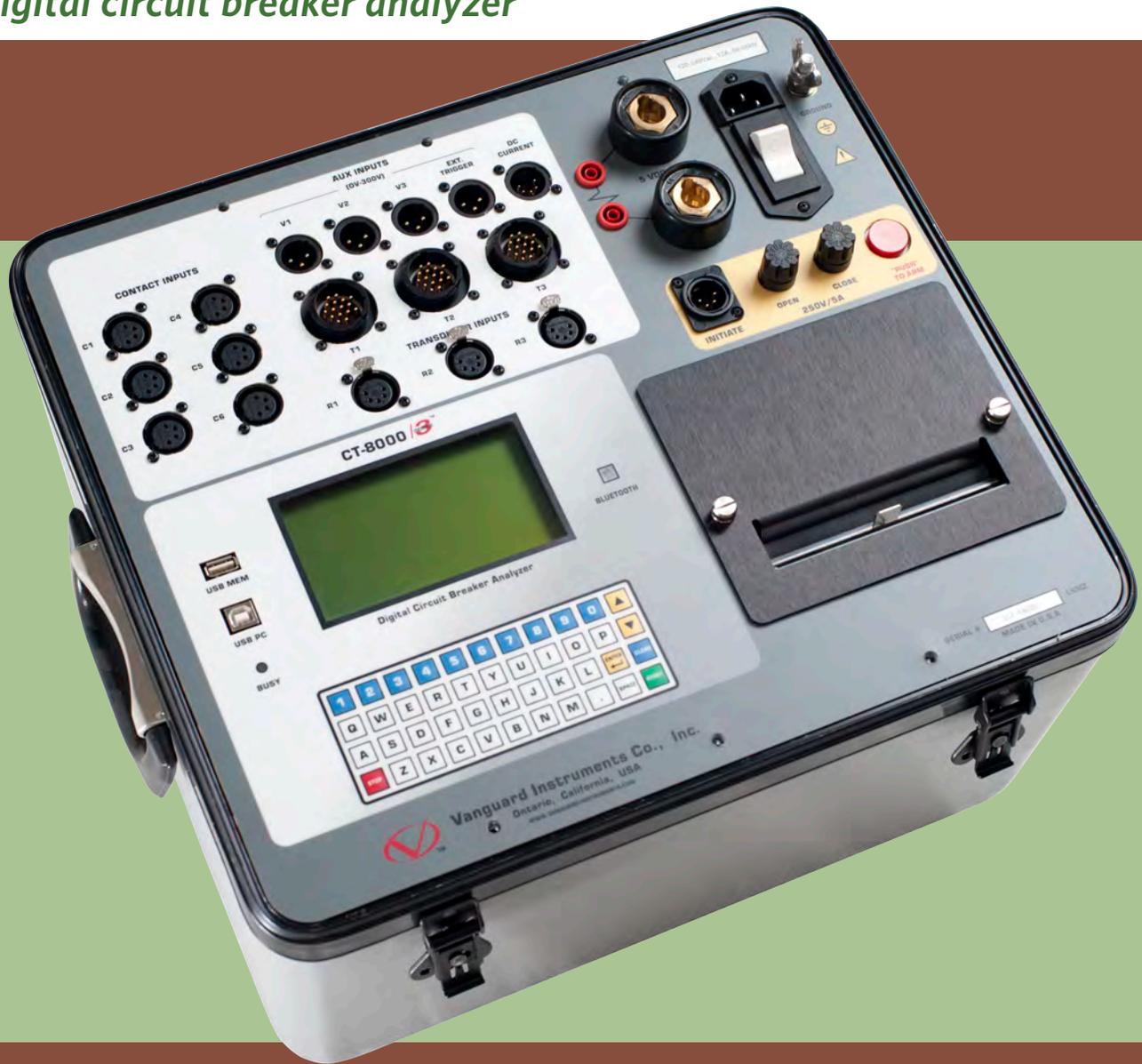


# CT-8000 S3

*digital circuit breaker analyzer*



**Vanguard Instruments Company, Inc.**  
[www.vanguard-instruments.com](http://www.vanguard-instruments.com)



# CT-8000 S3

digital circuit breaker analyzer

## Product Overview

The CT-8000 S3 is Vanguard's fourth generation EHV circuit breaker analyzer. The CT-8000 S3 is available with 3 or 6 contact timing channels (part number 9103-UC and 9104-UC, respectively). The CT-8000 S3 can fully analyze a circuit breaker's performance by measuring the main contact and resistor contact time, stroke, velocity, over-travel, bounce back and contact wipes. Also, an outstanding feature of the CT-8000 S3 is the ability to perform dynamic resistance tests on circuit breaker contacts.

## ordering information

Part No.	Description
9103-UC	CT-8000 S3 with 3 contact channels, cables, and PC software
9104-UC	CT-8000 S3 with 6 contact channels, cables, and PC software
9103-DG	Dual ground option
9103-OT	On-line timing option
9103-BT	Bluetooth option
9103-SC	CT-8000 S3 shipping case
TP4-CS	TP4 thermal printer paper (24 rolls)

## Dynamic Contact Resistance

The CT-8000 S3 can perform dynamic-resistance tests using a 200-ampere, built-in, DC power supply. 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. The resistance chart can be used to analyze the circuit-breaker contact condition during the CB 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 S3 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.

## Contact Timing Input Channels

The CT-8000 S3's dry contact timing channels (up to 6 channels) are used to time the circuit breaker main contacts. Each main contact timing channel is capable of detecting the main contact and insertion resistor contact time. Timing results are displayed in milliseconds and cycles. The CT-8000 S3's timing window is selectable between 1 second, 10 seconds, and 20 seconds.

## Resistor Type Transducer Inputs

The CT-8000 S3 offers 3 resistor type transducer input channels. These input channels are used to interface with any resistor-type transducers to monitor the circuit breaker motion. Transducer resistance ranges from 200 Ohms to 10K Ohms.

## Breaker Stroke and Velocity

Three dedicated digital travel transducer channels are available on the CT-8000 S3 for measuring circuit-breaker contact stroke, velocity, over-travel, and bounce back. With the use of the Vanguard digital travel transducers, neither calibration nor setting is required. Circuit breaker contact velocity is calculated based on contact's travel distance over a period of time. Special formulas to calculate velocity is also accommodated by the CT-8000 S3. Special feature is also available to "Slow-Close" test the circuit breaker and obtain a test result report.

## Voltage Monitoring Channels

The CT-8000 S3 features three voltage monitoring input channels (V1, V2, and V3). The V1 voltage channel is dedicated to monitoring the substation DC supply or coil voltage (0-255 V, DC or peak AC). The nominal and minimum DC supply voltage levels are recorded and printed on the tabulated report. An analog waveform showing the DC power supply is plotted on the graphical report. The two digital voltage input channels, V2 and V3, are dedicated to monitoring voltage on/off status presence or absence of the circuit breaker auxiliary switches. Digital waveforms showing V2 and V3 activity are plotted on the graphical report. Three timing events of the V2 and V3 activities are recorded and printed on the tabulated report.

## Breaker Initiate Features

A built-in solid-state initiate device is used to operate a breaker from the CT-8000 S3. Operational modes include OPEN, CLOSE, OPEN-CLOSE, CLOSE-OPEN, and OPEN-CLOSE-OPEN. Multiple operation like OPEN-CLOSE, CLOSE-OPEN, and OPEN-CLOSE-OPEN can be initiated by using a programmable delay time (in milliseconds) or by sensing a specific breaker contact condition.

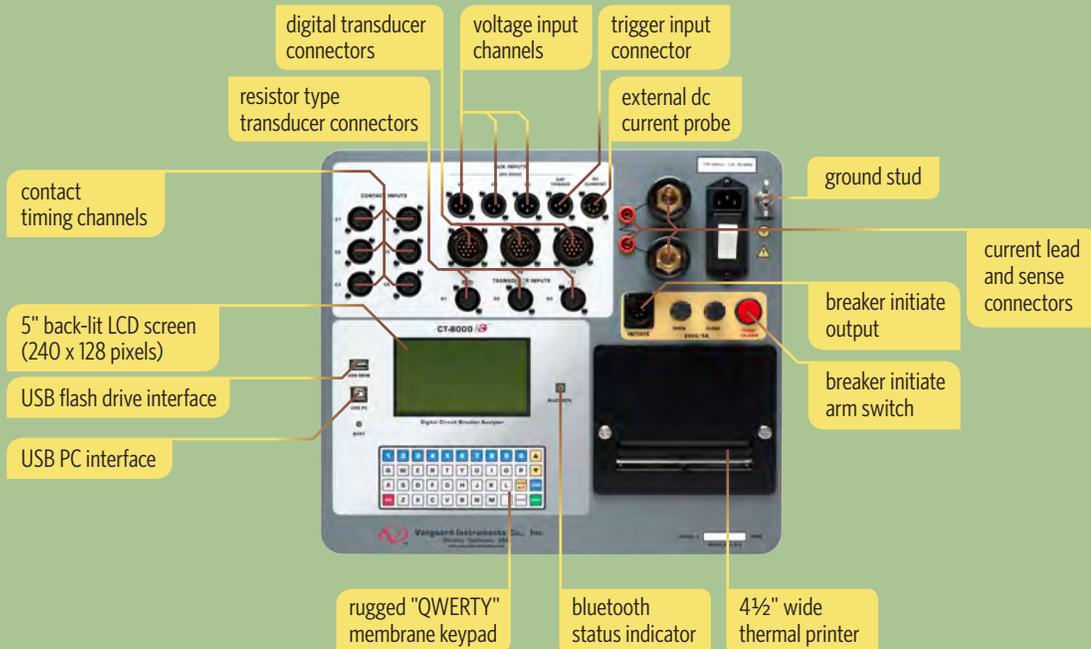
## OPEN/CLOSE Coil Current Monitoring

One built-in, hall-effect sensor records the OPEN/CLOSE coil current amplitude and waveform. The circuit breaker's coil current waveform, effectively, a coil performance "fingerprint" or "current profile", can be used as a diagnostic tool for analyzing the circuit breaker's performance.

## Computer Interface

The CT-8000 S3 can be computer-controlled via the USB or optional Bluetooth interface. Windows-based Circuit Breaker Analysis 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-8000 S3 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 S3. Additionally, test records can be automatically exported in Excel, PDF, and XML formats.

# CT-8000 S3 Features



## Built-in Thermal Printer

The CT-8000 S3's built-in 4.5" wide thermal printer can print the breaker contact analysis results in both tabular and graphic formats.

## User Interface

The CT-8000 S3 features a back-lit graphic LCD screen (240 x 128 pixels) that is viewable in direct sunlight and low-light levels. A rugged 44-key "QWERTY"-style membrane keypad is used to control the unit and input information.

## Internal Test Record and Test Plan Storage

The CT-8000 S3 uses Flash memory to store up to 200 test records internally. Test records can be recalled and printed on the unit's built-in 4.5" wide thermal printer. Test records can also be transferred to a USB Flash drive or exported to a PC via the USB port or Bluetooth (optional) with the included Windows-based software.

Up to 100 circuit breaker test plans can be stored in the CT-8000 S3's Flash memory. A test plan is comprised of all circuit breaker performance specifications (contact time, stroke, velocity, etc.). When a test plan is used with a timing test, a Pass/Fail report is generated by comparing the actual performance with the specifications in the stored test plan. Test plans can be transferred to the CT-8000 S3 from a USB Flash drive, or from a PC via the USB port or Bluetooth (optional).

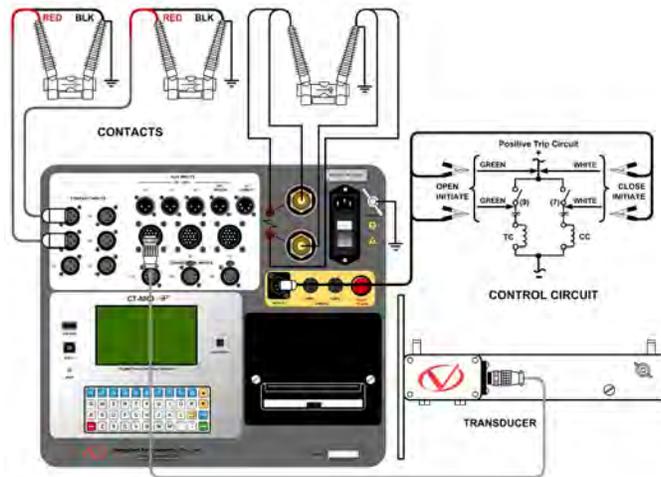
## Diagnostic Capabilities

The CT-8000 S3 can perform diagnostics on its internal electronics. Diagnostics can be performed to verify contact cable connections and to test the travel transducer's electronics.

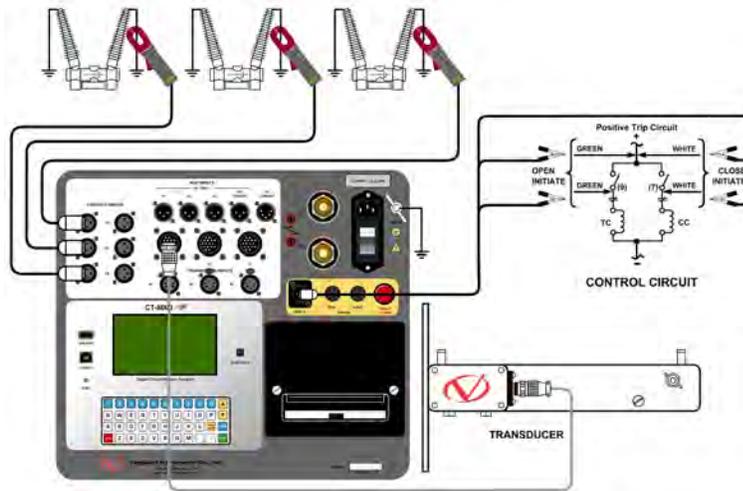
## Optional Features



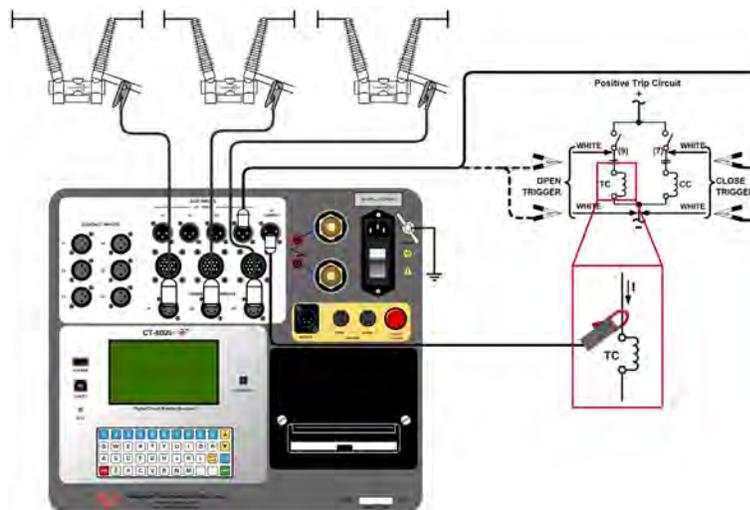
# CT-8000 S3 Connections



Typical CT-8000 S3 Dynamic Resistance Test Connections



Connections for Optional Dual Ground Testing Mode



Connections for Optional Online Timing Mode

# CT-8000 S3 *technical specifications*

 <b>physical specifications</b>	<b>Dimensions:</b> 16"W x 11"H x 14"D (40.6 cm x 29.9 cm x 35.6 cm) <b>Weight:</b> 22 lbs. (9.98 Kg)	 <b>input power</b>	10 A, 100 – 240 Vac, 50/60 Hz
 <b>dry-contact inputs</b>	3 channels (9103-UC) or 6 channels (9104-UC). Each channel can detect the main contact and resistor contact time.	 <b>timing windows</b>	1 second, 10 seconds, or 20 seconds
 <b>timing resolutions</b>	±50 micro-seconds @ 1 sec. duration, ±500 micro-seconds @ 10 sec. duration, ±1.0 milliseconds @ 20 sec. duration		
 <b>timing accuracy</b>	0.05% of reading ±0.05 milli-seconds @ 1 second duration	 <b>dry-contact detection range</b>	<b>closed:</b> less than 20 ohms; <b>open:</b> greater than 5,000 ohms
 <b>resistor detection range</b>	50 – 5,000 ohms	 <b>trigger input voltage</b>	open/close: 24 – 300 V, dc or peak ac
 <b>dry contact input protection</b>	All contact inputs are grounded until test. Input channels are also protected against static discharge.		
 <b>voltage sensing input range</b>	V1: analog input; 0 – 250 V dc or peak ac; sensitivity ±1 V; record and print voltage level V2 and V3: voltage presence/absence detector input; 24 – 255 V dc or peak ac; record and print 3 timing events		
 <b>breaker initiate capacity</b>	30 A, 250 V ac/dc max	 <b>resistor type transducer inputs</b>	3 channels, 200 ohms – 10 K ohms
 <b>digital travel transducer input</b>	3 digital travel transducer channels; linear range: 0.0 – 60.0 in (±0.01 in); rotary range: 0 – 360 degrees (±0.36 degrees)		
 <b>initiate current reading range</b>	one, non-contact, Hall-effect sensor, 0 – 20 amp range, dc to 5 KHz ac	 <b>contact travel point difference</b>	measures “slow-close” contact-point distances; results can be printed
 <b>dynamic/static resistance range</b>	0.1 – 1,999 micro-ohms; accuracy: ±2% of reading, ±5 micro-ohms	 <b>resistance test current</b>	200 A max
 <b>display</b>	5" back-lit LCD screen (240 x 128 pixels); viewable in bright sunlight and low light levels	 <b>internal test record storage</b>	stores up to 200 test records and 100 test plans
 <b>printer</b>	built-in 4½" wide thermal printer that can print both graphic contact travel waveforms and tabulated test results		
 <b>pc software</b>	Windows®-based Circuit Breaker Analysis software (VCBA S2) included with purchase price. Software updates available at no additional charge		
 <b>safety</b>	designed to meet UL 6101A-1 and CAN/CSA C22.2 No 1010.1-92 standards		
 <b>temperature</b>	<b>Operating:</b> -10°C to +50°C (+15°F to +122°F) <b>Storage:</b> -30°C to +70°C (-22°F to +158°F)	 <b>humidity</b>	90% RH @ 40°C (104°F) non-condensing
 <b>cables</b>	20' (6.1 m) contact leads, 30' (9.1 m) contact lead extensions, 20' (6.1 m) control and voltage cables, 25' (7.6 m) digital transducer cable, USB cable, power cord, ground cable		
 <b>options</b>	shipping cases (available for the CT-8000 S3 and travel transducers), on-line timing mode, dual ground testing mode, bluetooth interface	 <b>warranty</b>	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.

## Optional Testing Features

### ON-LINE TIMING MODE

<b>on-line current sensor</b>	three non-contact ac current sensors, range 0 – 100 A
<b>on-line dc current sensor</b>	one non-contact dc current sensor, range 0 – 20 A
<b>on-line timing accuracy</b>	±1 ms

### DUAL GROUND TIMING MODE

<b>dual ground clamp-on probes</b>	three non-contact ac current sensors, range 0 – 100 A
<b>dual ground timing accuracy</b>	±1 ms

# CT-8000 S3 Desktop Printer output

## Desktop printout of tabulated test results



**Vanguard Instruments Company, Inc.**

Filename: 78072-052908-SHOT069.DAT      Date/Time: 01/30/15 11:36:25  
 Company: DUKE ENERGY      Manufacturer: SIEMENS  
 Station: DAN RIVER 100 YARD      S/N: 30075423 4  
 Circuit: 30075423 4      Operator: J THOMPSON  
 Model: SPS2      Test: OPEN

**CONTACT (OPEN)**

CHA	P/F	Time(ms)	Cycle	Bounce(ms)	Wipe(mm)
1	P	27.300	1.64	0.05	34.04
2	P	27.500	1.65	0.05	34.93
3	P	27.200	1.63	-0.05	33.53

Delta Time(ms) 0.300 (P/F) = F

CT Channel Analysis: 0.000 (ms)

**Travel Analysis**

	T1	P/F
Stroke (mm)	109.22	P
Velocity (m/s)	5.49	P
Overtravel (mm)	4.19	P
Bounce Back (mm)	2.16	P

**Speed Analysis**

AP1 CT

AP2 CT+10.000 ms

Initiator Current: 12.136 A      V1 Nominal: 0V      V1 Min: 0V

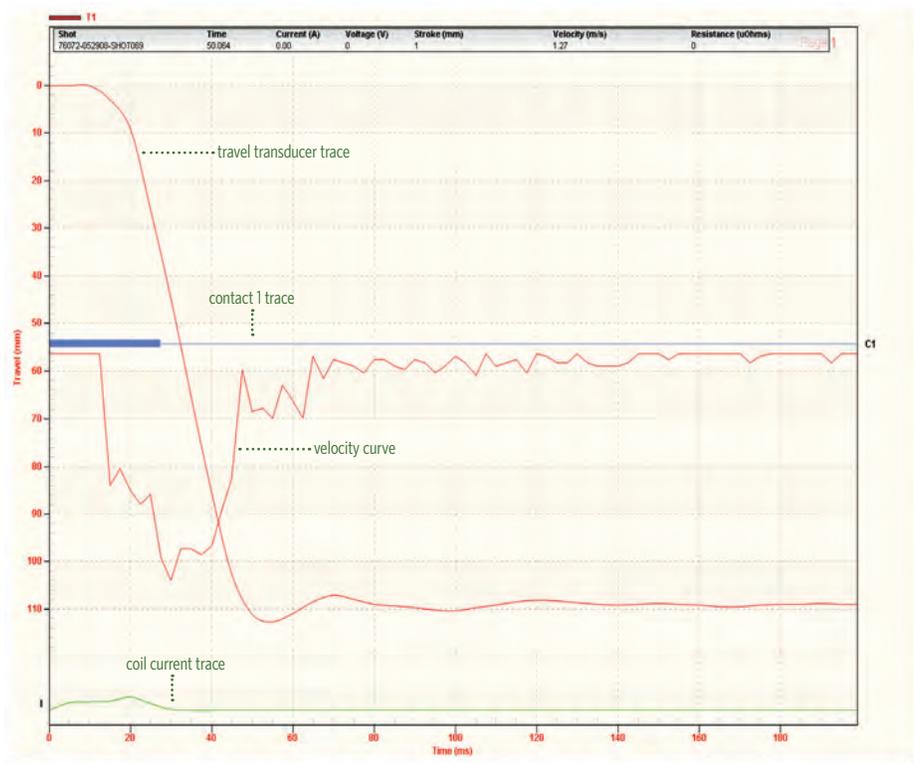
Shot Length: 1 SEC

Insertion Resistor: None

Delay: None

Trigger: Internal

## Desktop printout of graphic test results

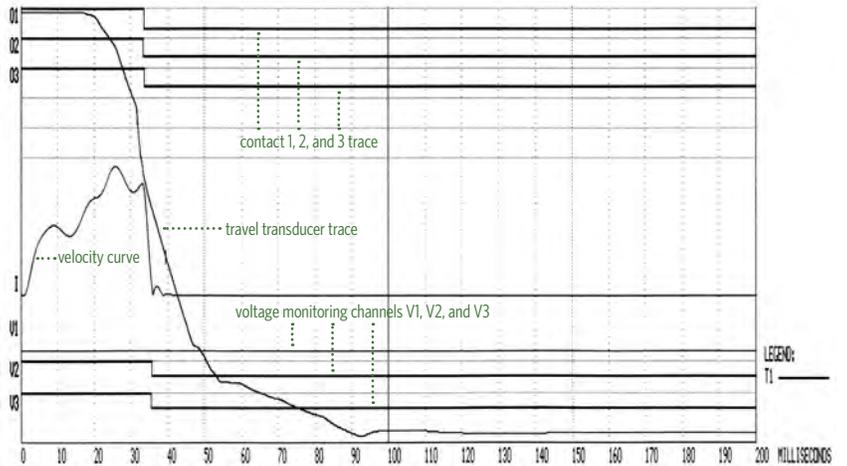


# CT-8000 S3 Thermal Printer Output

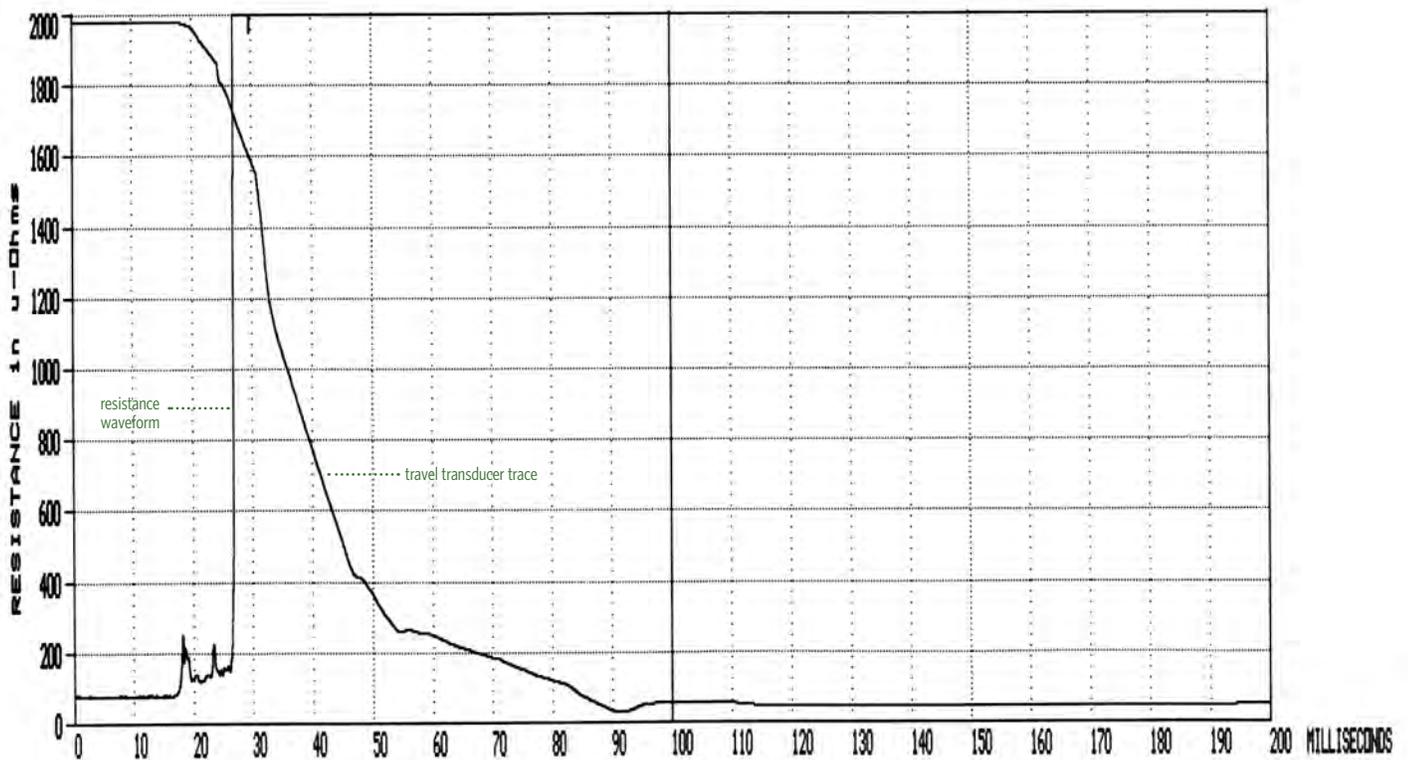
Thermal printout of tabulated test results

BREAKER TIMING RESULTS - 60 Hz				
SHOT NUMBER: 44				
DATE: 01/17/15 TIME: 14:41:02				
COMPANY: VANGUARD INSTRUMENTS				
STATION: STATION NUMBER 1				
CIRCUIT:				
MFR: ABB				
MODEL: 72FM31 12B				
S/N: 101797				
OPERATOR:				
TEST: OPEN				
CONTACT TIME				
CH	TIME	CYCLE	BOUNCE	WIPE
	(ms)		(ms)	(ms)
1	33.35	1.98	0.05	47.0
2	33.15	1.99	0.15	45.5
3	33.50	2.01	0.10	47.9
DELTA TIME (ms): 0.35				
TRAVEL ANALYSIS				
		T1		
STROKE	mm	120.1		
SPEED	m/s	5.21		
OVER-TRAVEL	mm	1.1		
BOUNCE BACK	mm	0.6		
SPEED ANALYSIS:				
POINT 1	= 30.0 mm			
POINT 2	= 70.1 mm			
U1 NOMINAL VOLTAGE = 0 VOLTS				
U1 MINIMUM VOLTAGE = 0 VOLTS				
U2/U3 TRANSITION TIMES				
	U2	U3		
T1:	35.50 ms	35.30 ms		
T2:	N/A	N/A		
T3:	N/A	N/A		
INITIATOR CURRENT = 9.7 AMPS				
SHOT LENGTH: 1 SECOND				
INSERTION RESISTOR: NO				
TRIGGER: INTERNAL				

Thermal printout of graphic test results



Thermal printout of dynamic resistance test graph





## 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 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, 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.



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