TRF-100

automatic, 3-phase transformer turns ratio finder

Vanguard Instruments
A DOBLE COMPANY

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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.

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
TP4-CS	TP4 thermal printer paper (24 rolls)

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.

Built-in Thermal Printer Option

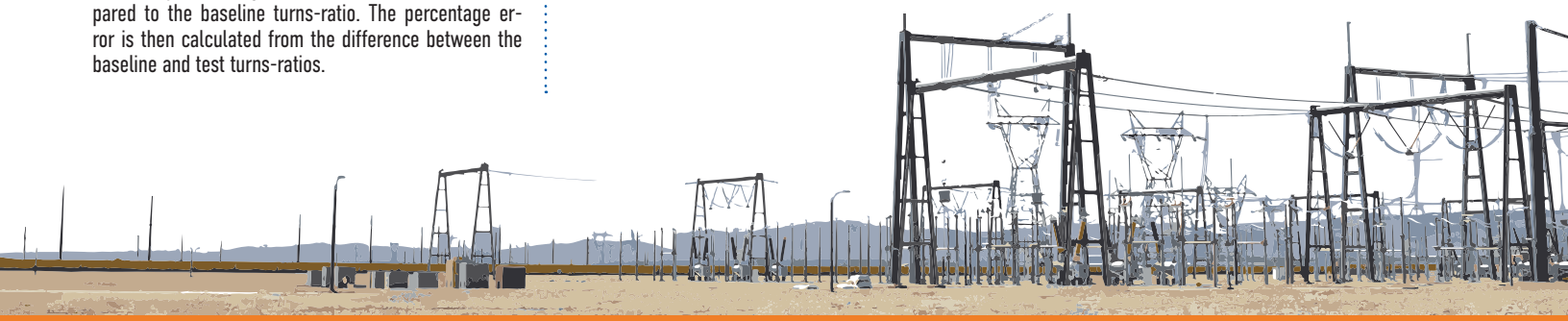
The TRF-100 can be outfitted with an optional built-in 4.5" wide thermal printer that can be used to print test results.

Internal Test Record Storage

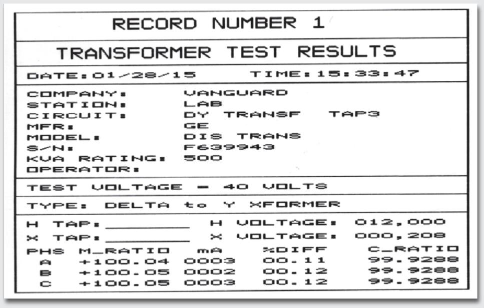
Up to 1,000 test records can be stored in the TRF-100's Flash EEPROM memory. Each test record may contain up to 99 turns-ratio, excitation current, phase angle, and nameplate voltage readings. Test records can be recalled locally or transferred to a PC via the USB interface.

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.

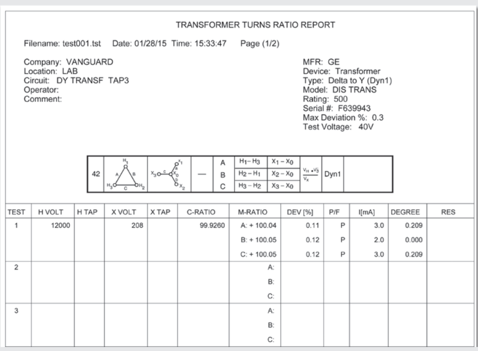


Thermal Printer Output


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: F639943
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	%DIFF	C_RATIO
A	+100.04	0003	00.11	99.9288
B	+100.05	0002	00.12	99.9288
C	+100.05	0003	00.12	99.9288

Desktop Printer Output


TRANSFORMER TURNS RATIO REPORT

Filename: test001.tst Date: 01/28/15 Time: 15:33:47 Page (1/2)

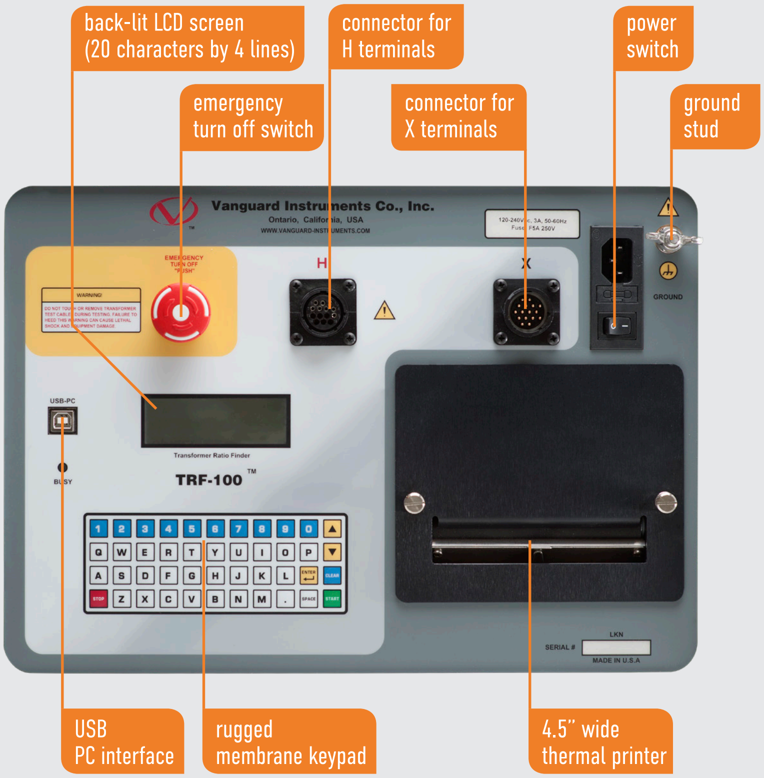
Company: VANGUARD
Location: LAB
Circuit: DY TRANSF TAP3
Operator:
Comment:

MFR: GE
Device: Transformer
Type: Delta to Y (Dyn1)
Model: DIS TRANS
Rating: 500
Serial #: F639943
Max Deviation %: 0.3
Test Voltage: 40V

42 | A B C | H_1-H_3, H_2-H_1, H_3-H_2 | X_1-X_0, X_2-X_0, X_3-X_0 | $\frac{V_H \cdot \sqrt{3}}{V_X}$ | Dyn1

TEST	H VOLT	H TAP	X VOLT	X TAP	C-RATIO	M-RATIO	DEV [%]	P/F	I[mA]	DEGREE	RES
1	12000		208		99.9260	A: + 100.04	0.11	P	3.0	0.209	
						B: + 100.05	0.12	P	2.0	0.000	
						C: + 100.05	0.12	P	3.0	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%)		
test voltages	4 Vac @ 1.0A, 40 Vac @ 0.6A, 100 Vac @ 0.1A	**current reading range**	0 – 2 Amperes; Resolution: ±1mA Accuracy: ±2% of reading (±1 digit)
display	back-lit LCD screen (20 characters by 4 lines) viewable in bright sunlight and low-light levels	**phase angle measurement**	0 – 360 degrees accuracy: ±0.2 degree (±1 digit)
printer	optional built-in 4½" wide thermal printer	**computer interface**	USB PC interface
pc software	Windows®-based transformer turns-ratio analysis software is included with purchase	**internal test plan storage**	stores up to 128 transformer test plans
internal test record storage	stores 1,000 complete transformer test records, each including nameplate voltage, turns-ratios, excitation current, and winding phase angle	**safety**	designed to meet IEC 61010 (1995), UL 61010A-1, and CSA-C22.2 standards
temperature	**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
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	**altitude**	2,000 m (6,562 ft) to full safety specifications
options	shipping case, 30' (9.14 m) single and 3-phase H and X leads	**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.

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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