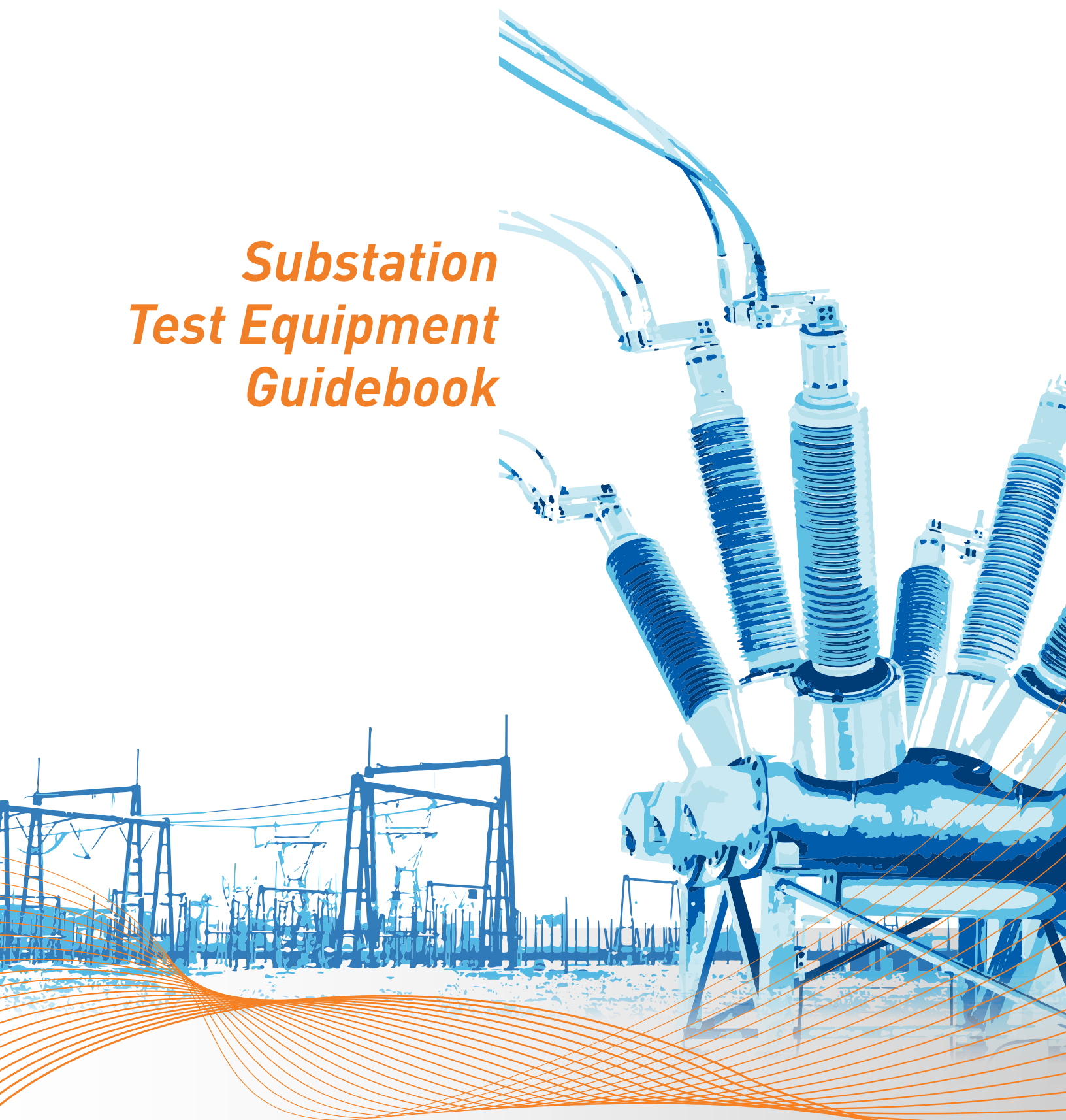


# *Substation Test Equipment Guidebook*



**Vanguard Instruments**  
A DOBLE COMPANY







# CONTENTS

<b>TRANSFORMER TURNS RATIO TESTERS</b>	<b>4</b>
<b>CURRENT TRANSFORMER TESTERS</b>	<b>5</b>
<b>CIRCUIT BREAKER ANALYZERS</b>	<b>6</b>
<b>CIRCUIT BREAKER POWER SUPPLIES</b>	<b>7</b>
<b>BREAKER ANALYZER ACCESSORIES</b>	<b>8</b>
<b>WINDING RESISTANCE METERS</b>	<b>9</b>
<b>MICRO-OHMMETERS</b>	<b>10</b>
<b>VACUUM BOTTLE TESTERS</b>	<b>11</b>
<b>RELAY TEST EQUIPMENT</b>	<b>11</b>



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# TRANSFORMER TURNS RATIO TESTERS

Vanguard offers an extensive line of microprocessor-based, automatic single-phase and three-phase turns ratio testers that use the IEEE C57.12.90 measurement method. Vanguard's three-phase turns ratio testers can automatically detect and test 130 transformer types defined by ANSI, CEI/IEC and Australian standards.

## TRF-250 *automatic, 3-phase transformer ratio finder*



- ANSI/IEEE C57.12.90 testing method
  - Ratios: 0.8 – 50,000 to 1
  - Test voltages: 4 Vac, 40 Vac, 100 Vac, and 250 Vac
  - 4.5" thermal printer\*
  - Built-in LTC Controller
- USB Flash drive, USB PC, Bluetooth PC interfaces
  - Export test report in Excel, XML, and PDF format
  - Stand-alone or computer-controlled
  - Automatically detects and tests 67 transformer types defined by ANSI, CEI/IEC and Australian standards
- \* Optional

## TRF-250A



Battery-operated, automatic, 3-phase transformer ratio finder with 250 Vac maximum test voltage

## TRF-100



Automatic, 3-phase transformer ratio finder with 100 Vac maximum test voltage

## ATRT-03 S2



Automatic, 3-phase transformer turns ratio tester

## Tri-Phase



True 3-phase transformer turns ratio tester with 100 Vac maximum test voltage

## ATRT-01/01B S3



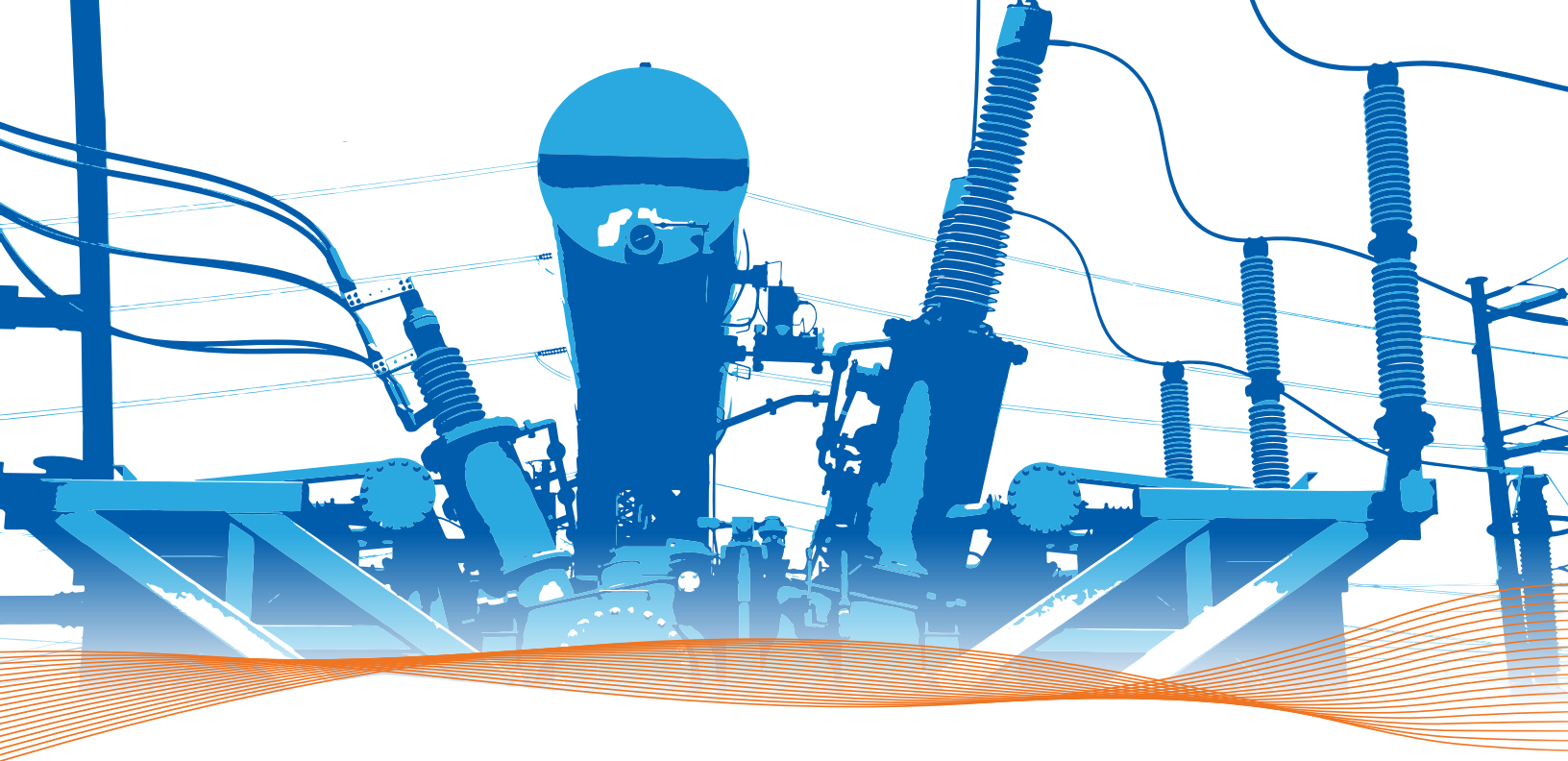
Automatic, single-phase transformer turns ratio testers

## CVT-765



Automatic, single-phase, capacitor voltage transformer turns ratio tester with 7,440 Vac test voltage

For full specifications, please visit <http://www.vanguard-instruments.com/categories/transformer-turns-ratio-meters>.



## CURRENT TRANSFORMER TESTERS

Vanguard's current-transformer test sets can perform excitation, turns ratio, and winding polarity tests on single and multi-ratio current transformers. CT's can be tested in their field-mounted configuration, eliminating the need to remove them from the host equipment.

### **EZCT-2000C** *2,000 Vac current transformer tester with insulation resistance and burden test*



- 2,000 Vac excitation test voltage
- One-time connection (X1-X5)
- Excitation test
- Current ratio test
- Polarity test
- Phase Angle test
- Winding resistance measurement
- Winding insulation test measurement
- CT load burden
- 20 A current source
- USB Flash drive, USB, and Bluetooth PC interfaces
- Built-in thermal printer

### **EZCT-2KA** *2,000 Vac current transformer tester*



- 2,000 Vac excitation test voltage
- One-time connection (X1-X5)
- Excitation test
- Current ratio test
- Polarity test
- Phase Angle test
- Winding resistance measurement
- USB Flash drive, USB, and Bluetooth PC interfaces
- Built-in thermal printer

For full specifications, please visit <http://www.vanguard-instruments.com/categories/current-transformer-testers>.

# CIRCUIT BREAKER ANALYZERS

Vanguard offers a wide range of microprocessor-driven circuit-breaker analyzers that can fully analyze a circuit breaker's performance. Vanguard's test instruments are designed for ease of use, and most can be computer-controlled or operated in stand-alone mode.

## CT-8000 S3 *circuit breaker analyzer*



- 3 or 6 timing channels
  - Three voltage monitoring channels
  - Three digital and three resistor transducer channels
  - Built-in 4.5" wide thermal printer
  - USB Flash drive, USB, and Bluetooth\* PC interfaces
  - Stand-alone or PC-controlled
  - Time-travel test
  - On-line (First Trip) test mode\*
  - Dual ground timing test\*
  - Dynamic resistance test (200 A)
  - Static resistance test (200 A)
  - USB Flash drive, USB PC, and Bluetooth\* PC interfaces
- \* Optional

## CT-7000 S3



Circuit breaker analyzer with built-in 4.5" thermal printer, 3 or 6 dry contact channels, digital and resistor-type transducer inputs, and USB PC interface

## DigiTMR S2



Inexpensive, easy to use digital circuit breaker analyzer with 3 contact timing channels, built-in 4.5" thermal printer, and USB PC interface

## CT-3500 S2



Circuit breaker timer with built-in 2.5" thermal printer, USB PC interface, and USB Flash drive interface

## MCCB-250



250 A Molded Case Circuit Breaker Tester

For full specifications, please visit <http://www.vanguard-instruments.com/categories/circuit-breaker-timers>.



## CIRCUIT BREAKER POWER SUPPLIES

Vanguard's AC/DC power supplies are designed to meet a utility company's substation needs for an independent AC/DC power source for operating circuit breakers where substation batteries are not available.

### UPS S3 *portable AC/DC power supply*



- AC/DC adjustable output power supply designed to operate substation circuit breakers
- Can supply up to 10 A during the circuit breaker coil energization and circuit breaker charging motor operation
- Variable AC output voltage source (10-140 Vac) rated at 140 Vac @ 9 A continuous
- DC voltage source (10-200 Vdc) rated at 180 Vdc@9 A (2 seconds) or 180 Vdc @ 2 A continuous
- Both AC & DC voltage source outputs protected by a circuit breaker

### UPS S2



Variable AC/DC power supply

### CB PWS



Fixed-voltage DC power supply

### CBCT



Programmable DC power supply

For full specifications, please visit <http://www.vanguard-instruments.com/categories/circuit-breaker-timers>.

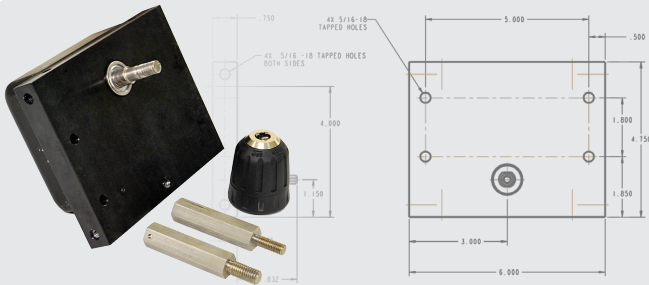
# BREAKER ANALYZER ACCESSORIES

## Digital Linear Transducers



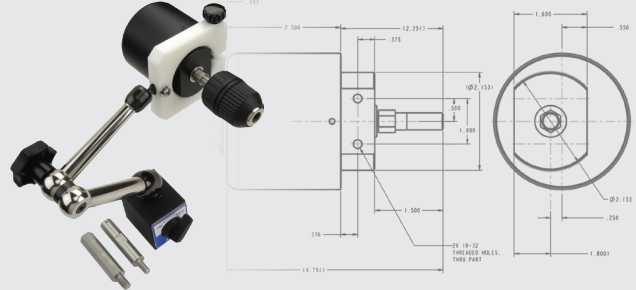
Vanguard digital linear travel transducers are designed to precisely measure circuit breaker contact linear motion. Using an optical encoder, the linear transducer can measure distances up to 25" with a 0.01" resolution. Our robust design measures velocity up to 41ft/sec (12.5m/sec). Vanguard linear travel transducers are available in 10" and 25" travel lengths. 30" travel or different lengths of travel are also available up on request.

## Type 2 Rotary Transducer



Furnished with a drill chuck adapter and two adapter shafts with 8mm and 10mm threading

## Type 3 Rotary Transducer



Features a magnetic mount and furnished with a drill chuck adapter and two adapter shafts with 8mm and 10mm threading

## Resistor Transducer Adapter



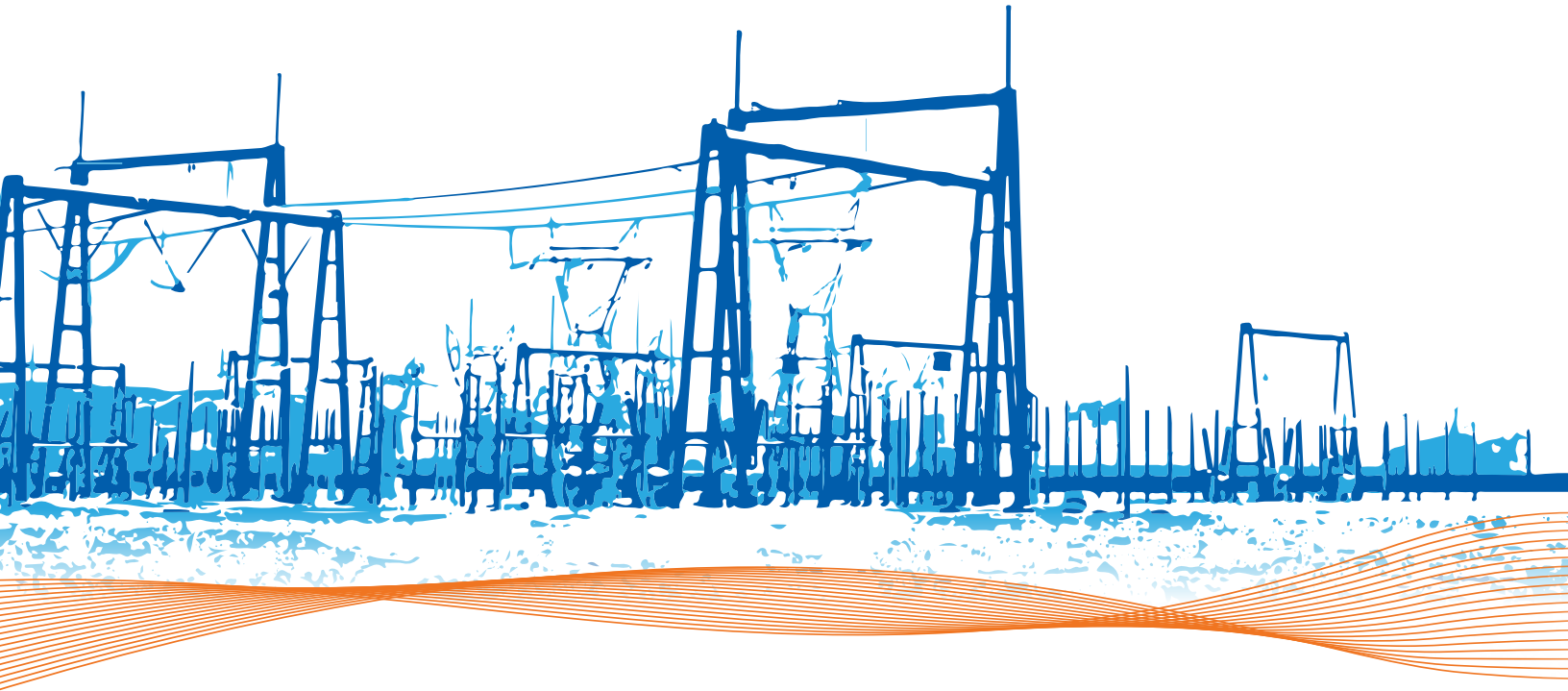
Used to connect any resistor type transducer to the digital transducer channel of a Vanguard circuit breaker analyzer

## Doble Transducer Adapter



Used to interface any Doble travel transducer to a Vanguard circuit breaker analyzer





# TRANSFORMER WINDING RESISTANCE METERS

Vanguard's winding resistance meters are designed to accurately measure the winding resistance of highly inductive power transformers and can also be used to measure EHV circuit-breaker contact resistance, motor winding resistance, or any low resistance.

## TRM-403 *40 A three-phase winding resistance meter with demagnetization*



- Three-phase transformer resistance meter
- Calculates resistance value of each delta winding
- Calculates resistance value of Wye windings with no accessible neutral
- Calculates equivalent resistance value
- Heat run test
- Demagnetizes transformer after test
- Detects LTC contact "make-before-break" using resistance graph
- Stand-alone or PC-controlled
- USB Flash drive, USB PC, and Bluetooth PC interfaces
- Built-in LTC controller

## TRM-203



25 A three-phase winding resistance meter with demagnetization

## TRM-20/40



25 or 40 A single-phase winding resistance meters with demagnetization

## WRM-10P S2



10 A single-phase winding resistance meter

For full specifications, please visit <http://www.vanguard-instruments.com/categories/transformer-winding-resistance-meters>.

# MICRO-OHMMETERS

Vanguard's true DC micro-ohmmeters are designed for testing EHV circuit breaker contact resistances, bushing contact joints, welding joints, or for any low-resistance measuring application.

## DMOM-600 *600 A true DC micro-ohmmeter*



- Resistance reading range from 1  $\mu\Omega$  to 300 m $\Omega$
- True DC current from 10-600 A
- Controlled rise and fall current time
- Can test CB contact with both sides grounded\*
- 44-key "QWERTY"-style keyboard
- Stores 100 test records internally
- USB Flash drive interface
- Built-in 2.5" wide thermal printer
- Custom test cable lengths\*

\* Optional

## DMOM-200 S3



200 A true DC micro-ohmmeter with built-in thermal printer

## Auto-Ohm 200 S3



200 A true DC micro-ohmmeter

## Auto-Ohm 10



10 A true DC micro-ohmmeter

## SGT-200



200 A safety ground tester with built-in thermal printer

For full specifications, please visit <http://www.vanguard-instruments.com/categories/circuit-breaker-contact-resistance-meters>.

# VACUUM BOTTLE TESTERS

## VBT-75 S2/VBT-75P S2 75 kVdc vacuum bottle testers



- 10 kV to 75 kVdc test voltages in 5 kV steps
  - 100, 200, 300 micro-amperes programmable test current
  - Displays test voltage and test current
  - "Pass/Fail" indicator and message
  - Very lightweight
  - Shipping case included
  - Built-in 2.5" thermal printer\*
  - Can store up to 84 records of 16 readings in Flash EEPROM\*
  - USB Flash drive interface\*
- \* VBT-75P S2 only

For full specifications, please visit <http://www.vanguard-instruments.com/categories/vacuum-bottle-testers>.

# RELAY TEST EQUIPMENT

## RFD-200 S3 portable relay test set



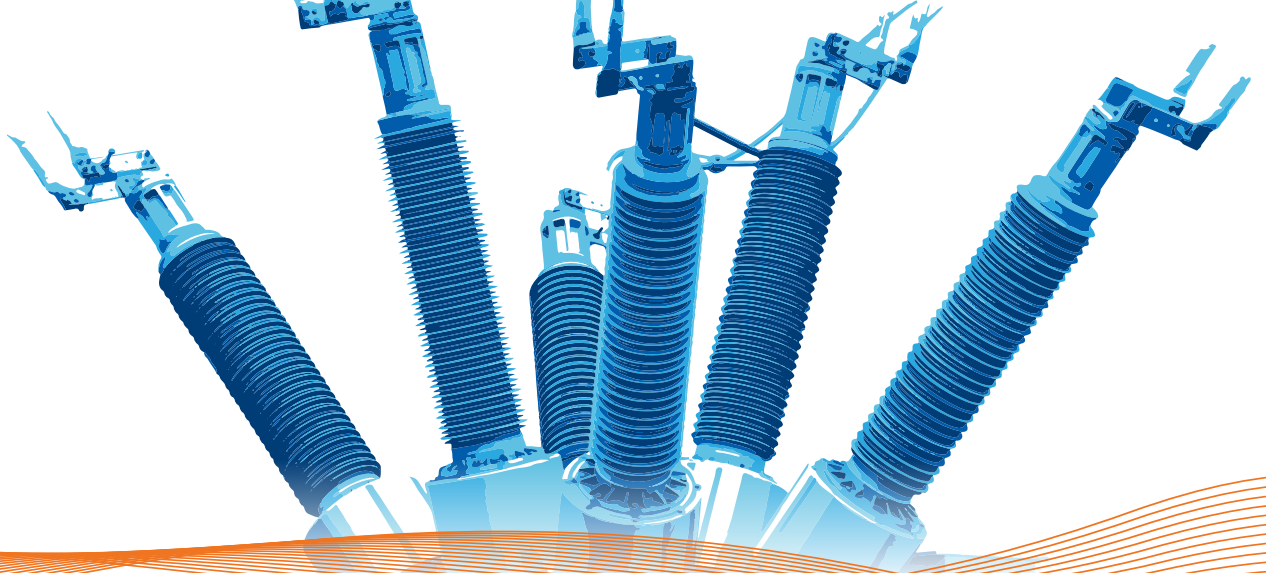
- Tests over-voltage, over-current relay
- Tests CT saturation and ratio
- AC current source: 1-100 A(250 A for 1 second)
- Voltage source: 0-240 Vac or 0-300 Vdc
- DC auxiliary output: 24 Vdc, 120 Vdc, 240 Vac
- Built-in digital timer
- Built-in current and voltage meters

## PCI-600 primary current injection



- 10 A to 600 A test current
- Built-in timer for CB testing
- Built-in internal current meter
- Built-in external current meter (CT ratio testing)

For full specifications, please visit <http://www.vanguard-instruments.com/categories/relay-test-equipment>.



## Instruments designed and developed by the hearts and minds of utility electricians around the world.

Founded in 1991 and located in Ontario, California, USA, Vanguard Instruments™ offers a wide range of diagnostic test equipment that accurately and efficiently measures the health of critical substation equipment, such as transformers, circuit breakers, and protective relays.

Our first product was a computerized, extra high voltage (EHV) circuit breaker analyzer, which became the forerunner of an entire line of EHV circuit breaker test equipment. Over the years, our portfolio has grown tremendously 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 application-specific products.

Our instruments are rugged, reliable, accurate, and user friendly. They eliminate tedious and time-consuming operations, while providing fast, complex test-result calculations. Using our equipment helps reduce errors and eliminates the need to memorize long sequences of procedural steps.

In 2017, Vanguard Instruments became a part of Doble Engineering Company, an energy industry leader in hardware, software, and services that diagnose and monitor the health of critical assets.



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