

# Tri-Phase

*true 3-phase transformer turns ratio tester*



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



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## 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).

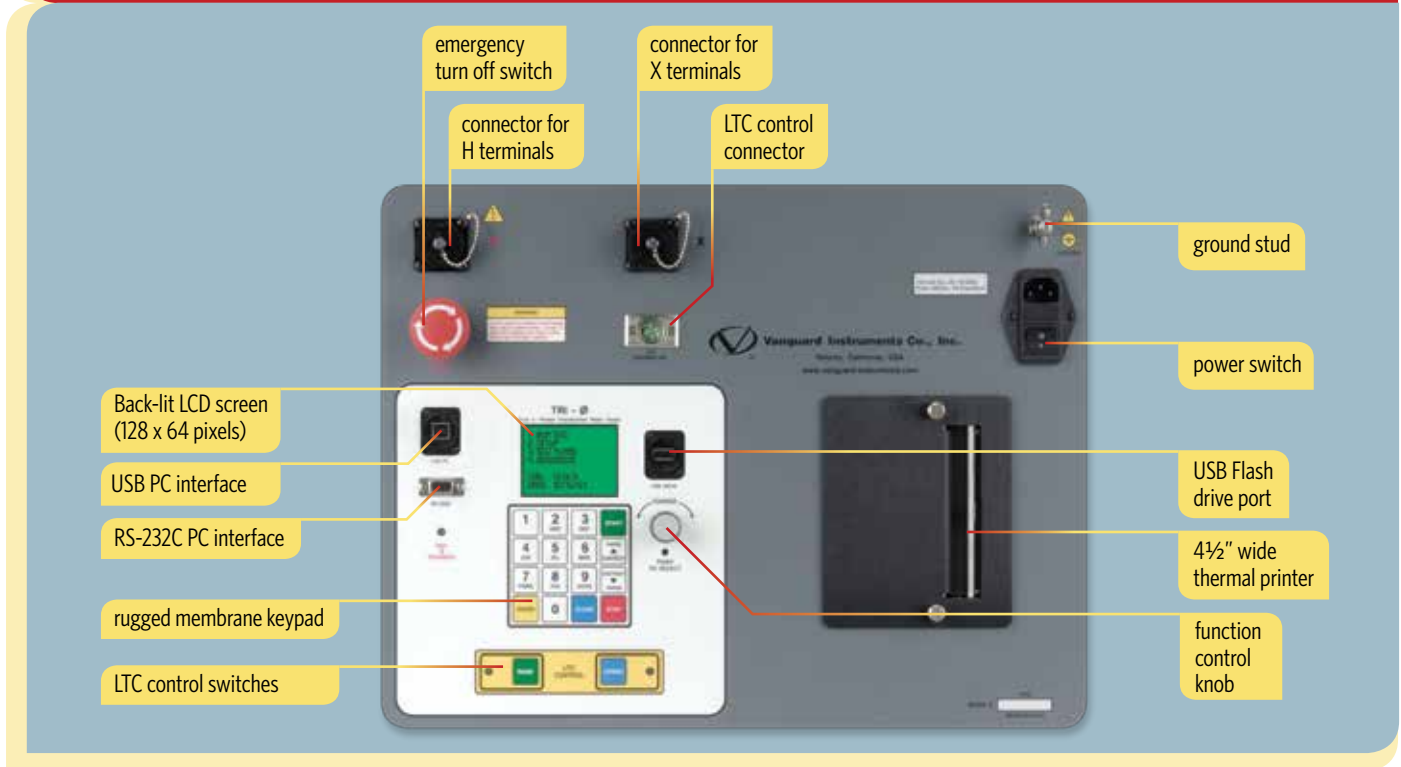
## outstanding features

- 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 4½" 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 1/2" 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.

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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	MFR: GE	Device: Transformer	Type: Dyn1								
Location: LAB	Model: DISTRIBUTION TRANSF	Rating: 500KVA	Serial #: F639943 67P								
Circuit: DY TRANSFORMER	Max Deviation %:	Test Voltage: 40V									
Operator: VN											
Comment:											
		INTERNAL JUMPER	MEAS. RATIO	URNS RATIO	NOTES						
A		H1-H3	X1-X0	$\frac{V_{H1}}{V_{X1}}$							
B		H2-H1	X2-X0	$\frac{V_{H2}}{V_{X2}}$							
C		H3-H2	X3-X0	$\frac{V_{H3}}{V_{X3}}$							
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	0.26	P	2.200	29.970	
						B: 57.841	0.26	P	2.700	149.950	
						C: 57.734	0.07	P	3.500	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

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

1 YNd1  
40 VOLTS 60 Hz

PHASE DATA

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

Measured Ratio for Phase A, B, and C

Winding Polarity

Percentage Error

Excitation Current Reading

Phase A Angle

Phase B Angle

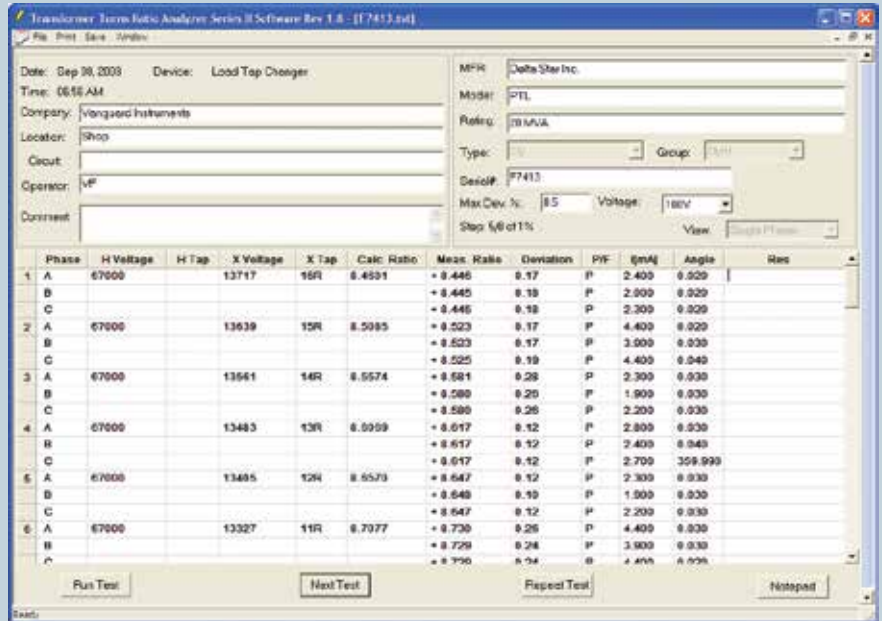
Phase C Angle

# 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](http://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.



## Tri-Phase technical specifications

 <b>physical specifications</b>	<b>Dimensions:</b> 21"W x 9"H x 17" D (53 cm x 24 cm x 43 cm) <b>Weight:</b> 35 lbs. (15.8 Kg)	 <b>input power</b>	100 – 240 Vac, 50/60 Hz, 3 amps
 <b>measuring method</b>	ANSI/IEEE C57.12.90	 <b>ratio measuring range</b>	0.8 – 15,000 : 1 (5-digit resolution)
 <b>typical turns-ratio accuracy</b>	<b>8 Vac:</b> 0.8 – 1,000 ( $\pm 0.08\%$ ), 1,001 – 4,000 ( $\pm 0.1\%$ ), 4,001 – 15,000 ( $\pm 0.25\%$ ) <b>40 Vac:</b> 0.8 – 1,000 ( $\pm 0.05\%$ ), 1,001 – 4,000 ( $\pm 0.1\%$ ), 4,001 – 15,000 ( $\pm 0.2\%$ ) <b>100 Vac:</b> 0.8 – 1,000 ( $\pm 0.05\%$ ), 1,001 – 4,000 ( $\pm 0.1\%$ ), 4,001 – 15,000 ( $\pm 0.2\%$ )		
 <b>test voltages</b>	Three-phase, 8 Vac @ 1 Amp, 40 Vac @ 0.2 Amps, 100 Vac @ 0.1 Amp	 <b>current reading range</b>	0 – 1 Ampere, accuracy: $\pm 0.1\text{mA}$ , $\pm 2\%$ of reading ( $\pm 1\text{mA}$ )
 <b>display</b>	back-lit LCD screen (128 x 64 pixels) viewable in bright sunlight and low-light levels	 <b>phase angle measurement</b>	0 – 360 degrees accuracy: $\pm 0.2$ degree ( $\pm 1$ digit)
 <b>printer</b>	built-in 4½" wide thermal printer	 <b>computer interfaces</b>	one RS-232C port, one USB port
 <b>pc software</b>	Windows®-based transformer turns-ratio analysis software is included with purchase	 <b>internal test plan storage</b>	stores up to 128 transformer test plans; plans can be transferred to PC.
 <b>internal test record storage</b>	stores 112 complete transformer test records, each record holding the test record header and up to 99 readings	 <b>external data storage</b>	up to 999 test records on external USB flash drive (drive not included)
 <b>safety</b>	designed to meet UL 61010A-1 and CAN/CSA C22.2 No. 1010.1-92 standards	 <b>humidity</b>	90% RH @ 40°C (104°F) non-condensing
 <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>altitude</b>	2,000 m (6,562 ft) to full safety specifications
 <b>cables</b>	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	 <b>ltc contact</b>	240 Vac, 2A
 <b>options</b>	shipping case, 30' (9.14 m) 3-phase H and X leads, 30' (9.14 m) single phase H and X leads	 <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.





## 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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