The CT-7000 S2 is Vanguard’s third generation, stand-alone, microprocessor-driven EHV circuit-breaker analyzer. This inexpensive and easy to use analyzer is available in models with either 3 (CT-7000-3 S2), 6 (CT-7000-6 S2), or 12 (CT-7000-12 S2) dry-contact inputs. The CT-7000 S2 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 circuit breaker operations (Open, Close, Open – Close, Close – Open, and Open – Close – Open). The CT-7000 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.

1. **Contact Timing Inputs**
The CT-7000 S2 is available in models with either 3 (CT-7000-3 S2), 6 (CT-7000-6 S2), or 12 (CT-7000-12 S2) dry-contact inputs. Each contact input channel can detect main contact and insertion-resistor contact times in milli-seconds and cycles.

2. **Breaker Stroke and Velocity**
Three digital travel transducer channels are available on the CT-7000 S2 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.

3. **Resistor Type Transducer Input**
One optional resistor type input channel is also available on the CT-7000 S2. 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.

4. **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.

5. **Breaker Initiate Features**
A built-in solid-state initiate device is used to operate a breaker from the CT-7000 S2. 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. 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.

6. **Built-in Thermal Printer**
The CT-7000 S2's built-in 4.5-inch wide thermal printer can print the breaker contact analysis results in both tabular and graphic formats.

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**ordering information**

- Part number **CT-7000-3 S2**
- Part number **CT-7000-6 S2**
- Part number **CT-7000-12 S2**
- Part number **CT-7000-CASE**
- Part number **Paper-TP4**

- CT-7000 S2 with 3 contact channels, cables, and PC software
- CT-7000 S2 with 6 contact channels, cables, and PC software
- CT-7000 S2 with 12 contact channels, cables, and PC software
- CT-7000 S2 shipping case
- Thermal printer paper
Computer Interface
The CT-7000 S2 can be computer-controlled via its RS232C or USB interface. Windows® based BreakerAnalysis software is provided with each unit. Using this software, circuit-breakers can be timed from the PC. Test records can be retrieved from the CT-7000 S2 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-7000 S2. Additionally, test records can be exported in Excel, PDF, and XML formats for further analysis.

Internal Test Record and Test Plan Storage
Up to 150 test records can be stored 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 RS232C or USB interface. Up to 99 circuit breaker test plans can be stored in Flash EEPROM. 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-7000 S2 via the unit’s RS232C or USB interface.

Diagnostic Capabilities
The CT-7000 S2 can perform diagnostics on its internal electronics. Diagnostics can also be performed to verify contact cable connections and to test the travel transducer’s electronics.

User Interface
The CT-7000 S2 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.
CT-7000 S2 connections

CT-7000 S2 desktop printer output

Desktop printout of tabulated test results

CT-7000 S2 thermal printer output

Thermal printout of tabulated test results

Desktop printout of graphic test results

Thermal printout of graphic test results
### CT-7000 S2 specifications

- **Type**: Portable digital circuit-breaker analyzer
- **Physical Specifications**
  - **Input Power**: 100 – 240 Vac, 50/60 Hz
  - **Dry-Contact Inputs**: 3, 6, or 12 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 sec. duration, ±500 micro-seconds @ 10 sec. duration, ±1.0 milli-seconds @ 20 sec. duration
  - **Timing Accuracy**: 0.05% of reading ±0.05 ms @ 1 second duration
- **Dry-Contact Channel Protection**: All contact inputs are grounded until test; input channels are protected against static discharge
- **Dry-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 – 300 VDC or peak AC
- **Voltage Sensing Input Range**: V1: Analog input; 0 – 255 V DC or peak AC; Sensitivity ±1 V
  - V2: Voltage presence/absence detector input; 30 – 300 V DC or peak AC
- **Breaker Operations**: Initiate Open, Close, Open-Close, Open-Close, Open-Close
- **Breaker Initiate Capacity**: 30A, 250 Vac/dc max
- **Initiate Current Reading Range**: One, non-contact, Hall-effect sensor, 0 – 20 amp range, dc to 5 Khz
- **Digital Travel Transducer Inputs**: 3 digital travel transducer channels; Linear range: 0.0 – 60.0 in (±0.01 in)
  - Rotary range: 0 – 360 degrees (±0.36 degrees)
  - Optional Resistor Type Transducer Input: One channel, resistance range: 200 ohms – 10 K ohms
- **Contact Travel Point Difference**: Measures “slow-close” contact-point distances; results can be printed
- **Display**: Back-lit LCD screen (20 characters by 4 lines); Viewable in bright sunlight and low light
- **Printer**: Built-in 4½” wide thermal printer that 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® based Breaker Analysis software included with purchase price
- **Safety**: Designed to meet UL 6101A-1 and CAN/CSA C22.2 No 10101-92 standards
- **Environment**
  - Operating: -10°C to +50°C (+15°F to +122°F); Storage: -30°C to +70°C (-22°F to +158°F)
  - Humidity: 90% RH @ 40°C (104°F) non-condensing
- **Altitude**: 2,000 m (6,562 ft) to full safety specifications
- **Cables**: Furnished with full set of test leads (including 20-foot contact leads and 30-foot contact lead extensions)
- **Options**: Transportation case (available for the CT-7500 S2 and 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.
VCBA S2
Vanguard circuit breaker analyzer software

The Vanguard Circuit Breaker Analyzer Series 2 (VCBA S2) Windows®-based software is included with all compatible Vanguard Circuit Breaker Analyzers (CT-6500 S2, CT-7000 S2, CT-7500 S2, CT-8000, DigiTMR S2, DigiTMR S2 PC) at no additional cost. This robust application can be used to control the circuit breaker analyzer from a PC to perform CB timing tests. It can also be used to retrieve test records from the circuit breaker analyzer, analyze timing records, and view test results in tabulated and graphical format. Circuit breaker test plans can also be created and transferred to the circuit breaker analyzer.

Retrieving and Analyzing Test Records

The VCBA S2 software can be used to quickly retrieve test records from a compatible Vanguard circuit breaker analyzer. Test results can be viewed in tabular and graphical format and can be saved on the PC hard drive. Test record header information, such as the company name, station, circuit, operator name, manufacturer, model, and serial number can also be edited.

Sample Test Results (OPEN Test)

Getting a Closer View with Graph Expansions

The VCBA S2 software can be used to expand a portion of the graphical test results for more accurate analysis.
Timing a Circuit Breaker with the VCBA S2 Software

The VCBA-S2 software can be used to control a CB analyzer and run circuit breaker timing tests. The following tests are supported: OPEN, CLOSE, OPEN-CLOSE, CLOSE-OPEN, OPEN-CLOSE-OPEN, and STATIC RESISTANCE. Also, a test plan for a specific breaker can be used with the test. If a test plan is used, the Pass/Fail indicator will be displayed based on the settings in the test plan.

Creating Test Plans for Faster Testing

A circuit breaker test plan is comprised of all circuit-breaker performance specifications (stroke, velocity, and contact time). A test plan can be used to test a circuit breaker. When used with a test record, a Pass/Fail report is generated by comparing the actual performance of the breaker with the specifications in the stored test plan. Test plans can be easily created with the VCBA-S2 software and can be stored on the hard drive or transferred to a CB analyzer.
Instruments designed and developed by the hearts and minds of utility electricians around the world

Vanguard Instruments Company, (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 circuitbreaker analyzer, which was a resounding success. It became the forerunner of an entire series of circuitbreaker 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, transformer winding-resistance meters, mega-ohm 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.

Vanguard Instruments Company, Inc.
1520 S. Hellman Avenue • Ontario, California 91761, USA
Phone 909-923-9390 • Fax 909-923-9391
www.vanguard-instruments.com

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