

TRF-100

automatic, 3-phase transformer turns ratio finder



Vanguard Instruments
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3-phase transformer turns ratio finder

The TRF-100 is Vanguard's third generation, microprocessor-based, automatic, three phase, transformer turns-ratio tester. This lightweight, portable unit is designed for testing transformers at utility power substations.

The TRF-100 determines the transformer turns-ratio using the IEEE C57.12.90 measurement method. The transformer turns-ratio (ranging from 0.8 to 50,000) is determined by precisely measuring the voltages across the unloaded transformer windings. To ensure accuracy, the TRF-100's measuring circuitry self-calibrates before each measurement. It requires neither adjustment nor temperature compensation. The TRF-100's turns-ratio measurement accuracy is 0.1% or better.

Product Overview

The TRF-100 can perform a specific test for each transformer type (such as single phase, delta to Y, Y to delta, delta to delta, or Y to Y) without the need to switch test hookup cables. Also, the unit's automatic transformer phase detection feature can detect different transformer vector diagrams. The TRF-100 can automatically detect and test 67 transformer types defined by ANSI, CEI/IEC and Australian standards.

To prevent an accidental wrong test-lead hook-up (e.g., when the operator reverses H and X leads), the TRF-100 outputs a low-level test voltage to verify the hook-up condition before applying the full test voltage to the transformer.

In addition to measuring a transformer's turns-ratio, the TRF-100 can also measure a transformer's excitation current (in milli-amperes) and its winding phase angle.

Three test voltages (4 Vac, 40 Vac, 100 Vac) allow the TRF-100 to test CT's and PT's, as well as power transformers.

The TRF-100 can also calculate the turns-ratio percentage error if the transformer's nameplate voltages are provided. The baseline turns-ratio is calculated using the nameplate voltages, and the test results are compared to the baseline turns-ratio. The percentage error is then calculated from the difference between the baseline and test turns-ratios.

User Interface

The TRF-100 features a back-lit LCD screen (20 characters by 4 lines) that is viewable in both bright sunlight and low-light levels. The test results screen displays the transformer turns-ratio, excitation current, and turns-ratio accuracy. The unit is controlled via a rugged "QWERTY"-style membrane keypad.

Computer Interface

The TRF-100 can be computer-controlled via the USB interface using the supplied Vanguard TTRA S2 turns ratio analysis PC software. The TTRA S2 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.

Transformer Load Tap Changer Control

Voltage regulator or LTC tap positions can be changed remotely using the optional Tap-Changer Remote Control Box. This option eliminates the need to manually raise or lower tap positions from the transformer control panel.

ordering information

Part No.	Description
9117-UC	TRF-100, cables, and PC software
9117-SC	TRF-100 shipping case
9117-PR	Built-in thermal printer option
9124-UC	Load tap changer remote control box
TP4-CS	TP4 thermal printer paper (24 rolls)

Internal Test Record Storage

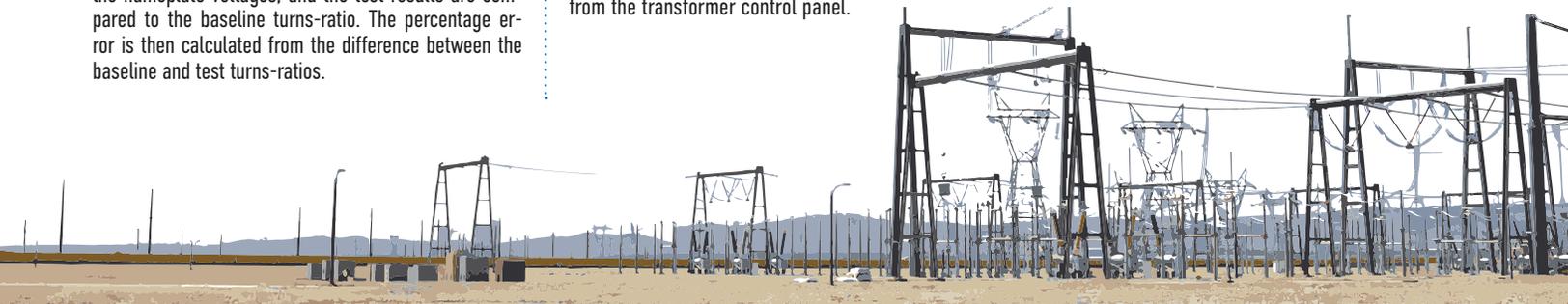
Up to 1,000 test records can be stored in the TRF-100's Flash EEPROM memory. Each test record may contain up to 99 turns-ratio, excitation current, phase angle, and nameplate voltage readings. Test records can be recalled locally or transferred to a PC via the USB interface.

Transformer Test Plans

The TRF-100 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 using 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 included PC software and can be transferred to the ATRT-03 via the USB interface.

Built-in Thermal Printer Option

The TRF-100 can be outfitted with an optional built-in 4.5" wide thermal printer that can be used to print test results.



Thermal Printer Output

RECORD NUMBER 1			
TRANSFORMER TEST RESULTS			
DATE: 01/28/15	TIME: 15:33:47		
COMPANY: VANGUARD	STATION: LAB		
CIRCUIT: DY TRANSF TAP3	MFR: GE		
MODEL: DIS TRANS	S-N: F69943		
KVA RATING: 500	OPERATOR:		
TEST VOLTAGE = 40 VOLTS			
TYPE: DELTA to Y XFORMER			
H TAP: _____	H VOLTAGE: 012,000		
X TAP: _____	X VOLTAGE: 000,208		
PHS M-RATIO	MA	NO DIFF	C-RATIO
A	+100.04	0003	00.11
B	+100.05	0002	00.12
C	+100.05	0003	00.12

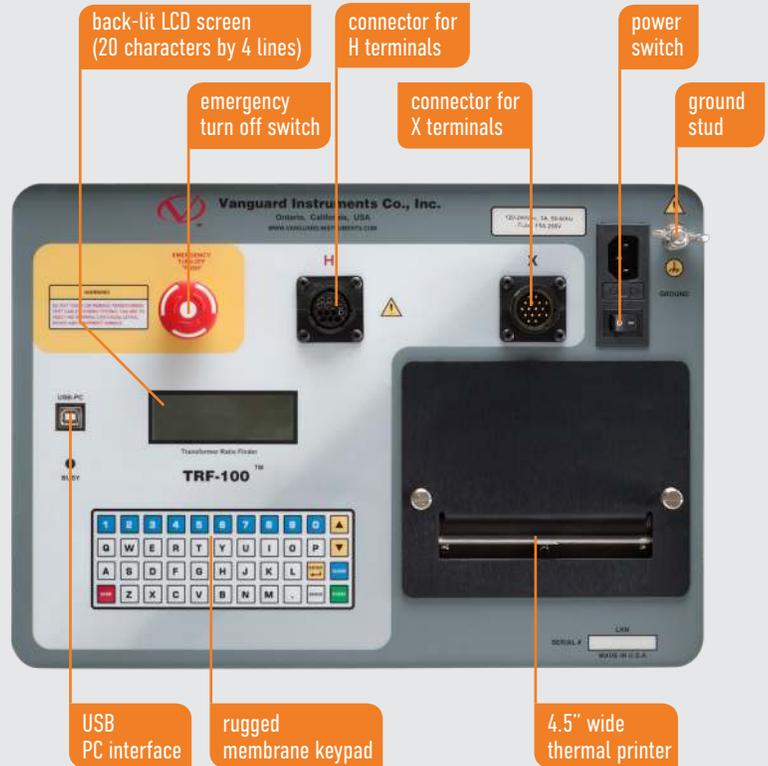
Desktop Printer Output

Transformer Turns Ratio Report
Filename: test001.txt Date: 01/28/15 Time: 15:33:47 Page (1/2)

Company: VANGUARD
Location: LAB
Circuit: DY TRANSF TAP3
Operator:
MFR: GE
Device: Transformer
Type: Delta to Y (Dyn1)
Model: DIS TRANS
Rating: 500
Serial #: F69943
Max Deviation %: 0.3
Test Voltage: 40V

TEST	H VOLT	H TAP	X VOLT	X TAP	C-RATIO	M-RATIO	DEV (%)	PF	(kVA)	DEGREE	RES
1	12000		208		99.9280	A = 100.04 B = 100.05 C = 100.05	0.11 0.12 0.12	P P P	3.0 2.0 3.0	0.209 0.000 0.209	
2						A B C					
3						A B C					

TRF-100 Controls & Indicators



TRF-100 technical specifications

 physical specifications	Dimensions: 17"W x 7"H x 13" D (43.2 cm x 17.8 cm x 33.0 cm) Weight: 14 lbs. (6.4 Kg)	 input power	100 – 240 Vac, 50/60 Hz, 3 Amps
 measuring method	ANSI/IEEE C57.12.90	 ratio measuring range	0.8 – 50,000 : 1 (5-digit resolution)
 typical turns-ratio accuracy	4 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 (±0.25%), 15,001 – 20,000 (±0.4%), 20,001 – 50,000 (±0.5%) 100 Vac: 0.8 – 1,000 (±0.05%), 1,001 – 4,000 (±0.1%), 4,001 – 15,000 (±0.25%), 15,001 – 20,000 (±0.4%), 20,001 – 50,000 (±0.5%)	 current reading range	0 – 2 Amperes; Resolution: ±1mA Accuracy: ±2% of reading (±1 digit)
 test voltages	4 Vac @ 1.0A, 40 Vac @ 0.6A, 100 Vac @ 0.1A	 phase angle measurement	0 – 360 degrees accuracy: ±0.2 degree (±1 digit)
 display	back-lit LCD screen (20 characters by 4 lines) viewable in bright sunlight and low-light levels	 computer interface	USB PC interface
 printer	optional built-in 4½" wide thermal printer	 internal test plan storage	stores up to 128 transformer test plans
 pc software	Windows®-based transformer turns-ratio analysis software is included with purchase	 safety	designed to meet IEC 61010 (1995), UL 61010A-1, and CSA-C22.2 standards
 internal test record storage	stores 1,000 complete transformer test records, each including nameplate voltage, turns-ratios, excitation current, and winding phase angle	 humidity	90% RH @ 40°C (104°F) non-condensing
 temperature	Operating: -10°C to +50°C (+15°F to +122°F) Storage: -30°C to +70°C (-22°F to +158°F)	 altitude	2,000 m (6,562 ft) to full safety specifications
 cables	15 ft (4.6m) single phase cable set, 15 ft (4.6m) 3-phase cable set, 25 ft (7.6m) extension cable set, USB cable, power & ground cables, cable bag	 warranty	one year on parts and labor
 options	shipping case, transformer load tap-changer remote control device, 30' (9.14 m) single and 3-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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