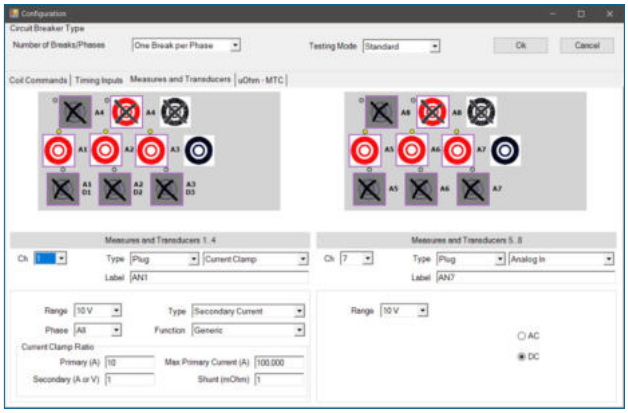
The communication to the PC can be performed via Ethernet and USB. Test results can be saved also into an USB drive.

TDMS software suite

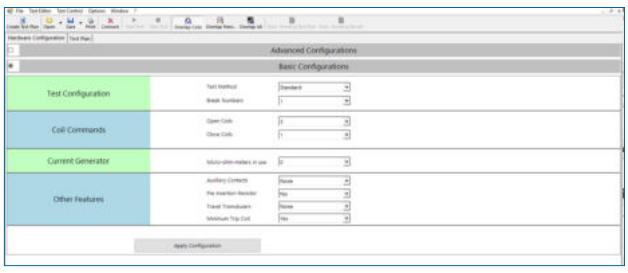
The dedicated TDMS software has the following main features.
. Execute tests
. Download of test sequences
. Download of test results
. Test sequences and test results can be viewed, edited in the missing descriptions, saved, printed, exported
. Test data can be organized in a data base including all sub-station devices
. Possibility of viewing, overlaying and gluing more results, for an easy test result comparison
. Possibility to pre-set test sequences and to download them into the test set
. Two cursors to select measurement points and intervals
. Zoom in and out feature
. Pass – fail timing test result analysis
. Pass – fail current profile test result analysis
. Enhanced measurement features for movement – speed – acceleration control.



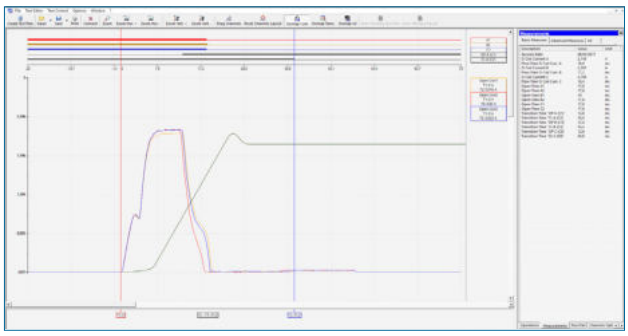
Test settings



Custom configuration



Predefined configuration



Test results

Technical Specification

Coil command circuits

. Number of circuits: 2, 4 or 6.
. Type of driver: electronic; it ensures superior timing control
. Driver characteristic: 300 V DC max; 60 A DC max; 300 V AC max; 42 A AC max
. Operating time accuracy: 0.025% of delay ± 20 us
. Coil current ranges: 3; 10; 60 A full scale, user selectable
. Coil current measurement accuracy: 0.1% of the reading ± 0.1% of the selected range
. Outputs are isolated between them and between ground

Timing contact inputs (main / pir or auxiliary)

. Number of contact inputs: 16 (optionally 24), divided in 8 (optionally 12) groups of two each
. Each input group is isolated with respect to the others
. The contact inputs may be configured as main/PIR breaker contact or auxiliary contact
. The contacts status (closed or opened) are displayed on the screen

Main/PIR breaker contact

. Test of the main contact and of the pre-insertion resistor contact, selectable
. PIR resistance range : 30Ω to 10kΩ
. PIR resistance measurement value (optional) accuracy : ± 2% of the reading ± 0.1% of the range. The contact is closed when the contact resistance is less than 10Ω
. Contact test voltage: 24V; test current: 100mA

Auxiliary contacts

. Capability of testing dry contacts. Contact test voltage: 24 V; test current: 5 mA
. Capability of testing wet contacts. If wet, the input contact has these characteristics:
- Voltage threshold : 15V / 77V or programmable with steps of 5V (for PIR resistance measurement value option)
- Impedance : >150kΩ or > 500kΩ (for PIR resistance measurement value option)

. Contact selection (dry or wet with thresholds) can be different on the groups

Auxiliary binary output

. One relay auxiliary output
. Characteristics of the contacts with a resistive load: AC: 300V; 8A; 2400VA - DC: 300V; 8A; 50W
. The contact operation can be timed with respect to test start

Inputs time measurement

. Sample rate: from 10Hz to 100kHz maximum
. Resolution: 0.01ms to 100ms
. Inputs timing accuracy: see the following table

RANGE s	FREQUENCY Hz	RESOLUTION ms	ACCURACY % of the reading
1	100.000	0.01	±0.02 ms ± 0.01%
2	50.000	0.02	±0.02 ms ± 0.01%
4	20.000	0.05	±0.05 ms ± 0.01%
10	10.000	0.1	±0.1 ms ± 0.01%
20	5000	0.2	±0.2 ms ± 0.01%
40	2000	0.5	0.5 ms ± 0.01%
100	1000	1	1 ms ± 0.01%

Analog inputs

Number of analog inputs: 8, fully programmable.
Common characteristics of analog inputs:
. Measurement resolution: 16 bit
. Number of ranges : three. 300Vac (420 Vdc peak), 10Vdc, 1V DC
. Measurement accuracy:
1 V range : ± 0.2% of the reading ± 0.2% of the range
10 V range : ± 0.1% of the reading ± 0.01% of the range
420 V range : ± 0.5% of the reading ± 0.1% of the range
. Input impedance: more than 600kΩ
. Measurement sampling rate: 100kHz max
. Number of insulated and independent neutrals: 4.

Two groups of three channels each (to be used, for example, as transducer inputs for motion analysis and for voltage coming from micro-ohmmeter) and two different neutrals for the remaining two channels (for monitoring motor current or DC coil supply).
. Voltage value: + 5 V; maximum output current 30 mA; minimum transducer resistance 170Ω. It is also available a +12V supply with the same power
. Insulation between different neutrals : 1kV AC

Digital transducer inputs

CBA 3000 allows monitoring up to three digital transducers at the meantime.
. Maximum input frequency: 50kHz
. Interface: RS422
. Accepted transducers: up to 5000 impulses
. Connection: by three multi-pole connectors used also for the analog inputs

Other characteristics

. Mains supply:
  - From 85 to 265V AC; 47-63Hz
  - From 120 to 350V DC.
. Maximum supply current: 3.6A @ 100V AC or 1.8A @ 200V AC; maximum power consumption: 360 VA
. Housing: aluminium case, with hinged removable cover and handles
. Dimensions: 407 x 450 x 230mm. Weight: 15kg

The instrument comes complete with the following items:
. Mains cable
. User manual
. Ethernet cable
  - USB cable
. One cable, yellow/green, for the connection to ground. Cable length: 4 m; cross section 1 sq. mm, terminated with a crocodile.
. Spare fuses
. Software TDMS

Applicable standards

The test set conforms to the EEC directives regarding Electromagnetic Compatibility and Low-Voltage instruments.
. Electromagnetic Compatibility: Directive no. 2014/30/UE. Applicable Standard: EN61326-1:2013.
. Low Voltage Directive: Directive n. 2014/35/UE. Applicable standards: CEI EN61010-1:2010.
In particular:
. Input/output protection: IP 2X - IEC69529
. Operating temperature: -10° to 55 °C; storage: -20 °C to 70 °C
. Relative humidity: 5-95% without condensing
. Vibration: IEC 68-2-6 (20 m/s2 at 10 – 150 Hz)
. Shock: IEC 68-2-27 (15 g; 11 ms; half-sine)

Standard cables kit

Main contacts cables kit

Microhmmeter voltage measurement cables kit

Microhmmeter current generation cables kit

Transducers cables kit

Auxiliary contacts cables

Two breaks per phase: (3x) Main contacts kit + two cables with silicone sheath for the connection to the auxiliary contacts, each of three conductors. Cable length: 10m + two cables with four conductors each, for the connection to the CB coils. Cable length: 10m.

Four breaks per phase: (6x) Main contacts kit + two cables with silicone sheath for the connection to the auxiliary contacts, each of three conductors. Cable length: 10m + two cables with four conductors each, for the connection to the CB coils. Cable length: 10m.

One microhmmeter cable kit: Microhmmeter voltage measurement kit + (2x) Microhmmeter current generation kit.

One microhmmeter cable kit + additional two microhmmeters: (3x) Microhmmeter voltage measurement kit + (6x) Microhmmeter current generation kit.

Optional accessories

Additional coil commands

With this option the test set is provided with the circuits to drive four or six coils (three Open, three Close). The option is made of one additional printed circuit board. Even if it is possible to upgrade CBA 3000, it is advisable to request the option at order.

PIR

This option allows to measure the pre insertion resistance value of a main contact.

MTC - Minimum voltage trip coil tester

The option has the purpose of allowing to test the behaviour of the Minimum Trip Coil circuit and of Open or Close coils, when supplied at a reduced auxiliary voltage.
. Voltage adjustment in steps of 1V
. Over-current protection
. Max Voltage: 150V

External printer

Thermal printer, for the printout of all test results. Paper 112 mm wide.

Internal printer

Integrated thermal printer, 58 mm wide, housed in the test set cover.

Transport case

The transit case allows delivering CBA 3000 with no concern about shocks up to a fall of 1m and it provided with clasp removable cover.

Heavy duty transport case (code 57178)

Analog transducers

We have a set of analog transducers, linear and rotating. Linear transducers have different strokes, and also different IP protections: low for the TLH series, high for the LWG series. A mounting kit is also available. The table summarizes characteristics.

TYPE	DESCRIPTION	STROKE mm / °
linear	TLH 150	150
linear	TLH 225	225
linear	TLH 300	300
linear	TLH 500	500
linear	LWG 150	150
linear	LWG 225	225
linear	LWG 500	500
linear	LWG 750	750
analog rotary	IP 6501	355°

The mounting kit includes the following materials:
. N. 1 Magnetic support
. N. 1 Adaptive arm
. N. 1 Small mechanical clamp
. N. 1 Big mechanical clamp
. N. 1 Support for the rotating transducer
. N. 1 Connection cable, 10m long
. N. 1 Rotary transducer (or linear transducer, or both)
. N. 1 Flexible shaft coupler (only with rotary transducer)

The kit is included into a plastic transport case.

Digital transducers

The digital transducer option has the following characteristics.
. Transducer name: HENGSTLER RS0-550-170
. Transducer type: RS422 interface; 5000 impulses per turn
. Connection: the transducer is connected to the test set via a shielded cable, 10m long, terminated with a connector

The mounting kit is the same as above.
Digital linear transducers are available upon request.

Pressure transducer

The KELLER pressure transducer type PA-21Y/40bar/81554.33 allows monitoring the variation of the SF6 pressure while the circuit breaker is operated.
Main characteristics:
. Pressure range: 0 to 40 bar (pressure differential with respect to 1 bar of the atmospheric pressure)
. Supply voltage: 8 to 32 V DC
. Output voltage: 0 to 5 V DC. 0 V at the atmospheric pressure, 5 V at the absolute pressure of 41 bar
. Linearity error: maximum 0.5% of the range
. Total error, 0 to 50 °C: maximum 1% of the range

Hall effect clip-on transformer for DC current measurements

The Hall effect clip-on transformer allows measuring the DC current of motors and of the auxiliary supply.
Main characteristics:
. Metering: AC and DC currents
. DC measurement null with a knob
. Ranges: 10 mV/A, 80 A DC, 40 A AC maximum, and 1 V/A, 2 A DC, 1.5 A AC maximum
. Low battery indicator
. Measurement errors: 4% of reading + 20 mA for the 80 A range; 2% of reading + 5mA for the 2 A range
. Phase shift (up to 65Hz): maximum 1°
. Maximum working voltage: 600 V rms
. Power supply: alkaline 9 V battery, type 6 LR 61
. Service life: 70h typical
. Maximum cable diameter: 10mm
. Weight: 330g
. Dimensions: 65mm wide (clamp closed); 36 mm thick; 230 mm long

AC current clamp for first trip test

The current clamp allows performing the first trip test: for three phase testing, three of them are necessary. The clamp ratio is 1 A//0.1 V; maximum primary current 10 A; maximum cable diameter 12 mm.

Rotary Transducer

LWG Linear Transducer

TLH Linear Transducer

Transducers Mounting Kit

Hall effect clamp

Ordering information

Instrument and cables set configurations

CODE	MODULE
	CBA 3000
79178	8 Configurable Main/ Auxiliary inputs 8 configurable Analog inputs 2 Coil commands (Open / Close)
40188	Two Breaks per phase cable kit with transport case
	TDMS - Test & Data Management Software
	CBA 3000
75178	8 Configurable Main/ Auxiliary inputs One (1) 200 A DC Microhmmeter 8 configurable Analog inputs 2 Coil commands (Open / Close)
40188	Two Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transport case
	TDMS - Test & Data Management Software
	CBA 3000
20178	16 Configurable Main/ Auxiliary inputs One (1) 200 A DC Microhmmeter 8 configurable Analog inputs 2 Coil commands (Open / Close)
40188	Two Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transport case
	TDMS - Test & Data Management Software
	CBA 3000
21178	24 Configurable Main / Auxiliary inputs One (1) 200 A DC Microhmmeter 8 configurable Analog inputs 4 Coil commands (Open / Close)
41188	Four Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transportcase
	TDMS - Test & Data Management Software
	CBA 3000
85178	16 Configurable Main / Auxiliary inputs Three (3) 200 A DC Microhmmeter 8 configurable Analog inputs 4 Coil commands (Open / Close)
40188	Two Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transport case
43188	Additional two microhmmeters cable kit with transport case (Both Sides Grounded function)
	TDMS - Test & Data Management Software
	CBA 3000
22178	24 Configurable Main / Auxiliary inputs Three (3) 200 A DC Microhmmeters

CODE	MODULE
	8 configurable Analog inputs 4 Coil commands (Open / Close) Both Side Grounded function
41188	Four Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transportcase
43188	Additional two microhmmeters cable kit with transport case (Both Sides Grounded function)
	TDMS - Test & Data Management Software
	CBA 3000
23178	24 Configurable Main / Auxiliary inputs Three (3) 200 A DC Microhmmeters 8 configurable Analog inputs 6 Coil commands (Open / Close) Both Sides Grounded function
41188	Four Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit + transportcase
43188	Additional two microhmmeters cable kit with transport case (Both Sides Grounded function)
	TDMS - Test & Data Management Software

Optional accessories

CODE	MODULE
86178	CBA3000 (8 Inputs - 2 coil command configuration) short cable test kit for Medium Voltage Switchgear
40188	Two Breaks per phase cable kit with transport case
41188	Four Breaks per phase cable kit with transport case
42188	One microhmmeter cable kit with transport case
43188	Additional two microhmmeters cable kit with transport case (Both Sides Grounded function)
44188	Cable Kit 3 Phases, 2 Breaks per Phase for Microhmeter and BSG (option requires also code PII42188 + PII43188)
55178	1 Extension for single Microhmeter Cable 7 mt (requires code PII42188)
60178	Additional 2 Coils Command (Open / Close)
61178	Additional 8 Inputs Main-PIR/ Auxiliary
62178	Additional 8 Inputs Main -PIR / Auxiliary with Pre-Insertion Resistor value measurement
37178	MTC - Minimum trip coil test module
64178	External thermal printer
65178	Internal thermal printer
57178	Heavy duty transport case
11166	TLH 150 Analog Linear Transducer 150 mm
12166	TLH 225 Analog Linear Transducer 225 mm
36166	TLH 300 Analog Linear Transducer 300 mm
13166	TLH 500 Analog Linear Transducer 500 mm
14166	Analog Rotary Transducer: IP 6501 – 355° rotation angle
26166	LWG 150 Analog Linear Transducer 150 mm
27166	LWG 225 Analog Linear Transducer 225 mm
28166	LWG 500 Analog Linear Transducer 500 mm
42166	LWG750 linear transducer 750 mm
11169	Digital transducer Hengstler RSO-550-170
35178	Pressure transmitter PA-21Y 40 BAR
33178	Analogic mounting kit
34178	Digital transducer mounting kit
88169	Current clamp for First Trip test
29166	Hall effect clip-on transformer
44166	Flexible shaft coupler

ICS Schneider Messtechnik GmbH
Briesestraße 59
D-16562 Hohen Neuendorf / OT Bergfelde

Tel.: 03303 / 504066
Fax: 03303 / 504068

info@ics-schneider.de
www.ics-schneider.de