

TRI-PHASE

true 3-phase transformer turns ratio tester



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



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The Tri-Phase is a true three-phase transformer turns-ratio tester designed to conform to the IEEE C57.12.90 measurement standard. The Tri-Phase generates and outputs a three-phase excitation test voltage to the three transformer primary windings. The induced three-phase secondary voltages are sensed, and the transformer turns-ratio is calculated. The Tri-Phase can measure turns-ratios from 0.8 to 15,000. The three-phase turns-ratios, excitation current, and phase angle readings are displayed on the unit's LCD screen. Since a three-phase voltage is used to excite the transformer windings, the Tri-Phase can detect and measure turns-ratios of any transformer type, including phase-shifting transformers.

The Tri-Phase can be used as a stand-alone unit or can be computer-controlled. It can be operated locally using its alpha-numeric keypad and rotary switch. Information is displayed on a back-lit LCD screen (128 x 64 pixels) that is viewable in both bright sunlight and low-light levels. Test reports can be printed in the field on the unit's built-in 4.5-inch wide thermal printer.

The Tri-Phase can store up to 112 test records and 128 test plans in Flash EEPROM. Test records or test plans can be stored or transferred to and from a PC via the available interfaces (RS-232C port, USB port, USB Flash drive port).

Transformer Test Voltages

The Tri-Phase generates three-phase transformer test voltages from a single-phase AC or DC power source. Three test voltages (8 Vac, 40 Vac, 100 Vac) allow the Tri-Phase to test CT's and PT's, as well as power transformers.

Auto-Detect Transformer Configuration

The Tri-Phase can automatically detect 130 different transformer types defined by ANSI, CEI/IEC, and Australian standards, as well as phase-shifting transformers.

Transformer Test Plans

The Tri-Phase can store up to 128 transformer test-plans in its Flash EEPROM. A test-plan is comprised of the transformer nameplate voltages for each tap setting. The calculated turns-ratio based on the nameplate voltages is compared with the measured turns-ratio to derive the percentage error and Pass/Fail results. By recalling a test plan, a transformer can be quickly tested and turns-ratio Pass/Fail reports can be reviewed. Test plans can be created with the PC software and can be transferred to the Tri-Phase via the available interfaces (RS-232C port, USB port, USB Flash drive port).

Internal Test Record Storage

Up to 112 test records can be stored in the Tri-Phase's Flash EEPROM. Each test record may contain up to 99 turns-ratio, excitation current, phase angle, and nameplate voltage readings. Test records can be recalled locally or transferred to a PC via the available interfaces (RS-232C port, USB port, USB Flash drive port).

outstanding features

- Generates 3-phase transformer test voltage from single-phase AC or DC power input
- Capable of detecting 130 different 3-phase transformer types defined by ANSI, IEC, and Australian standards
- 3 test voltages available: 8Vac, 40Vac, 100Vac
- RS-232C and USB PC interfaces
- Built-in 4.5-inch wide thermal printer

ordering information

Part number **TRI-PHASE**

Tri-Phase, cables, and PC software

Part number **TRI-PHASE CASE**

Tri-Phase shipping case

Part number **Paper-TP4**

Thermal printer paper

TRI-PHASE Controls & Indicators



1

User Interface

The Tri-Phase features a back-lit LCD screen (128 x 64 pixels) that is viewable in both bright sunlight and low-light levels. The test results screen displays the transformer turns-ratio, excitation current, phase angle, and percentage error. The unit is controlled via a rugged, 16-key, membrane keypad and a digital rotary switch.

2

Computer Interface

The Tri-Phase can be computer-controlled via the RS-232C or USB port using the Windows®-based Transformer Turns-Ratio Analyzer Series 2 (TTRA S2) software provided with each Tri-Phase. The software can be used to run a test and to store test results on a PC. Test results can also be exported to Excel, PDF, and XML formats for further analysis.

3

Built-in Thermal Printer

The Tri-Phase features a convenient built-in 4.5-inch wide thermal printer that can be used to print test results.

4

Transformer Load Tap Changer Control

Voltage regulator or LTC tap positions can be changed remotely using the unit's built-in transformer load tap changer. This feature eliminates the need to manually raise or lower tap positions from the transformer control panel.

5

Input Power Sources

The Tri-Phase can be powered from a single-phase 100 – 240 Vac 50/60 Hz power source. A built-in safety ground detection circuit can detect and display any ground fault problems with the AC input source.

6

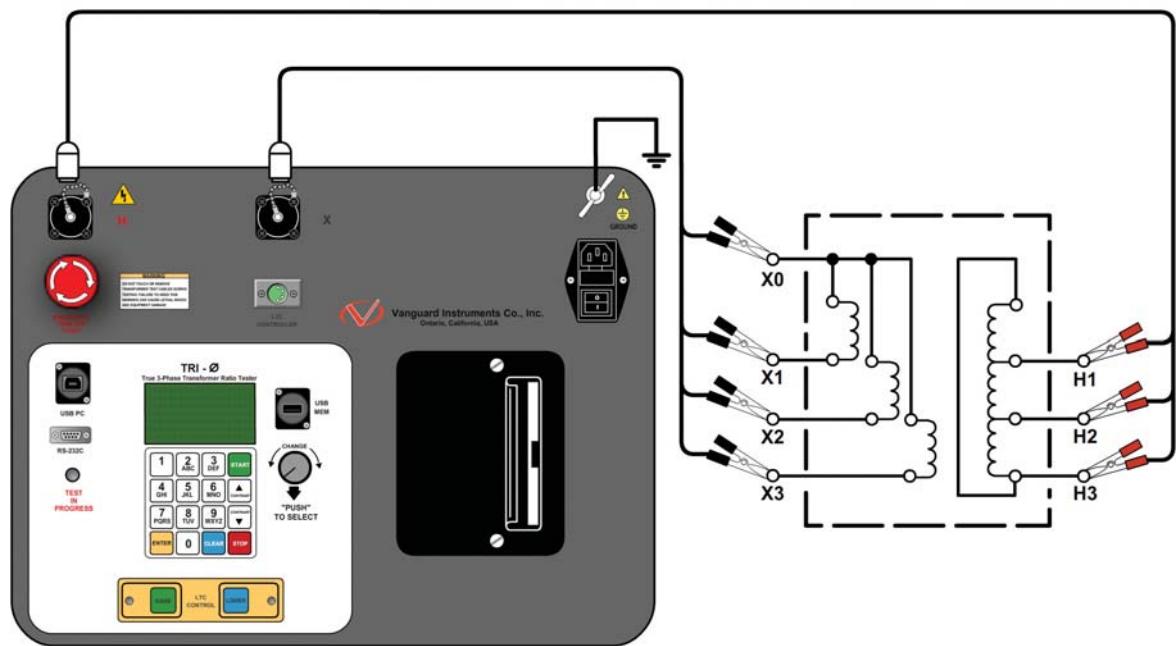
USB Flash Drive Interface

A built-in USB Flash drive interface provides a convenient method for transferring test plans and test records to or from a USB Flash drive. The user can store up to 999 transformer test plans and test records on a USB Flash drive, and the supplied PC software can be used to view the test records.



Tri-Phase at Rotex Engineering, South Africa

TRI-PHASE connections



TRI-PHASE
desktop printer output

TRI-PHASE
thermal printer output



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TRANSFORMER TURNS RATIO REPORT

Filename: Tri Phase Shot001.tst Date: Apr 12, 2012 Time: 08:16 AM Page (2/2)Tri Phase

Company: VANGUARD INSTRUMENTS
Location: LAB
Circuit: DY TRANSFORMER
Operator: VN
Comment:

MFR: GE
Device: Transformer
Type: Dyn1
Model: DISTRIBUTION TRANSF
Rating: 500KVA
Serial #: F639943 67P
Max Deviation %:
Test Voltage: 40V

	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	VECTOR GROUP	PHASE	INTERNAL JUMPER	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	MEAS. RATIO	URNS RATIO	NOTES
			Dyn1	A		H1 - H3	X1 - X0	$\frac{V_{H1}}{V_{X1}}$	$\frac{V_{H1}}{V_{X1}}$	
				B		H2 - H1	X2 - X0	$\frac{V_{H2}}{V_{X2}}$	$\frac{V_{H2}}{V_{X2}}$	
				C		H3 - H2	X3 - X0	$\frac{V_{H3}}{V_{X3}}$	$\frac{V_{H3}}{V_{X3}}$	

TEST	H VOLT	H TAP	X VOLT	X TAP	C-RATIO	M-RATIO	DEV [%]	P/F	I[mA]	DEGREE	RES
1	12000		208		57.6923	A: 57.841 B: 57.841 C: 57.734	0.26 0.26 0.07	P P P	2.200 2.700 3.500	29.970 149.950 269.960	

RECORD NUMBER 1

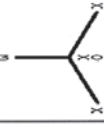
TRANSFORMER TEST RESULTS

DATE: 04/12/12 TIME: 08:16:27

COMPANY: VANGUARD INSTRUMENTS
STATION: LAB
CIRCUIT: DY TRANSFORMER
MFR: GE
MODEL: DISTRIBUTION TRANSF
S/N: F639943 67P
KVA RTG: 500
OPERATOR: VN

TEST VOLTAGE = 40 V, 60 Hz

TYPE: Dyn1



H TAP: H VOLTAGE: 12,000
X TAP: X VOLTAGE: 208
NAME PLATE RATIO: 57.692

THREE PHASE TEST RESULTS:

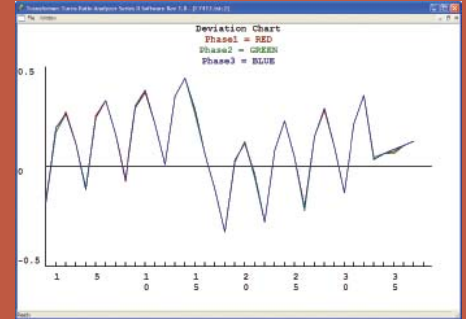
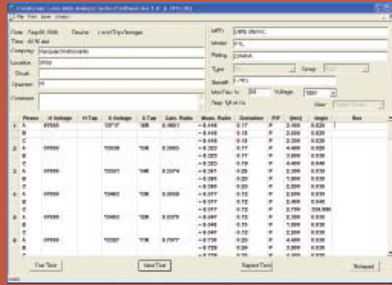
PHS M-RATIO	MA	PHASE	%DIFF
A 57.841	2.2	29.97	0.26
B 57.841	2.7	149.95	0.26
C 57.734	3.5	269.96	0.07

SINGLE PHASE TEST RESULTS:

PHS M-RATIO	MA	PHASE	%DIFF
A +101.06	2.4	1.55	1.14
B +100.11	1.9	0.17	0.19
C +100.08	2.9	0.17	0.15

Computer control and analysis with included TTRA S2 Software

The Tri-Phase comes with the Vanguard Transformer Turns Ratio Analysis Series 2 (TTRA S2) PC software. The TTRA S2 software can be used to test winding turns ratios of transformers, voltage regulators, and load-tap changers. Test plans can be created using the TTRA S2 application and then transferred to the Tri-Phase. Test records can be exported to Excel, PDF, and XML formats for further analysis.



TRI-PHASE specifications

type	True, 3-phase transformer turns ratio tester
physical specifications	21"W x 9"H x 17"D (53 cm x 24 cm x 43 cm); Weight: 35 lbs (15.8 kg)
input power	3 amps, 100 – 240 Vac, 50/60 Hz
measurement method	ANSI/IEEE C57.12.90
turns ratio measuring range	0.8 – 15,000 (5-digit resolution)
turns ratio accuracy	0.8 – 999: ±0.1%, 1000 – 1599: ±0.2%, 1600 – 9999: ±1%, 10,000 – 15,000: 1.5% @ 8 Vac 0.8 – 999: ±0.1%, 1000 – 1599: ±0.2%, 1600 – 9999: ±1%, 10,000 – 15,000: 1.5% @ 40 Vac 0.8 – 999: ±0.1%, 1000 – 1599: ±0.2%, 1600 – 9999: ±1%, 10,000 – 15,000: 1.5% @ 100 Vac
test voltages	Three-phase, 8 Vac @ 1 Amp, 40 Vac @ 0.2 Amps, 100 Vac @ 0.1 Amp
excitation current reading range	0 – 2 Amperes; Accuracy: ±0.1 mA, ±2% of reading (±1 mA)
phase angle measurement	0 – 360 Degrees; Accuracy: ±0.2 degree (±1 digit)
display	Back-lit LCD screen (128 x 64 pixels) viewable in bright sunlight and low-light levels
printer	Built-in 4.5-inch wide thermal printer
computer interfaces	One RS-232C port, one USB port
external data storage	One USB Flash drive interface port; Up to 999 transformer test records can be stored on a USB Flash drive (not included)
internal test record storage	Can store 112 transformer test records internally. Each record holds the test record header and up to 99 readings.
internal test plan storage	Can store 128 transformer test plans internally. Test plans can be transferred to the unit from the PC via the RS-232C/USB port or via the USB Flash drive interface
pc software	Windows®-based Transformer Turns Ratio Analyzer application is included with purchase price
load tap changer contact	240 Vac, 1 Amp
safety	Designed to meet UL 61010A-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)
humidity	90% RH @ 40°C (104°F) non-condensing
altitude	2,000 m (6,562 ft) to full safety specifications
cables	One 15-foot single-phase set, one 15-foot three-phase set, one 25-foot extension set, one ground cable, one USB cable, one RS-232C cable, power cord, cable bag
options	transportation case
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.



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.



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