CBV-16 Instrument	
	The CBV-16 is a high performance, software driven data acquisition system, operating under Microsoft Windows. The CBV-16 is designed to perform timing & motion analysis on all types of circuit breakers typically installed in electrical substations going from the distribution level all the way to high voltage levels, up to 800 kV. The timing and motion analysis is done based on the International Standard CEI56. Furthermore, the CBV-16 also comes with the capability to record vibro-acoustic signals having rich frequency content. It allows the detection of the different mechanical faults in all types of circuit breakers. OpenZen is a highly integrated and specialized software environment that includes all the necessary tools for testing in the field or in the laboratory, for processing, calculations, analysis, interpretations of test results and online help needed by circuit breakers maintenance professionals OpenZen is included with the system free of charge with unlimited updates.

Zensol Automation Inc.
2281 rue Guénette
Sain Laurent, QC, Canada, H4R 2E9
www.zensol.com – e-mail : zensol@zensol.com

High performance: Precision and resolution	• Signal Frequency range: DC to 200 kHz. • Analog to Digital conversion: 16 bits resolution (+/- 1 LSB) in less than 180 nanoseconds. • Noise level : 1 mV peak to peak (Signal to Noise Ratio : - 84 dB)
Sampling time and sampling frequency	• Sampling time: 1.0 microsecond to 26 milliseconds, programmable in 50 nanoseconds steps on all inputs. • Sampling frequency : 31 Hz to 1 MHz.
Recording time	• Programmable recording time 10 millisecond to 30 minutes
Multiple Acquisition modes	• By pulse commands to the circuit breaker close and open coils. • By signal TRIG START and TRIG END on any signal
Autotest function on Accelerometers	• This function allows for simulation of a typical vibration signal and also for accelerometers functional verification.
Computer Link	• Connection via a USB link to a computer or notebook running Windows 2000, XP, Vista or Windows7 • Fast transfer of recorded data on operation s (or events) such as Close (C), Open (O), CO, OCO, etc. …
Printing	• B&W or Color printing on standard with a standard printer. • Easy printing of all graphical analysis (superposition, zoom, time scale expansion and amplitude scale expansion, etc. ….
Dimensions & weight	• Robust construction: casing made of reinforced polyethylene with molded-in ribs for extra protection including top and bottom covers. • True Portable unit, no extra carrying case required • Dimensions (closed with covers on): 43x42x25.4 cm • Weight: 9 kg.

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Inputs and Outputs	

1 Contact Input for Main & Resistive Contacts (Optical isolation up to 5000 V)	• The contact input consists of two parallel measurement circuits, one with an analog output and one with a digital output:
	  ○ The digital output measurement circuit shows the states of the contacts. The classical digital measurement method (2 bit resolution with 3 states) is visualised as:
	  ▪ 0 for OPEN state
	  ▪ 1 for CLOSED state
	  ▪ 0.5 for resistive state
	  ○ The analog output measurement circuit (16 bits resolution with 65535 states) not only informs us on the contacts states but also measures the breaker's insertion resistance values in Ohms. The contact resistance measurement, unique to Zensol, allows for visualisation of the insertion resistance values with a precision of less than 1% in a range from 10 Ohms to 10,000 Ohms. The advantage of this type of measurement is to allow detection of more behavioural defects in breakers contacts. The contacts states are defined as follows:
	  ▪ CLOSE (R < 10Ω)
	  ▪ Pre-Insertion (10Ω < R < 10kΩ)
	  ▪ Open (R > 10kΩ)
	• Power supply on Contacts: 40 VDC
	• Type of connector: 3-pin Neutrik male
	• This input is immune to noise typically present in high voltage environment up to 800 kV.

12 ICP Accelerometer Inputs (for vibration measurement)	• Direct input from ICP accelerometer (+/- 5 V) • Analog to Digital converters with 16-bits resolution and ultra fast conversion of less than 180 nanoseconds • Accelerometer excitation courant: 4.0 mA @ 24V • Accuracy: +/- 1mV, • Frequency response: 0.7 HZ à 25 KHZ • Range : +/- 50g, +/- 500g, +/- 1000g • Signal to Noise Ration: - 84 dB • Connector: BNC

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2 Command Outputs paired with 2 Inputs for Open and Close coils currents measurement	• 8 selectable ranges for Open and Close Coil current measurement: 0-20A, 0-10A, 0-5A, 0-1A, -20+20A, -10+10A, -5+5A, -1+1A. • Analog to Digital converters with 16-bits resolution and ultra fast conversion of less than 180 nanoseconds • Maximum input voltage for command contactor: up to 300V • Chassis isolation voltage: 2 KV • Command delay and duration pulses (1 millisecond à 100 seconds) are programmable in steps of 1 millisecond which allows for the creation of an unlimited number of commands of which the most classical are: C, O, CO, O - 300ms - CO, O - t - CO, CO - CO, OC-OC, etc. ... • Type of connector: 4 pins Neutrik female.
1 Universal Analog Input (measurement of voltage, current, pressure, temperature, travel ….)	• +/- 10 V Universal input able to adapt to different types of transducers (displacement or travel, voltage, current, pressure, humidity. Temperature, etc. …). • Analog to Digital converters with 16-bits resolution and ultra fast conversion of less than 180 nanoseconds • Frequency range: DC – 200 KHz • Type of connector: 3 pins Neutrik, male. • 10 VDC power source for displacement transducers (linear or rotary) supplied on the Neutrik connector.

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Software	Ease of use, Power and Flexibility
OpenZen : Test analysis, interpretation of time, motion and vibration measurement under Windows **Extensive Library of test plans for more than 200 circuit breakers from 17 manufacturers** **DB-BREAK : typical circuit breakers Vibro-Acoustic signatures data base** **(In construction !)**	Once the test cables connected to the circuit breaker and the instrument connected to a computer, even the non-experienced operator can immediately run all his tests simply by choosing his type of circuit breaker from the existing test plans library. With the numerous design tools included in OPenZen, the experienced operator can enrich the library with test plans as well as creating or modifying acquisition modes, mathematical processing, graphical or tabular reports. Following is a description of the general characteristics of OpenZen which are the result of 18 years of evolution and continued improvements in the circuit breakers test field. ○ Integrated library consisting of test plans for more than 200 circuit breaker (17 different manufacturers: ABB, AREVA (Alstom), ASEA, GE, Mitsubishi, Westinghouse, Siemens, Schneider, S&S, etc.) ○ Complete computer control of the CBV-16 during the tests. ○ Fast recorded data transfer to the computer. ○ Instantaneous mathematical processing of received data for immediate analysis on the computer. ○ Unlimited storage capacity of test results (Windows limitations of 4 GB per file) ○ Data Export with immediate visualisation under Microsoft Word or Excel or export in XML. ○ Unlimited free update.
Basic Functions	• Easy execution (with a click of the computer mouse) of classical tests such as: C, O, CO, O-300ms - CO, O - t - CO, CO - CO, OC-OC, etc., ... • Easy standard test data input: time of test, operator name, HV substation number, circuit breaker manufacturer, serial number, inventory number, number of operations, etc. … • Classical calculations such as: opening time, closure time, current maximum values, short circuit duration, isolation time, contacts speed, total contacts travel, over-travel, bounce, etc. … • Instantaneous graphical visualisation of standard timing (synchronisation) report on the computer • Instantaneous visualisation of test results in multilingual tabular forms with pass / fail result indicators on the computer screen. • Easy official report generation under Word for commissioning or official maintenance tests

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	• Instantaneous analysis of tests in progress with the help the graphical tools such as scale expansion in X or Y, precise point by point Examine, Zoom of a defined zone, signals superposition. • Comparative analysis of signals or portions of signals from identical tests or different tests executed on same date or different dates is very useful for trends analysis. • Batch tests very useful for new circuit breakers certification
Advanced Functions	• Test plans designer • Test designer(up to 30 test per test plan) • Multilingual tabular report designer • General information Screen Designer • Graphical reports Designer • Specialised Mathematical processing Designer: more than 100 mathematical functions are available and deal with time and motion as well as vibration (developed by Hydro-Quebec) processing. These functions constitute a precious aid to the operators because they make the analysis and interpretation of the synchronisation and/or vibration test results a very easy task. • Tabular reports designer. • Batch tests designer

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International Standards, Certifications and Accreditation	• International standards:
	  ○ Conducted emission EN 55011 : 1991, CLASS A
	  ○ Radiated emission EN 55011 : 1991, CLASS A
	  ○ RF Immunity EN 61000-4-3 :1997 & ENV 50204 : 1996, 10 V/m
	  ○ Conducted Immunity EN 61000-4-6 : 1996, 10 V
	  ○ Electrostatic Discharges EN 61000-4-2 : 1995, 8 kV/4 kV contact
	  ○ Electrical Fast Transients EN 61000-4-4 : 1995, 2 kV
	• Zensol is certified ISO 9001
	• Accreditations: Hydro-Quebec 800 KV(HQ), Appalachian Electric Power (APCO a division of American Electric Power AEP) – USA, CFE-Comision Federal de Electricidad (Mexico), RTE (France) …

Optimal Conditions of use	• Environmental : 0 to 50°C • Noisy environment in High Voltage area up to 800 kV • Humidity : 0-95% Non Condensing • Power input : universal auto-ranging 100 to 240 VAC 50/60 Hz +/-10%

Accessories included	Each CBV-16 is supplied with:
	• A set of cables :
	  ○ 1 contact cables(10 ft)
	  ○ 1 displacement cables (10 ft)
	  ○ 1 command (30 ft)
	  ○ 1 Earth (or ground) cable
	• OpenZen Software
	• Calibration certificate and a conformance report
	• Manuals

Recommended Accessories	• 1 contact extension cable (30 ft) • 1 displacement extension cable (30 ft) • 12 ICP accelerometers +/- 500 G for vibrations measurement • 12 accelerometer cables (30 ft)

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