

Tri-Phase

true 3-phase transformer turns ratio tester



Vanguard Instruments
A DOBLE COMPANY





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true 3-phase transformer turns ratio tester

Product Overview

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).

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.

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 specific vector groups for different transformer types defined by ANSI, CEI/IEC, and Australian standards, as well as phase-shifting transformers.

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).

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).

outstanding features

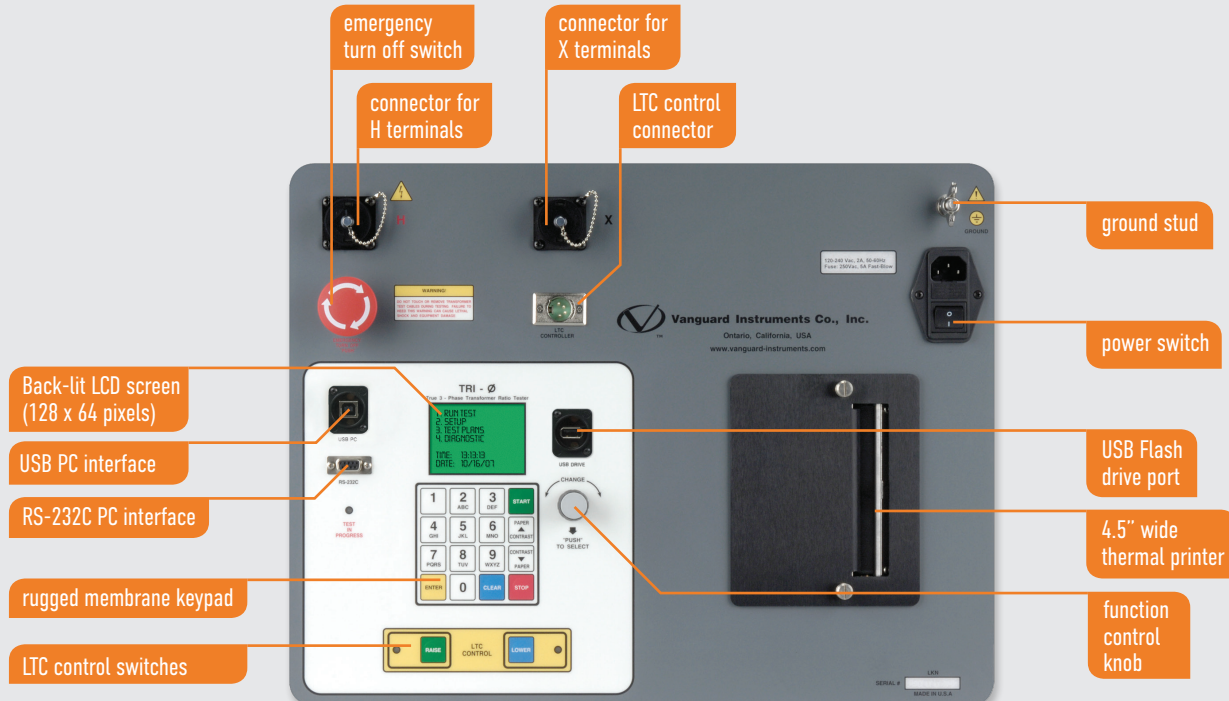
- Generates 3-phase transformer test voltage from single-phase AC or DC power input
- Capable of detecting 130 different 3-phase transformer types defined by ANSI, IEC, and Australian standards
- 3 test voltages: 8Vac, 40Vac, and 100Vac
- RS-232C and USB PC interfaces
- Built-in 4.5" wide thermal printer

ordering information

Part No.	Description
9008-UC	Tri-Phase, cables, and PC software
9008-SC	Tri-Phase shipping case
TP4-CS	TP4 thermal printer paper (24 rolls)



Tri-Phase Features



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.

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.

Built-in Thermal Printer

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

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.

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.

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.



RECORD NUMBER 1

TRANSFORMER TEST RESULTS

DATE: 01/12/15 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

thermal printer output

Test results can be quickly printed in the field on the Tri-Phase's built-in thermal printer without the need to connect the unit to a PC.



Vanguard Instruments Company, Inc.

1520 S. Hellman Avenue, Ontario, CA 91761, USA Phone: 909.923.9390 FAX: 909.923.9391
 www.vanguard-instruments.com

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	$\frac{V_H}{V_X} + \sqrt{3}$	$\frac{V_H}{V_X} + \sqrt{3}$	
			B		H2-H1	X2-X0			
			C		H3-H2	X3-X0			

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	

desktop printer output

Test reports can be generated with the included TTRA S2 PC software. Test records can be exported to Excel, PDF, and XML formats for further analysis

Test Voltage Transformer Type

1 YNd1
40 VOLTS 60 Hz

SINGLE-PHASE RESULTS:

RATIO	mA	%DIFF
A+10.039	4.7	0.27
B+10.027	3.9	0.16
C+10.035	5.3	0.24

Measured Ratio for Phase A, B, and C

Percentage Error

Winding Polarity

Excitation Current Reading

1 YNd1
40 VOLTS 60 Hz

PHASE DATA

Phs A	Phs B	Phs C
29.83°	149.79°	269.84°

Phase A Angle

Phase B Angle

Phase C Angle

typical test results screens



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.

The latest version of the TTRA S2 software can always be downloaded free from the Vanguard web site at www.vanguard-instruments.com. Please note that you will need to create a free account on our site in order to download software or firmware.

Transformer Turns Ratio Analyzer Series II Software Rev 1.8 - [F7413.tst]

Date: Sep 08, 2008 Device: Load Tap Changer MFR: Delta Star Inc.
 Time: 06:56 AM Model: PTL
 Company: Vanguard Instruments Rating: 20 MVA
 Location: Shop Type: Dy Group: Dyn1
 Circuit: Operator: VF Serial#: F7413
 Comment: Max Dev. %: 0.5 Voltage: 100V
 Step: 5/8 of 1% View: Single Phase

Phase	H Voltage	H Tap	X Voltage	X Tap	Calc. Ratio	Meas. Ratio	Deviation	P/F	I[mA]	Angle	Res
1 A	67000		13717	16R	8.4601	+ 8.446	0.17	P	2.400	0.020	
B						+ 8.445	0.18	P	2.300	0.020	
C						+ 8.445	0.18	P	2.300	0.020	
2 A	67000		13639	15R	8.5085	+ 8.523	0.17	P	4.400	0.020	
B						+ 8.523	0.17	P	3.900	0.030	
C						+ 8.525	0.19	P	4.400	0.040	
3 A	67000		13561	14R	8.5574	+ 8.581	0.28	P	2.300	0.030	
B						+ 8.580	0.26	P	1.900	0.030	
C						+ 8.580	0.26	P	2.200	0.030	
4 A	67000		13483	13R	8.6069	+ 8.617	0.12	P	2.800	0.030	
B						+ 8.617	0.12	P	2.400	0.040	
C						+ 8.617	0.12	P	2.700	359.990	
5 A	67000		13405	12R	8.6570	+ 8.647	0.12	P	2.300	0.030	
B						+ 8.648	0.10	P	1.900	0.030	
C						+ 8.647	0.12	P	2.200	0.030	
6 A	67000		13327	11R	8.7077	+ 8.730	0.26	P	4.400	0.030	
B						+ 8.729	0.24	P	3.900	0.030	
C						+ 8.729	0.24	P	4.400	0.030	

Buttons: Run Test, Next Test, Repeat Test, Notepad

Tri-Phase technical specifications

physical specifications	Dimensions: 21"W x 9"H x 17" D (53 cm x 24 cm x 43 cm) Weight: 35 lbs. (15.8 Kg)	input power	100 – 240 Vac, 50/60 Hz, 3 amps
measuring method	ANSI/IEEE C57.12.90	ratio measuring range	0.8 – 15,000 : 1 (5-digit resolution)
typical turns-ratio accuracy	8 Vac: 0.8 – 1,000 (±0.08%), 1,001 – 4,000 (±0.1%), 4,001 – 15,000 (±0.25%) 40 Vac: 0.8 – 1,000 (±0.05%), 1,001 – 4,000 (±0.1%), 4,001 – 15,000 (±0.2%) 100 Vac: 0.8 – 1,000 (±0.05%), 1,001 – 4,000 (±0.1%), 4,001 – 15,000 (±0.2%)	current reading range	0 – 1 Ampere, accuracy: ±0.1mA, ±2% of reading (±1 mA)
test voltages	Three-phase, 8 Vac @ 1 Amp, 40 Vac @ 0.2 Amps, 100 Vac @ 0.1 Amp	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	computer interfaces	one RS-232C port, one USB port
printer	built-in 4½" wide thermal printer	internal test plan storage	stores up to 128 transformer test plans; plans can be transferred to PC.
pc software	Windows®-based transformer turns-ratio analysis software is included with purchase	external data storage	up to 999 test records on external USB flash drive (drive not included)
internal test record storage	stores 112 complete transformer test records, each record holding the test record header and up to 99 readings	humidity	90% RH @ 40°C (104°F) non-condensing
safety	designed to meet UL 61010A-1 and CAN/CSA C22.2 No. 1010.1-92 standards	altitude	2,000 m (6,562 ft) to full safety specifications
temperature	Operating: -10°C to +50°C (+15°F to +122°F) Storage: -30°C to +70°C (-22°F to +158°F)	Itc contact	240 Vac, 2A
cables	15-foot (4.57m) single-phase set, 15-foot (4.57m) 3-phase set, 25-foot (7.62m) extension set, safety ground, power, USB, RS-232C, cable bag	warranty	one year on parts and labor
options	shipping case, 30' (9.14 m) 3-phase H and X leads, 30' (9.14 m) single phase H and X leads		

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.

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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1520 S. Hellman Avenue
Ontario, California 91761, USA
Phone 909-923-9390 • **Fax** 909-923-9391

www.vanguard-instruments.com

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