

CT-8000

Digital Circuit Breaker Analyzer



Vanguard Instruments Company

www.vanguard-instruments.com



CT-8000™

The CT-8000 is Vanguard's fifth generation, stand-alone, microprocessor-driven EHV circuit-breaker analyzer. This easy to use analyzer is available in models with either 3 (CT-8000-3) or 6 (CT-8000-6) dry-contact inputs. Both models feature three digital travel transducer input channels. The CT-8000 can operate either in Time-Travel analyzer mode or in Quick-Shot mode (for on-line timing).

Quick-Shot Mode

In Quick-Shot mode, the CT-8000 captures the breaker's trip or close time, the trip/close-coil current "fingerprint," and the battery supply voltage while the breaker is still in service. The trip/close time is derived from the time of trip, or close-coil initiation, to the breaker's bushing current-break-or-make as detected by an AC clamp-on current sensing probe.

With a simple connection, the Quick-Shot mode can detect a breaker's operating conditions with little or no down time. In Quick-Shot mode, the first trip operation time of the breaker is captured. If a breaker has been in service for a long period of time and sitting in close position, the first trip time of the breaker may be slow possibly due to a sticky mechanism. The Quick-Shot mode is very useful in such cases because traditional breaker timing may not detect this condition since several operations may have occurred before the first timing test is conducted.

Conventional Time-Travel Analysis Mode

In Time-Travel mode, the CT-8000 can fully analyze a circuit-breaker's performance by testing the contact time, stroke, velocity, over-travel, and contact wipe. Contact-motion analysis can be performed for all breaker contact operations (Open, Close, Open – Close, Close – Open, and Open – Close – Open). The CT-8000 S2's timing window is selectable between 1-second, 10-second, or 20-second periods. The 10-second and 20-second timing windows are ideal for timing long duration events such as circuit-switcher contact testing.

Contact Timing Inputs

Dry-contact input channels are used for timing breaker contacts. Each contact input channel can detect main contact and insertion-resistor contact times in milliseconds and cycles.

Rapidly

Voltage Monitoring Inputs

One analog voltage input channel, designated as V1, is dedicated to monitoring a circuit-breaker's DC power supply or coil voltage (0 – 255 volts, DC or peak AC). A second voltage input channel, designated as V2, is dedicated to detecting the voltage on/off status (presence or absence) of an A/B switch.

Trip/Close Current Monitoring

A built-in Hall-effect current sensor records the Trip/Close current level and duration. The breaker's operate-coil current waveform duration (effectively, a performance "fingerprint" or "current profile") can be used as a diagnostic tool for analyzing a breaker's performance.

Breaker Stroke and Velocity

Three digital travel transducer channels are available on the CT-8000 for measuring circuit-breaker velocity, stroke, over-travel, and bounce-back. Unlike other transducer types, the digital transducer requires neither calibration nor setup. A breaker's contact-velocity is calculated based on the contact's travel distance over a period of time. A special feature is also available to "slow-close" test a breaker and obtain a test result report.

Dynamic Contact Resistance

Using a 200-ampere, built-in, DC power supply, the CT-8000 can also perform dynamic-resistance tests. One channel is available for performing a dynamic contact resistance test. The resistance measuring range is from 1 micro-ohm to 1,999 micro-ohms. Using this test, the contact resistance can be monitored during circuit-breaker operation. This important feature can help detect circuit-breaker contact erosion or other contact problems that cannot be detected in static resistance tests. The CT-8000 can also be used as a 200-ampere micro-ohmmeter to test circuit-breaker contact resistance and bus connections, or can be used for other applications where a low-resistance measurement is required.

Resistor Type Transducer Input

One resistor type input channel is also available on the CT-8000. This input channel allows the unit to measure circuit-breaker motion by directly interfacing with resistive type transducers. The transducer resistance ranges from 200 ohms to 10K Ohms.

Breaker Initiate Features

A built-in solid-state initiate device is used to operate a breaker from the CT-8000. The operational modes include Open, Close, Open – Close, Close – Open, and Open – Close – Open. Multiple operations, such as Open – Close and Open – Close – Open, can be initiated by using programmable delay time or by sensing a breaker's contact condition.

Internal Test Record Storage

The CT-8000 can store up to 150 test records in Flash EEPROM. Test records can be retrieved and printed on the built-in thermal printer, or they can be transferred to a PC via the unit's RS-232C or USB interface.

Internal Breaker Test Plan Storage

The CT-8000 can store up to 99 circuit-breaker test plans. Test plans are comprised of all circuit-breaker performance specifications (stroke, velocity, and contact time). A test plan can be used to immediately test a circuit-breaker. A pass/fail report is then generated by comparing actual performance with the specifications in the stored test plan. Test plans can also be generated on a PC and transferred to the CT-8000 via the unit's RS-232C or USB interface.

Digital Circuit Breaker Analyzer

Analyze

OCB, Vacuum, and SF6 Circuit Breakers with Vanguard's CT-8000

Computer Interface

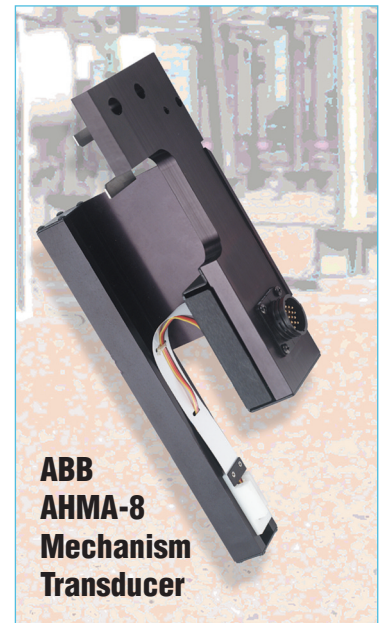
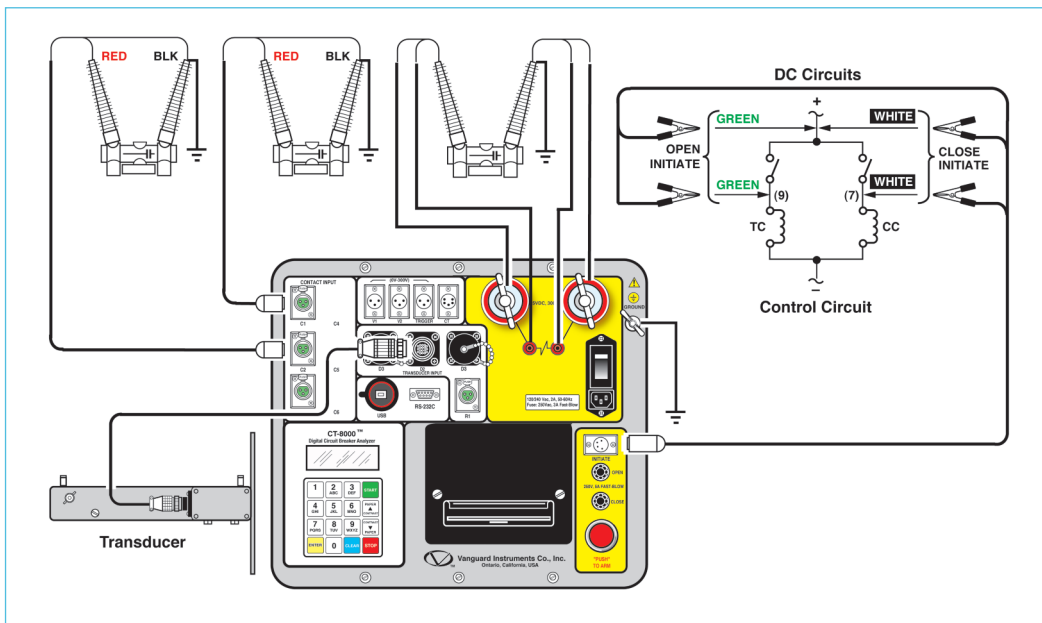
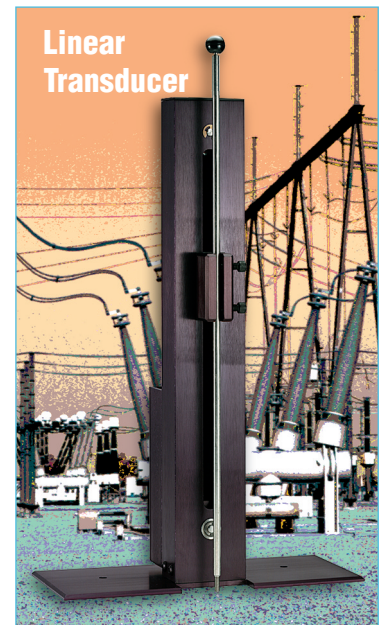
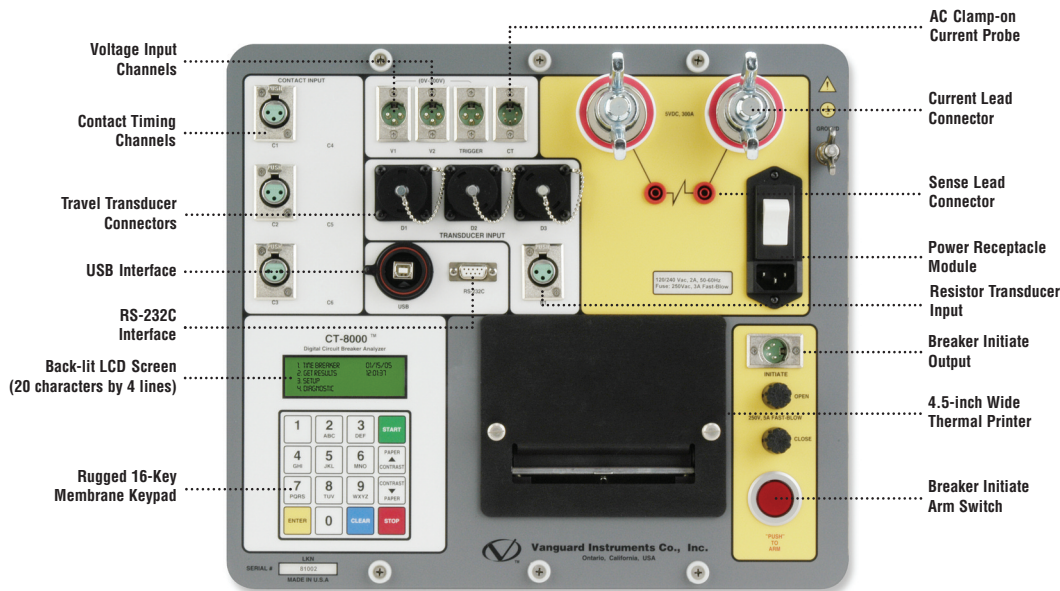
The CT-8000 can be computer-controlled via its RS-232C or USB interface. A Windows® XP/Vista-based Breaker-Analysis software application is provided with each unit. Using this software, circuit-breakers can be timed from the PC. Test records can be retrieved from the CT-8000 and then stored on the PC for future analysis and report generation. Circuit-breaker test plans can also be created on the PC and transferred to the CT-8000. Additionally, test records can be exported in Microsoft® Excel format for further analysis.

User Interface

The CT-8000 features a back-lit LCD screen (20 characters by 4 lines) that is viewable in both bright sunlight and low-light levels. A rugged, 16-key, membrane keypad is used to control the unit.

Built-in Thermal Printer

The CT-8000's built-in 4.5-inch wide thermal printer can print the breaker contact analysis results in both tabular and graphic formats.



Rapidly

Graphic and
Tabulated Printouts

BREAKER TIMING RESULTS - 60 Hz					
SHOT NUMBER: 0003					
DATE: 06/02/00 TIME: 09:10:41					
COMPANY: VANGUARD INSTRUMENT					
STATION:					
CIRCUIT:					
MFR: ITE					
MODEL: 14-4KS					
S/N: M3210102					
OPERATOR: HAI NGUYEN					
TEST: OPEN					
CONTACT TIME					
CH	TIME	CYCLE	BOUNCE	WIPE	
	<ms>		<ms>	<in>	
1	000.00	00.00	000.00	00.00	
2	000.00	00.00	000.00	00.00	
3	000.00	00.00	000.00	00.00	
CT CHANNEL ANALYSIS					
TIME	CYCLE				
<ms>					
034.70	02.08				
TRAVEL ANALYSIS T1					
STROKE	in	00.00			
SPEED	ft/s	00.00			
QUER-TRAVEL	in	00.00			
BOUNCE BACK	in	00.00			
SPEED ANAL					
POINT 1					
POINT 2					
U1 NOMINAL VOLTAGE = 10.0V					
U1 MINIMUM VOLTAGE = 0.0V					
INITIATOR CURRENT = 04.7 AMPS					
SHOT LENGTH: 1 SECOND					
INSERTION RESISTOR: NO					
TRIGGER: INTERNAL					

EEPROM Stored Test Parameters ▲

TEST PLAN NUMBER 19	
MFR:	SF-72
TYPE:	SIEMEN
COMMENT:	TYPICAL TEST PLAN1
CONTACT TIME PARAMETERS	
	OPEN CLOSE
MAX <ms>	025.0 100.0
MIN <ms>	025.0 090.0
DELTA LIM <ms>	003.0 003.0
RESISTOR TIME PARAMETERS	
	OPEN CLOSE
MAX <ms>	000.0 000.0
MIN <ms>	000.0 000.0
DELTA LIM <ms>	000.0 000.0
TRAVEL PARAMETERS	
STROK	VEL
1	20.00
2	66.00
3	50.00
ANALYSIS POINTS	
OPEN AP1:	01.00 in
OPEN AP2:	04.00 in
CLOSE AP1:	00.80 in
CLOSE AP2:	01.80 in

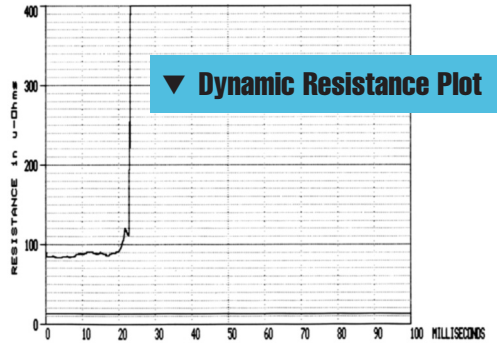


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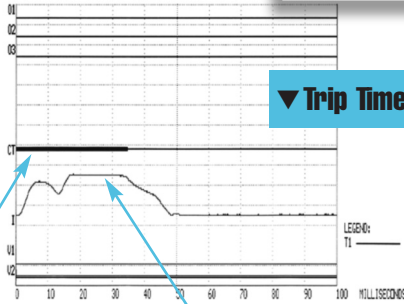
VANGUARD INSTRUMENT CO. (ST), HAWAII (C) 1991, 1992, 1993, 1994, 1995
1204 EAST FLAM CT., OMAHA, NE 68104, USA
TEL: (909)933-0034 FAX: (909)933-0046

SELFTEST RESULTS: PASSED

BREAKER TIMING RESULTS	
SHOT NUMBER: 0027	
DATE: 03/31/98 TIME: 16:06:57	
COMPANY: VANGUARD INSTRUMENT	
STATION: QHTARIO	
CIRCUIT:	
MFR: 300 20B	
MODEL: 1109	
S/N: JVEN	
OPERATOR: JEN	
CONTACT CLOSE TIME	
CH	TIME CYCLES BOUNCE
	<ms> <ms> <ms>
1	172.00 10.92 002.30
2	170.00 10.20 001.40
3	170.30 10.22 001.10
CONTACT OPEN TIME	
CH	TIME CYCLES BOUNCE
	<ms> <ms> <ms>
1	196.70 11.80 000.10
2	198.90 11.93 000.20
3	199.60 11.98 000.20
CONTACT LIVE TIME	
CH	TIME CYCLES
	<ms> <ms>
1	024.70 01.48
2	028.90 01.79
3	029.30 01.76
PEAK TO PEAK TRAVEL <in>	
T1	07.42
U1 NOMINAL VOLTAGE = 10.0V	
U1 MINIMUM VOLTAGE = 0.0V	
INITIATOR CURRENT = 06.6	
SHOT LENGTH: 1 SECOND	
INSERTION RESISTOR: NO	
TRIGGER: INTERNAL	
DELAY:	
300 ms	



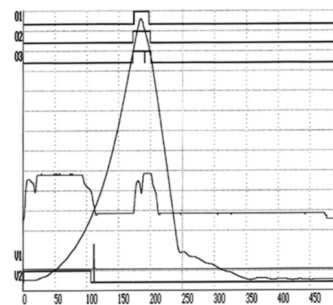
▼ Dynamic Resistance Plot



▼ Trip Time Using Quickshot Mode

Trip Time Using Bushing CT

Trip Coil Current Profile



CT-8000™

PARTS ORDERING INFORMATION for the CT-8000 CIRCUIT BREAKER TIMER

All of the below listed replacement parts may be ordered from Vanguard Instruments Company, Inc.

PC software and cables for CT-8000, 3 contact channels
PC software and cables for CT-8000, 6 contact channels
Carrying case for the CT-8000
Printer paper, thermally sensitive

CT-8000 TRAVEL TRANSDUCERS

10 inch linear transducer
25 inch linear transducer
30 inch linear transducer
Rotary transducer
15 inch universal transducer
ABB AHMA-8 Transducer
ABB AHMB-8 Transducer
Westinghouse SF/SFA transducer
Linear transducer case

Part No: CT-8000-3
Part No: CT-8000-6
Part No: CT-8000-CASE
Part No: Paper-TP4

Part No: LT-10
Part No: LT-25
Part No: LT-30
Part No: RT
Part No: UT-15
Part No: ST-AHMA-8
Part No: ST-AHMB-8
Part No: ST-SF/SFA
Part No: LT-CASE



Digital Circuit Breaker Analyzer

Analyze

OCB, Vacuum, and SF6 Circuit Breakers with Vanguard's CT-8000

FEATURES

- Quick-Shot mode for on-line timing; captures first trip time
- Static and dynamic resistance tests
- Prints breaker analysis results in both tabular and graphic formats
- Built-in 4.5-inch wide thermal printer
- Digital travel transducer requires no setup or calibration
- Supports resistance type transducers
- Detects main contact and insertion-resistor contact on the same input channel
- Stores up to 150 test records and 99 test plans
- RS-232C and USB computer interfaces



SPECIFICATIONS

TYPE	Portable circuit-breaker analyzer
PHYSICAL SPECIFICATIONS	16"W x 11"H x 14"D (40.6 cm x 29.9 cm x 35.6 cm); Weight: 25 lbs (11.3 kg)
INPUT POWER	100 – 120 Vac or 200 – 240 Vac (selectable), 50/60Hz
DRY-CONTACT INPUT	3 or 6 dry-input channels (depending on model). Each channel detects main and insertion-resistor contacts
TIMING WINDOWS	1-second, 10-seconds, or 20-seconds
TIMING RESOLUTIONS	±50 micro-seconds @ 1-second duration, ±0.5 milli-seconds @ 10-second duration, ±1.00 milliseconds @ 20-second duration
TIMING ACCURACY	0.05% of reading ±50 micro-seconds @ 1-second duration
CONTACT DETECTION RANGE	Closed: less than 20 ohms; Open: greater than 5,000 ohms
RESISTOR DETECTION RANGE	50 – 5,000 Ohms
CT CURRENT SENSOR	One, non-contact, 0 – 100 Amperes
TRIGGER INPUT VOLTAGE	Open/Close: 30 – 300V, DC or peak AC
VOLTAGE SENSING INPUT RANGE	V1: analog input; 0 – 255V DC or peak AC; Sensitivity ±1V V2: voltage presence/absence detector input; 30 – 300V DC or peak AC
BREAKER OPERATIONS	Initiate Open, Close, Open– Close, Close – Open, Open – Close – Open
BREAKER INITIATE CAPACITY	25A, 250Vac/dc max (100A Inrush)
INITIATE CURRENT READING RANGE	One, non-contact, Hall-effect sensor, 0 – 20 amp range, dc to 5Khz
TRAVEL TRANSDUCER INPUTS	3 digital travel transducer channels; Linear range, 0.0 – 30.0 in (±0.01 in); Rotary range: 0 – 360 degrees (±0.36 degrees)
CONTACT TRAVEL POINT DIFFERENCE	Measures “slow-close” contact-point distances; results can be printed
DYNAMIC/STATIC RESISTANCE RANGE	0.1 – 1,999 micro-ohms; Accuracy: ±2% of reading, ±5 micro-ohms
RESISTANCE TEST CURRENT	200 Amperes typical
RESISTOR TYPE TRANSDUCER INPUT	200 Ohms – 10K Ohms
DISPLAY	Back-lit LCD Screen (20 characters by 4 lines); viewable in bright sunlight and low-light levels
PRINTER	Built-in 4.5-inch wide thermal printer can print both graphic contact travel waveforms and tabulated test results
INTERNAL TEST RECORD STORAGE	Stores up to 150 test records and 99 test plans
COMPUTER INTERFACES	One RS-232C port, One USB port
PC SOFTWARE	Windows® XP/Vista-based Breaker-Analysis software is included with purchase price
SAFETY	Designed to meet UL 6101A-1 and CAN/CSA C22.2 No 1010.1-92 standards
ENVIRONMENT	Operating: -10°C to 50°C (+15°F to +122°F); Storage: -30°C to 70°C (-22°F to +158°F)
OPTIONS	Transportation case (available for the CT-8000 and the travel transducers)
WARRANTY	One year on parts and labor

Note: The above specifications are valid at nominal voltage and ambient temperature of +25°C (+77°F). Specifications are subject to change without notice.

Vanguard Instruments Company, Inc.

Vanguard Instruments Co., (VIC), was founded in 1991. Currently, our 28,000 square-foot facility houses Administration, Design & Engineering, and Manufacturing operations. From its inception, VIC's vision was, and is to develop and manufacture innovative test equipment for use in testing substation EHV circuit breakers and other electrical apparatus.

The first VIC product was a computerized circuit-breaker analyzer, which was a resounding success. It became the forerunner of an entire series of circuit-breaker test equipment. Since its beginning, VIC's product line has expanded to include microcomputer-based, precision micro-ohmmeters, single and three-phase transformer winding turns-ratio testers, winding-resistance meters, transformer tap-changing controllers, megaohm resistance meters, and a variety of other electrical utility maintenance support products.

VIC's performance-oriented products are well suited for the utility industry. They are rugged, reliable, accurate, user friendly, and most are computer controlled. Computer control, with innovative programming, provides many automated testing functions. VIC's instruments eliminate tedious and time-consuming operations, while providing fast, complex, test-result calculations. Errors are reduced and the need to memorize long sequences of procedural steps is eliminated. Every VIC instrument is competitively priced and is covered by a liberal warranty.



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