

# TMS3000

## Transformer Loss Measuring System



The measurement of the losses in power transformers is an indispensable quality-verification process. Due to the fact that normally the transformer user puts a penalty on the losses that occur in the load and no-load modes, the greatest possible accuracy in measuring the power losses is of primary economic importance. The TMS 3000 system was specially developed for highly accurate measurements of power losses in transformers.

The TMS3000 system combines well-established and reliable hardware with up-to-date and powerful software. The system can be integrated into a computerized test field. The control computer can be connected to the factory LAN and therefore the measuring data can be externally accessed for backup and further processing.

The TMS3000 software supports two measurement modes. One mode is intended for conventional single or three phase transformers with up to six windings. In this mode the transformer can be completely defined with its power and voltage rating, frequency, tap changer, vector group, phase displacement, flux density, conductor material, core code and reference temperature.

For autotransformers or special purpose transformers, which cannot be specified with the standard attributes, the TMS3000 provides a flexible and free-definable measuring mode. Herein transformer losses are measured according to the DUT-specific configured setups.

The TMS3000 offers an exceptional operating convenience. The measuring procedures are software supported. Time can be saved because the precision high voltage transformer requires no manual range selection. The risk of using wrong voltage or current range is thus eliminated.

The TMS3000 has distinguished itself in the rugged environment of the transformer test facility. The design of the system ensures that its control and instrumentation function circuits remain unaffected by existing interfering fields.

The TMS3000 equipped WT-3000, WT3000 is a Precision Power Analyzer where the highest accuracy measurements are required. It is the industry standard for R&D work on inverters, motor drives, lighting systems and electronic ballasts, UPS systems, aircraft power systems, transformer testing, and other power conversion devices. The WT3000 features a Basic Power Accuracy of 0.02% with a 1MHz bandwidth.

### Features

- ✧ Load loss measurement to reveal indications about stray losses and winding resistance.
- ✧ No-load loss measurement to determine transformer excitation.
- ✧ Heat run to verify temperature rises of oil and windings.
- ✧ Induced voltage test to check the voltage withstand capability of the insulations
- ✧ Zero sequence measurement to identify phase sequence impedance.
- ✧ Wattmeter use the YOKOGAWA WT-3000, perfect wattmeter in the world
- ✧ Wattmeter function to perform quick and easy measurements without any calculations

- ◇ 5%-120% testing range can arrive the maximum accuracy
- ◇ Use totally hardware permit long term accuracy
- ◇ More stable than any other electronics compensate circuit

## Benefits

**High measuring accuracy** of maximum  $\pm 0.15\%$  of the indicated power at a typical frequency of 50 Hz/60Hz and a power factor of 0.05. The stability of the error is guaranteed for 12 month.

**Short throughput times** due to the elimination of instrument transformer rewiring, remote range selection and computer aided processing.

**Assured documentation quality** with a precise test report, which is generated automatically at the end of a measurement.

## System Architecture

The transformer loss measuring system TMS3000 is designed for indoor use. As illustrated below the TMS3000 consists of four designated elements:

The **Voltage divider** is used to measure the phase to ground voltage with great accuracy. A metallic pressure tank with its corresponding internal concentric electrode forms the high voltage capacitance. The electrodes are insulated with SF<sub>6</sub>. The capacitor is practically corona free and is extremely stable. A guard electrode ensures that the proximity of other objects does not affect the capacitance. The low voltage section, which determines the ratio, is located in the TMS3000 voltage channel in the control cabinet.

The **Current transformer** consists of a toroidal coil in oil insulation. A fibre glass plastic insulator, which is located between the aluminum head and the base frame provides

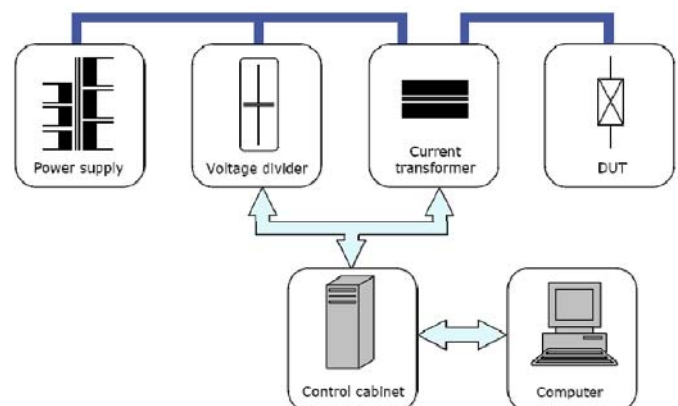
a flashover distance of more than half a meter. The accuracy over the entire range is attained with an electronic compensation circuit involving a zero flux transformer, located in the TMS3000 current channel in the control cabinet.

The measurement error is independent of the load. When the system is shut down or when the current transformer is disconnected or overloaded the secondary circuit is automatically shorted.

The **Control cabinet** contains the voltage and current channels, the wattmeter. The voltage channel incorporates the low voltage capacitors of the HV divider. The current channel essentially contains the secondary current transformer and the flux compensation circuitry. Both, current and voltage channels can be controlled manually or by the TMS computer. The digital wattmeter simultaneously measures the voltages and currents. From these values the wattmeter computes the real power, the apparent power and the power factors. The calibrator makes it possible to easily check the accuracy of the voltage and current channels.

The built-in industrial **Computer** monitors and controls the full system. It runs intuitive understandable Windows user interface software and is equipped with a color TFT monitor, hard disk, floppy disk, a CD RW and laser printer.

All TMS 3000 components are carefully tested prior and after final assembly to ensure accurate and reliable operation.



## Software



Software for TMS3000 series of loss measurement systems utilizes the globally recognized LabVIEW interface from National Instruments. The software runs in a Windows XP operating environment and is fast, easy and intuitive. Large buttons on the Main screen are used to insure correct settings for the measurements. All measurement data is displayed on the Measurement screen as well as waveforms for the voltage and current channels. Measurement data is stored to an ASCII file which can be exported over the Ethernet to a main computer for analyzing and producing calibration reports.

Software can be modified to meet the specific needs of the User prior to shipment of the system.

The Main screen provides easily recognized icons for entry into the UUT Data, Test GPIB and Calibration data entry screens. Test configuration selectors are also available.

The measurement screen allows the Operator to quickly review the measurement data. Included on this screen is the Hold and Save button for saving the data to an ASCII file. The Hold and Save button toggle back and forth depending on which is selected. Scrolling down to the bottom of the screen reveals the Waveform Analyzer showing the waveforms for both current and voltage on all three phases including the odd harmonics up to the 25<sup>th</sup> harmonic. These waveforms can be printed.

## Technical Specifications

### Voltage Measurement

Model	Range	Accuracy*
TMS3000-100-...	100 V, 200 V, 500 V, 1 kV, 2 kV, 5 kV, 10 kV, 20 kV, 50 kV, 100 kV	0.10 %
TMS3000-200-...	100 V, 200 V, 500 V, 1 kV, 2 kV, 5 kV, 10 kV, 20 kV, 50 kV, 100 kV, 200 kV	0.10 %

\* at 10-120% range utilization, includes uncertainty of calibration

### Current Measurement

Model	Range	Accuracy*
TMS3000-2000	10 A, 20 A, 50 A, 100 A, 200 A, 500 A, 1000 A, 2000 A	0.1 %
TMS3000-4000	20 A, 40 A, 100 A, 200 A, 400 A, 1000 A, 2000 A, 4000 A	0.1 %

\* at 5-120% range utilization, includes uncertainty of calibration

### Power Measurement

Power Factor	Range	Accuracy*
$\cos\Phi = 1.000$	$\geq 1 \text{ kV}, < 20 \text{ A}$	0.12 %
$\cos\Phi = 0.100$	$\geq 1 \text{ kV}, < 20 \text{ A}$	0.15 %
$\cos\Phi = 0.050$	$\geq 1 \text{ kV}, < 20 \text{ A}$	0.25 %

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cos $\Phi$ = 0.020	$\geq 1$ kV, < 20 A / 40A**	0.70 %
cos $\Phi$ = 0.010	$\geq 1$ kV, $\geq 20$ A / 40A**	1.05 %
cos $\Phi$ = 0.008	$\geq 1$ kV, $\geq 20$ A / 40A**	1.25 %

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\* includes uncertainty of calibration / \*\* for 4000A System

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#### Environmental Conditions

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Operating temperature: 15 ... 30° C (desk and rack), 10 ... 40° C (HV components)

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Storage temperature: -25 ... 55° C

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Relative humidity: 30 ... 80 % non condensing

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#### Power Supply

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Voltage: 115 V / 230 V

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Frequency: 50 Hz / 60 Hz

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Power: 600 VA (desk), 1200 VA (control cabinet)

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#### Weight and Dimension

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Weight: 5500kg

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**For further information please contact:**

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