

# ASD

**Automation Systems and Diagnostics**

*Integrated Systems Design and Development*



## TLS-300

*Three-Phase Transformer Loss-Test System*



# Three-Phase Transformer Loss-Test System

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Automation Systems and Diagnostics' TLS-300 is a three-phase transformer loss test system. TLS-300 performs loss measurements on a wide range of KVA and KV class rated new, installed, or repaired distribution transformers.

Since transformer losses contribute to some part of the total losses in power distribution systems, utilities are conducting loss evaluation tests on existing and new transformers to determine their efficiency and identify high loss transformers for replacement.

The TLS-300 performs the following tests and measurements in accordance with IEEE / ANSI and other international standards:

- Excitation Current
- No-Load (core) Losses
- % Impedance
- Load (copper) Losses
- Induced Test
- Applied Tests (HI POT HV/LV)

This system can be combined with another ASD system to form a complete automated three phase test system. Upon the customer's request, The TLS-300 and the AR<sup>2</sup> (automated resistance & ratio system) can be united and the following tests are added to the above available tests.

- Cold Resistance Test
- Ratio & Phase Test

The TLS-300 is designed specifically for shop and laboratory uses, but it can be customized into a mobile test system for use in the field with a motor generator set.

## TLS-300 HARDWARE

TLS-300 is formed of:

- PACIFIC 3-Phase AC Power Supply
- PACIFIC Controller
- YOKOGAWA 3 Phase Wattmeter
- ASD Controller
- ASD Control Panel
- Multi-tap step up transformer with motorized tap changer
- Three stage Capacitor Banks
- 50KV HI-Pot Transformer



**ASD Controller & Control Panel**

ASD's control units are shown in the figures below. The loss test set controller, controls the tap changer position, the capacitor banks, the applied/loss contactor and the current range selector. This controller has the capacity to control 32 outputs and monitor 16 inputs.



Visual light indicators will display when high voltage is applied or if interlocks are violated and when loss or applied tests are on. Equipped with an LCD screen, you will be informed of your TLS-300 and test stage status at all times. Further safety is introduced with with an emergency stop button and main breaker.

## Digital Power Meter

The Yokogawa 3phase wattmeter is a single unit for the measurement of the 3-phase voltage, current and power. Its fundamental accuracy is 0.1%, with a built-in small current range of 5mA for precise measurement of no-load losses. The most outstanding feature is user calibration (manually or by remote communication). The wattmeter can be easily calibrated in-house with the proper calibration source or sent out to





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calibration laboratories. This meter has a holding function that freezes the readings of the voltage, current, and power during manual operation. An optional harmonic analysis function can be added to the wattmeter to calculate and display active power, harmonics content, and phase angle relative to the fundamental up to the 50<sup>th</sup> order.

## AC Power Supply

This rugged, powerful electronic supply allows highly flexible, yet reliable, AC power output. It allows frequency operation at all levels, and is provided with its own internal controller for simple display and diagnostics. Two 62.5 KVA units are required to perform tests on 2500 KVA transformers.

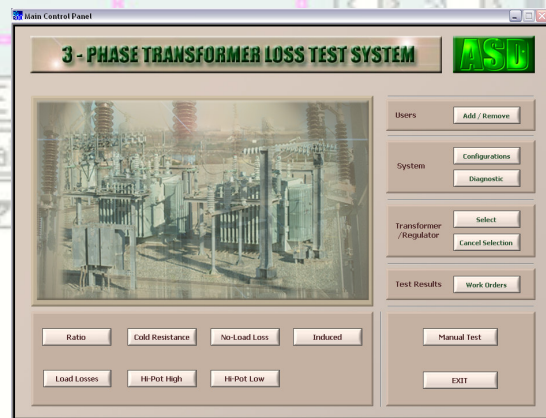


Several units can be cascaded into a master/slave configuration to provide power up to 625 KVA for future power upgrades to test larger transformers. The variable frequency range is 47-500 Hz, as well as switch selectable fixed frequency operation at 50, 60 or 400 Hz. It can drive virtually any load without damage or risk, and low power factor is not an issue.

A power supply controller provides total control of AC power produced by power supply. It provides continuous self calibration which improves accuracy to  $\pm 0.03\%$  referenced to the power source internal voltmeter. Graphical Analysis (Voltage and Current), Harmonic Analysis (Voltage and Current), Metering of RMS and Peak Values and many other features are available.

## TLS-300 SOFTWARE

A well developed software, adds much more versatility and power to our system. The attractive and user-friendly visual interface is simple to use. After logging on to the TLS-300 password protected software, users can configure all required parameters, select TUT (Transformer Under Test), perform complete diagnostics on the system's hardware, perform tests, store useful corrected results and generate result reports.



System users are of two ranks, either operators or supervisors. Supervisors have full privileges that they may add or delete any user they choose, as well as being able to edit any parameter in the system configuration. Supervisors can access the ADD/REMOVE USERS and CONFIGURATION options; while those logged in as operators, will view these option buttons in the main panel as disabled. The Configuration option allows viewing or editing user configurable system settings that are related to software control algorithms, file paths, installed hardware, ports and other such options.

Before attempting any test process, user should specify the TUT either by editing the transformer name plate data or selecting it from database. Further options are offered to facilitate the user's work as scanning the transformer's serial number directly from a bar code reader and search/sort the database for the requested TUT. When this process is done, all you have to do is to start a test, sit back and watch the PC do the work for you. A graphical monitor will show you the voltage, current,



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power levels at all times, as well as visual indicators that are on-screen.

When tests are done, results are saved to the database and can be retrieved at any time for any transformer. The work order form recalls the transformer name plate data, transformer condition, results of performed tests, date of test and operator's name. A report can be generated and printed out.

Tested Taps	NLL (W)	LL (W)	TL (W)	% Imp.	%Exc. A-A	%Exc. A-B	%Exc. A-C
3	172,489	831.9	1004.4	3.931	0.843	0.902	0.900
Efficiency (%)	98.00	167,033	853.7	1020.7	3.931	0.843	0.902
Regulation @ 0.8 pf (%)	3.62	200,000	1000.0	1200.0	4.000	3.000	3.000
Acceptable % Deviation	30.000	30.000	30.000	10.000	30.000	30.000	30.000
Test Results % Dev.	Pass	16,484	14,634	14,942	4,122	255,872	232,594
Pass / Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass

## TLS-300 SYSTEM FEATURES

- Short setup time
- Precision digital power meter with auto-ranging, providing both average and rms readings
- Measurement accuracy of 0.1%
- Easy calibration process
- Low current range measurement
- Rugged powerful output
- Power expandable up to 625 KVA
- Power supply delivers full load KVA into any power factor
- Selectable frequency output
- Multitap step-up transformer
- Motorized tap selector

## SAFETY FEATURES

- Zero voltage start
- Over-current & over-voltage protection
- Over-current Ground Protection
- Separate power and control circuit breaker
- Emergency shutdown button
- Safety interlock and two layers of protection

## SYSTEM SPECIFICATIONS

### Controller Features

- Intel 8032 microcontroller
- 4-channel A / D
- 8 kB RAM, 32 kB EPROM
- 32 Digital I/Os
- Serial Interface @ 9600 baud rate
- Parallel Port Interface
- LCD 4 x 20 Dot Matrix Display

### Regulated Power Supply

62.5 KVA Continuous load  
100 KVA load up to 10 Minutes

Input Voltage: 240/480 V  
3Φ, 50/60 Hz

Output voltage: Multiap 480-4800V  
3Φ, 47-500 Hz

### Power Meter Range

Voltage: 0 to 600 V, autoranging  
Current: 0 to 25 A, autoranging

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## Overall System Accuracy

Voltage  $\pm(0.1\% \text{reading} + 0.2\% \text{mg})$   
Current  $\pm(0.1\% \text{reading} + 0.2\% \text{mg})$   
Losses  $\pm(0.1\% \text{reading} + 0.2\% \text{mg})$   
\*mg = measurement range

Transformer Rating	Percent Impedance	HV Rating	Impedance Voltage	Required Current
500 kVA	6.00%	34.5kV	2400V	9A
1250 kVA	6.00%	34.5kV	2400V	21A
2500 kVA	6.00%	34.5kV	2400V	42A

## Testing Capability

(Optional: higher impedance and voltage class)

## PHYSICAL SPECIFICATIONS

### Environmental

Operating temperature 40° to 100°F  
Humidity 5 to 95%

### Dimensions

Regulated supply  
72" H x 40" W x 30" D

Step-up transformer  
66" H x 70" W x 40" D

Control console  
58" H x 64" W x 26" D

### Weight

Regulated power supply 2400 lbs.  
Step-up transformer 1800 lbs.  
Control console 220 lbs.

### Enclosure

The TLS-300 is housed in a rugged sheet metal enclosure equipped with casters for mobility.

## CONTACT INFORMATION

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