

DIGITMR S2

digital circuit breaker analyzer



Vanguard Instruments Company, Inc.
www.vanguard-instruments.com

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The Vanguard DIGITMR S2 is an inexpensive, easy to use digital circuit breaker analyzer. The DIGITMR S2 can be operated stand-alone or can be computer-controlled. It can fully analyze a circuit-breaker's performance by testing the contact time, stroke, velocity, over-travel, and contact wipe. Contact and motion analysis can be performed for all breaker contact operations (Open, Close, Open - Close, Close - Open, and Open - Close - Open). Timing results are recorded and displayed on the 240 x 128 pixels back-lit LCD screen and can also be printed on the built-in 4.5" wide thermal printer.

"On-line" Timing Mode

In addition to the conventional off-line timing mode, the DIGITMR S2 also offers an optional "on-line" timing mode. In this mode, the DIGITMR S2 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 breaker-make as detected by an AC clamp-on current sensing probe.

The "on-line" timing mode can detect a breaker's operating conditions with little or no down time. In this 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 "on-line" 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.

Diagnostic Capabilities

The DIGITMR S2 can perform diagnostics on its internal electronics. Diagnostics can be performed to verify contact cable connections and to test the travel transducer's electronics.

Open/Close Coil Current Monitoring

A built-in Hall-Effect current sensor records the circuit breaker's operating coil current amplitude and duration. The circuit breakers' operating-coil waveforms (effectively, a performance "fingerprint" or "current profile") can be used as a diagnostic tool for analyzing a circuit breaker's performance.

Internal Test Record and Test Plan Storage

The DIGITMR S2 can store up to 200 test records and 100 circuit breaker test plans in Flash EEPROM. A test plan comprises of all circuit breaker performance specifications (Stroke, Velocity, and Contact Time). When a test plan is used, the DIGITMR S2 compares the test results for the circuit breaker against its performance to generate a "Pass/Fail" report.

Test plans are generated using the included Windows®-based Circuit Breaker Analysis application. Test plans can be transferred to the DIGITMR S2 via the USB or optional Bluetooth interface, or by using an external USB Flash drive. Up to 999 test records and 999 test plans can be stored on an external USB Flash drive.

ordering information

Part number DIGITMR S2	DIGITMR S2, cables, and PC software
Part number DIGITMR S2-CASE	DIGITMR S2 shipping case
Part number Paper-TP4	thermal printer paper

DIGITMR S2 Controls & Indicators



1

Contact Timing Inputs

Dry-contact input channels are used for timing circuit-breaker contacts. Each contact input channel can detect main contact and insertion-resistor contact times in milli-seconds and cycles. Three contact timing channels are available on the DIGITMR S2.

2

Breaker Stroke and Velocity

One digital transducer input channel is available to measure circuit breaker contact stroke, velocity, over-travel, and bounce-back. With the use of a Vanguard digital travel transducer, no set-up calibration is required before testing. A special feature is also available to "Slow-Close" test a circuit breaker and obtain test results. An optional Resistor Transducer Adapter Device can be used to interface with any resistor transducer.

3

CT Input

One non-contact AC current sensor is used to monitor circuit breaker on-line current for the "on-line" timing mode.

4

Voltage Monitoring Input

One analog input channel, designated as (V1), is dedicated to monitoring the substation DC supply or coil voltage (0-255 Volts, DC or peak AC). A second voltage input channel, designated as V2, is dedicated to detecting voltage On/Off status (presence or absence). This input can be used to monitor the status of an A/B switch.

5

Circuit Breaker Initiate Feature

A built-in solid-state initiate device is used to operate the circuit breaker from the DIGITMR S2. Operational modes include Open, Close, Open-Close, Close-Open, and Open-Close-Open. Multiple operations such as Open-Close, Close-Open, and Open-Close-Open can be initiated using a programmable delay or by sensing the circuit breaker's contact condition. The circuit breaker coil current amplitudes and waveforms are recorded and can be printed on the thermal printer.

6

Computer Interface

One USB interface port and one optional Bluetooth interface is available for computer-control. Vanguard's Windows®- based Circuit Breaker Analyzer application is included with each DIGITMR S2. The software can be used to control the unit, review test records, and create circuit breaker test plans. Test records can be exported to PDF, Excel, and XML format. All future software updates can be downloaded from the Vanguard web site at no additional charge.

7

User Interface

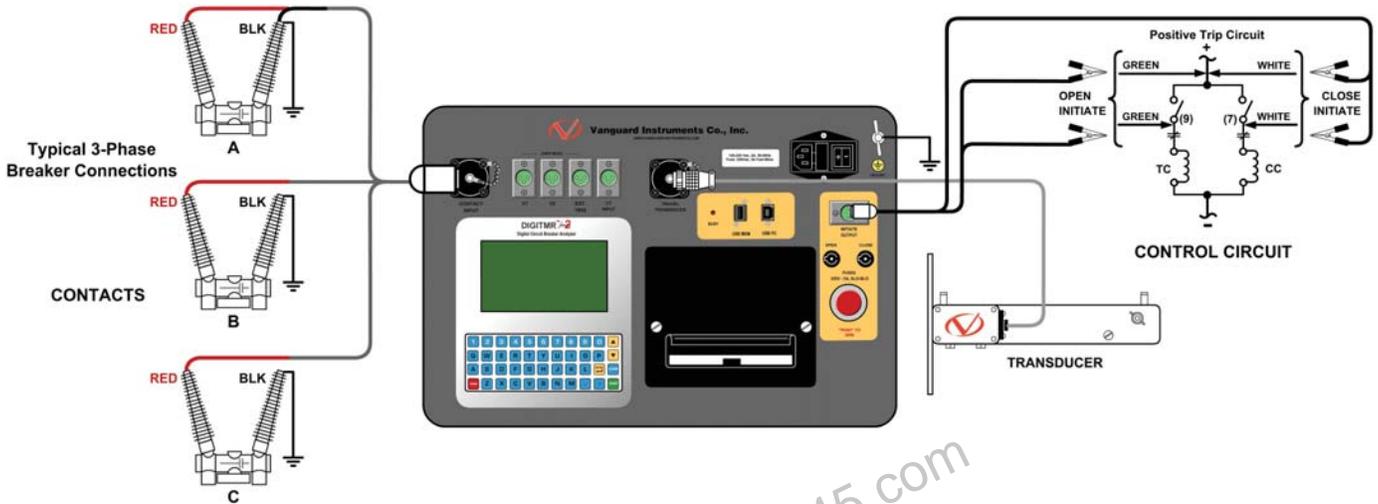
The DIGITMR features a back-lit (256 x 128 pixels) graphic LCD screen to display menus and test results. A convenient, rugged, 44-key QWERTY-style keypad is used to control the unit and enter data.

8

Built-in Thermal Printer

The DIGITMR S2 features a built-in 4.5" wide thermal printer that can print test results in both tabulated and graphic format.

DIGITMR S2 connections



DIGITMR S2 desktop printer output

Desktop printout of tabulated test results

Vanguard Instruments Company, Inc.
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Filename: Close-Open.dat Date/Time: 01/10/12 15:31:43
 Company: ITC Midwest Manufacturer: General Electric
 Station: Ottumwa Generation S/N: 0139A7230-303
 Circuit: BKR, B79 Operator: John Van Wanzhuizen
 Model: GE FX 169 31500 S Test: CLOSE-OPEN

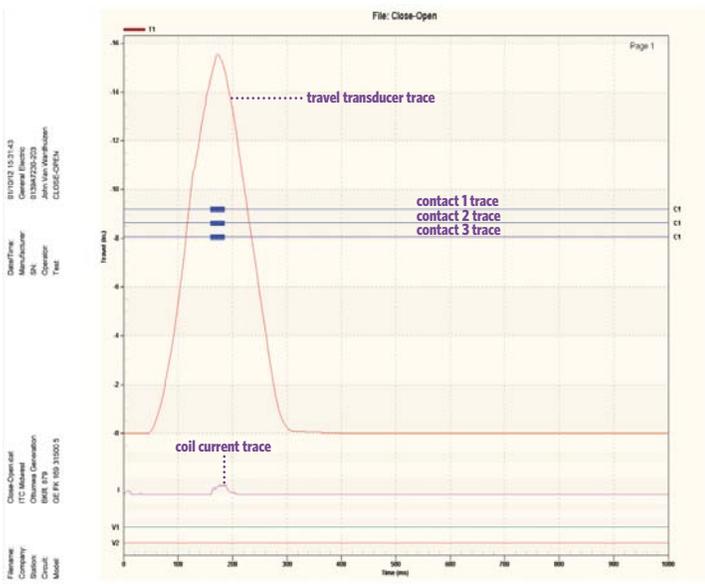
CONTACT (CLOSE)				CONTACT (OPEN)			
CHA P/F	Time(ms)	Cycle	Bounce(ms)	CHA P/F	Time(ms)	Cycle	Bounce(ms)
1	158.750	9.52	2.70	1	185.150	11.11	1.05
2	161.950	9.72	2.20	2	185.500	11.13	0.25
3	163.050	9.78	2.45	3	186.450	11.19	0.10
4	0.000	0.00	0.00	4	0.000	0.00	0.00
5	0.000	0.00	0.00	5	0.000	0.00	0.00
6	0.000	0.00	0.00	6	0.000	0.00	0.00

Delta Time(ms): 4.300 Delta Time(ms): 1.300

Travel Analysis	T1	T2	T3
Peak To Peak (in.)	15.565	0.000	0.000

Initiator Current: 11.644 A V1 Nominal: 1V V1 Mix: DV
 Shot Length: 1 SEC
 Insertion Resistor: None
 Delay: CONTACT #1
 Trigger: Internal

Desktop printout of graphic test results



DIGITMR S2 thermal printer output

Thermal printout of tabulated test results

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 1
 DATE: 04/03/12 TIME: 09:24:29

COMPANY: VANGUARD INSTRUMENTS
 STATION: MERA
 CIRCUIT: 220K
 PFR: MITSUBISHI
 MODEL: 200 SPT 53P
 S/N:
 OPERATOR: SPK

TEST: OPEN

CONTACT TIME	CYCLE	BOUNCE	WIFE
CH	TIME	TIME	TIME
1	18.05	1.08	0.10
2	18.55	1.11	0.05
3	18.55	1.11	0.05

DELTA TIME (ms): 0.50

CT CHANNEL ANALYSIS
 TIME CYCLE
 (ms) (ms)
 0.00 0.00

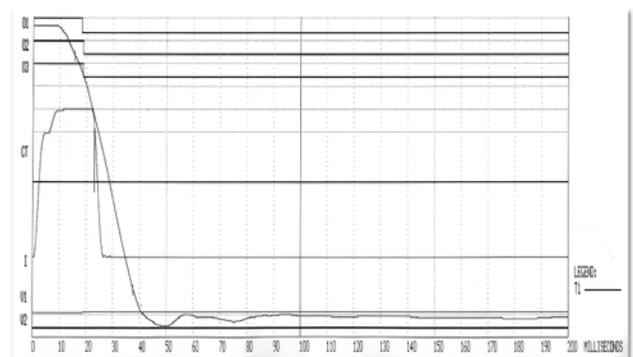
TRAVEL ANALYSIS T1
 STROKE mm 199.0
 SPEED M/S 7.21
 OVER-TRAVEL mm 5.2
 BOUNCE BACK mm 2.9

SPEED ANALYSIS:
 POINT 1 = 10%
 POINT 2 = 90%

V1 NOMINAL VOLTAGE = 1 VOLTS
 V1 MINIMUM VOLTAGE = 0 VOLTS
 INITIATOR CURRENT = 14.9 AMPS

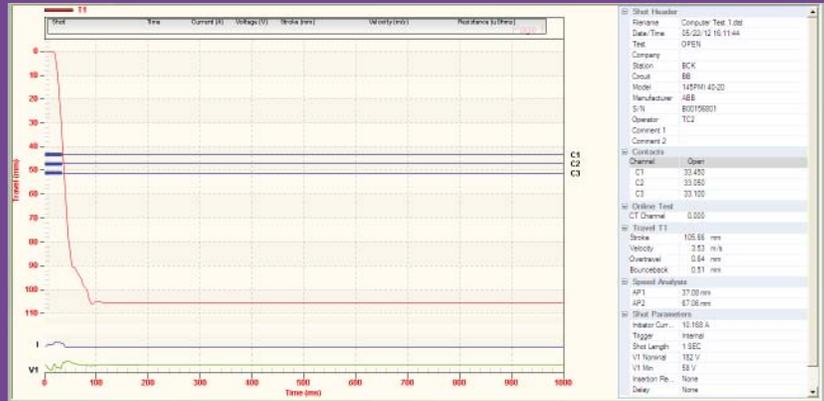
SHOT LENGTH: 1 SECOND
 INSERTION RESISTOR: NO
 TRIGGER: INTERNAL

Thermal printout of graphic test results



Computer control and analysis with included VCBA S2 Software

The DIGITMR S2 comes with the Vanguard Circuit Breaker Analysis Series 2 (VCBA S2) PC software. The VCBA S2 software can be used to retrieve timing records from the DIGITMR S2, analyze retrieved records, view test results in graphic format, generate timing reports, create breaker test plans, transfer breaker test plans to the DIGITMR S2, and control the unit from the PC to perform timing tests. The software can also be used to print test results to a desktop printer.



DIGITMR S2 specifications

type	portable digital circuit-breaker analyzer
physical specifications	18½"W x 14"H x 7"D (47.0 cm x 35.7cm x 17.6 cm); Weight: 20 lbs (9.1 kg)
input power	3 Amps, 100 – 240 Vac, 50/60 Hz
dry-contact inputs	3 dry contact channels; each channel detects main contact and insertion resistor contact
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 ±0.1 milli-seconds @ 1 second duration
dry-contact detection range	closed: less than 20 ohms; open: greater than 5,000 ohms
resistor detection range	50 – 5,000 ohms
trigger input voltage	open/close: 30 – 300 V, DC 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, Close-Open, Open-Close-Open
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 input	1 digital travel transducer channel; linear range: 0.0 – 60.0 in (±0.005 in) rotary range: 0 – 360 degrees (±0.006 degrees)
contact travel point difference	measures "slow-close" contact-point distances; results can be printed
CT current sensor	one, non-contact, 0–100A
display	back-lit LCD screen (240 x 128 pixels); viewable in bright sunlight and low light levels
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 200 test records and 100 test plans
computer interfaces	one USB port, optional Bluetooth interface
pc software	Windows®-based Circuit Breaker Analysis software (VCBA S2) included with purchase price. Software updates available at no additional charge
safety	designed to meet UL/IEC 61010 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)
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 DIGITMR 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

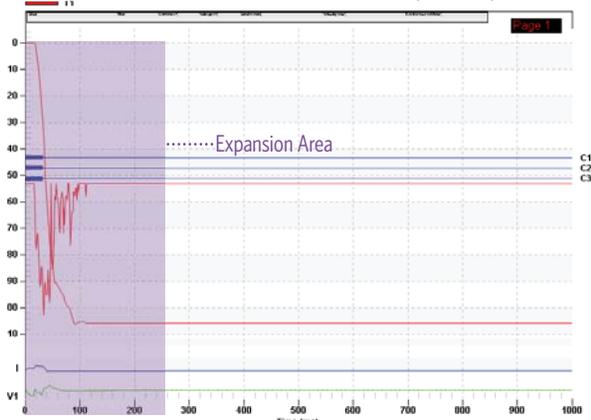
The VCBA S2 software can be used to quickly retrieve test records from a compatible Vanguard circuit breaker analyzer. Test results can be viewed in tabular and graphical format and can be saved on the PC hard drive. Test record header information, such as the company name, station, circuit, operator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



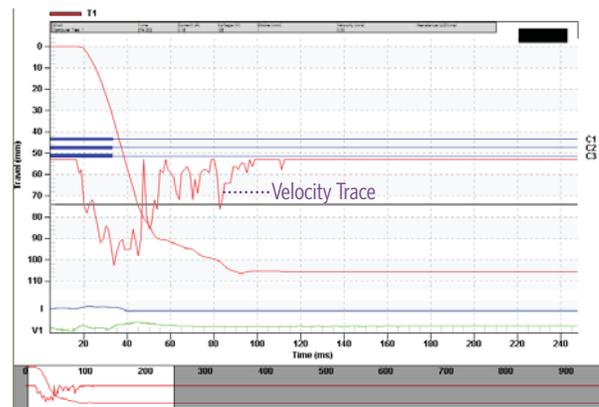
Sample Test Results (OPEN Test)

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.



Graphical Test Results



Graphical Test Results Expansion (from 0 to 200ms)

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.

The screenshot shows the 'Time Breaker' software window. It has a blue title bar and a light beige background. The window is divided into several sections:

- File Information:** Test Plan: c:\Vanguard\VCBA-S2\TestPlan\default.set; Save To: C:\Vanguard\VCBA-S2\Shots for Catalog; Filename: Shot. There are checkboxes for 'Add Date' and 'Add '001' to ensure uniqueness'.
- Shot Type:** Radio buttons for 'Open', 'Close', 'Open - Close', 'Close - Open', 'Open - Close - Open', and 'Static Resistance'. A dropdown menu for 'Close - Open' is set to 'Contact #1 Closed'. There are input fields for 'Delay between Open-Close' and 'Delay between Close-Open', both set to '10'.
- Timing Window:** Radio buttons for '1 Second', '10 Second', and '20 Second'. '1 Second' is selected.
- Trigger Type:** Radio buttons for 'Internal' and 'External'. 'Internal' is selected.
- Insertion Resistor:** Radio buttons for 'None', '< 1000 ohms', '1000 - 2000 ohms', and '> 2000 ohms'. 'None' is selected. There is a checkbox for 'Dynamic Resistance' which is unchecked.

At the bottom, there are buttons for 'Resend Shot', 'OK', and 'Cancel'.

Breaker Testing Parameters

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.

The screenshot shows the 'Shot Information' dialog box in the VCBA-S2 software. It has a light beige background and is divided into several sections:

- Shot Information:** Fields for Company, Station, Circuit, Manufacturer, Model, Serial Number, Operator, Comment #1, and Comment #2.
- File Information:** A section for file-related information.
- Contact Analysis:** A table with columns for 'Open (ms)', 'Close (ms)', 'C-O (LIVE) (ms)', and 'O-C (DEAD) (ms)'. The rows include Contact Low, Contact High, Contact Delta, Resistor On Low, Resistor On High, and Resistor On Delta, all with '0.0' in the input fields.
- Travel Analysis:** Fields for 'Open' and 'Close' analysis points. 'Open Analysis Point' has 'Point #1' and 'Point #2' set to '% of Stroke' with values of 25% and 50% respectively. 'Close Analysis Point' also has 'Point #1' and 'Point #2' set to '% of Stroke' with values of 25% and 50% respectively. There are also fields for 'Stroke Low', 'Stroke High', 'Velocity Low', 'Velocity High', 'Overtravel Low', 'Overtravel High', 'Bounce Back Low', and 'Bounce Back High'.

At the bottom, there is a 'Measure Unit' dropdown set to 'English' and a 'Manual Override' dropdown set to 'Disabled'. There is also a checkbox for 'Enable Rotary Encoder' and a field for '0.000 in./deg'.

Creating a Test Plan



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