

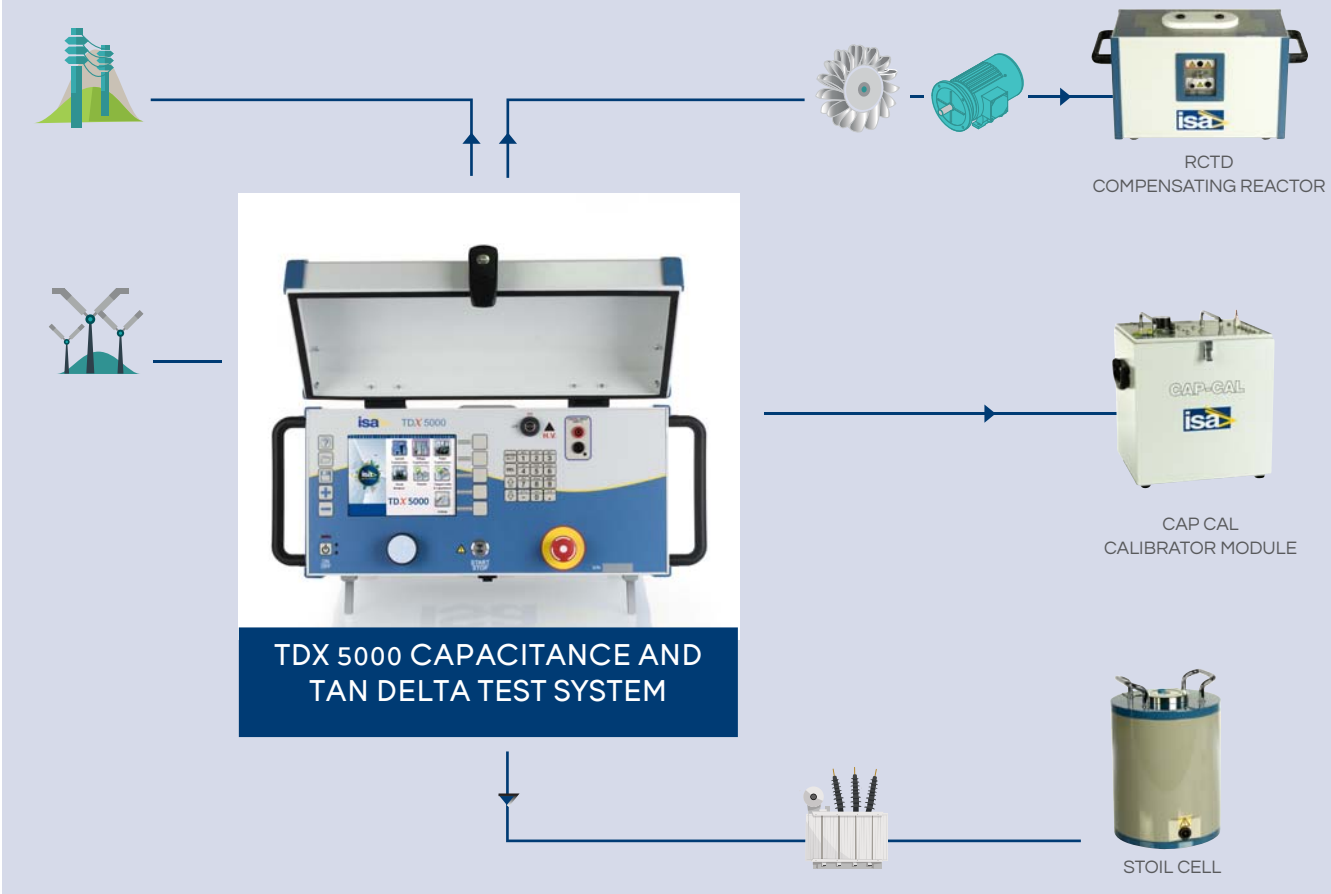
T D X 5 0 0 0

POWER FACTOR AND CAPACITANCE DIAGNOSTIC SYSTEM FOR POWER APPARATUS

www.isatest.com

Power Factor and Capacitance diagnostic system for power apparatus

- Fully automatic
- Tan Delta, capacitance, dissipation factor measurements and excitation current test
- Variable output frequency: 1 - 500 Hz
- Output voltage: from 12 V up to 12 kV
- Local control with a large graphic display
- PADS - Power Apparatus Diagnostic Software for automatic testing, assessment and report
- Tan Delta test for rotating machines (generators and motors)
- USB interface and Ethernet interface for PC connection
- Compact and lightweight
- Patented technology for capacitance and Tan Delta measurement.



APPLICATION

The following table lists the tests that can be performed on CTs, VTs and PTs.

N.	TEST	TEST DESCRIPTION
10	CT	Tan Delta measurements
16	VT	Tan Delta measurements
19	PT	No-load / excitation current
21	PT	Tan Delta measurements
23	CB	Tan Delta measurements
28	Capacitor Banks	Measurement of the capacitance

Tests are performed in accordance with the following IEC standards: IEC61869-2; IEC61869-3; EN 60044-1; EN 60044-2; EN 60044-5; EN 60076-1, and also in accordance with C57,12-90.

LEGENDA:



POWER TRANSFORMER TESTING



CIRCUIT BREAKER TESTING



CURRENT AND VOLTAGE TRANSFORMER TESTING



ELECTRIC MOTOR TESTING



POWER GENERATOR TESTING

GENERAL CHARACTERISTICS

TDX 5000 equipment performs the measurement of the Tan Delta, of the dissipation factor and of the capacitance of a transformer or of any device, at the frequency of the mains or in a wide frequency range. The measurement is performed by patented technology.

TDX 5000 measurement circuitry incorporates a reference high voltage capacitor, rated 200 pF, with a Tan Delta better than 0.005%, and a reference resistor bridge, with accuracy better than 0.01%, and thermal drift less than 1 ppM/°C. The patented circuitry and the variable frequency output make test results immune from external noise.
Available test selections:

. Ungrounded: UST-A; UST-B; UST A+B
. Grounded: GST; GSTg-A; GSTg-B; GSTg-A+B.

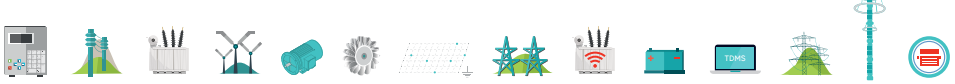
TDX 5000 is powered by an internal voltage generator with electronic control.

SYSTEM DESCRIPTION

The STS family includes three models : STS 5000, STS 4000 and TDX 5000. TDX 5000 is developed as a compact solution for high voltage Capacitance and Tan Delta (Dissipation Factor) measurements. Using the reactor option, TDX 5000 can also perform tests on rotating machines.
In the **local control mode**, the selected output is adjustable and metered on the large, graphic LCD display. With the control knob and the LCD display, it is possible to enter the MENU mode, that allows to set many functions and that make TDX 5000 a very powerful testing device, with manual and automatic testing capabilities and with the possibility to transfer test results to a PC via ETHERNET or Pen Drive. The TDMS software suite, which comes with the test set, allows to download, display and analyse test results obtained in local mode. Remote maintenance and diagnostic of the instrument is available via Ethernet. TDMS operates with all Windows® versions.

The ease of operation has been the first goal of TDX 5000 unit. This is why the LCD display is so large and the dialogue in MENU mode is made easy. TDX 5000 includes the detection of the digital signal coming from the RTCD- Compensating Reactor option.

The instrument is housed in a transportable aluminium box, which is provided with cover and handles for ease of transportation. A transport trolley can be optionally supplied.



TDMS - Test & Data Management Software

TDMS, Test & Data Management Software, is a powerful software package providing data management for acceptance and maintenance testing activities. Electrical apparatus data and test results are saved in the TDMS database for historical results analysis.
The TDMS database organizes test data and results for the majority of electrical apparatus tested with ISA test sets and related software.



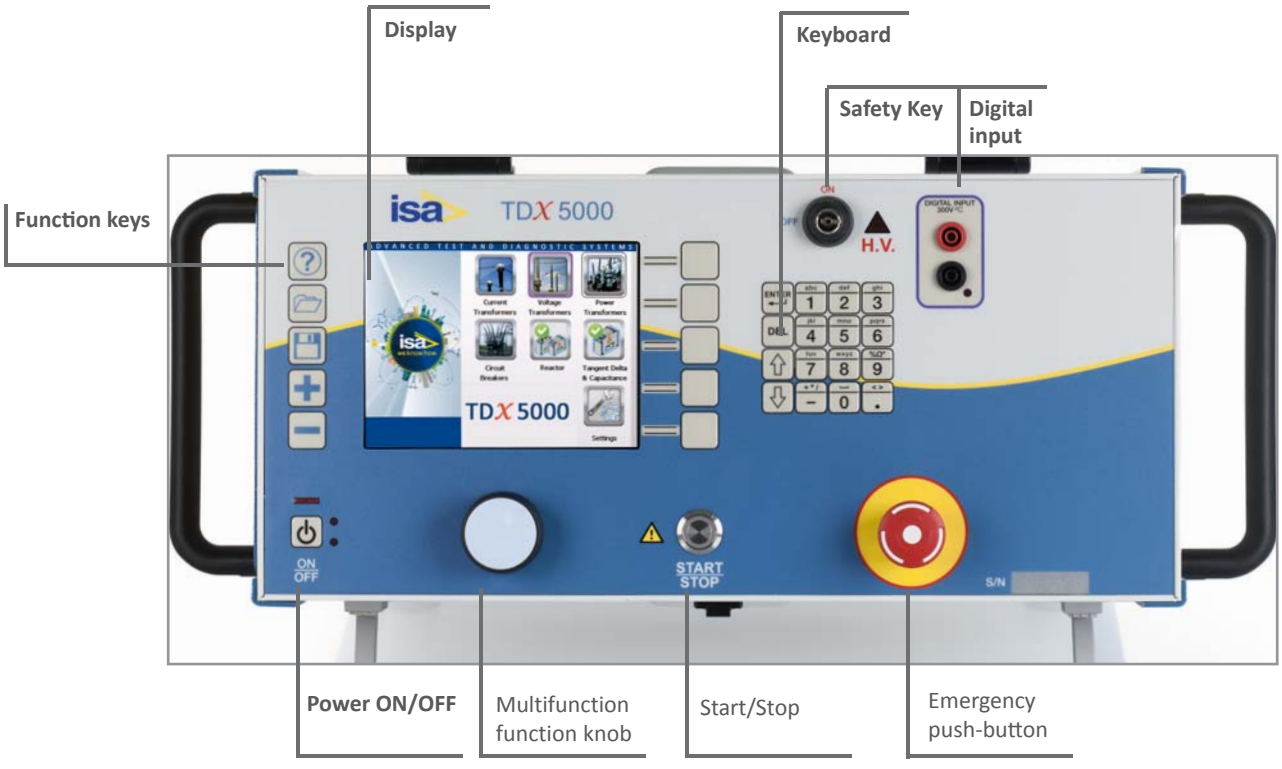
PADS - Power Apparatus Diagnostic Software

PADS - Power Apparatus Diagnostic Software is a powerful software application, included in TDMS software, that optionally allows the remote control of the STS family: STS 5000, STS 4000, TDX 5000. The software performs various tasks, such as:

. Control STS and TD remotely from PC
. Create test plan
. Download stored test results via Ethernet cable
. Create and customize test reports
. Print test results

This program runs under Windows© environment.
Note: Windows is trademark of Microsoft Corporation.

TDX 5000 - FRONT PANEL



TDX 5000 - SIDE PANELS



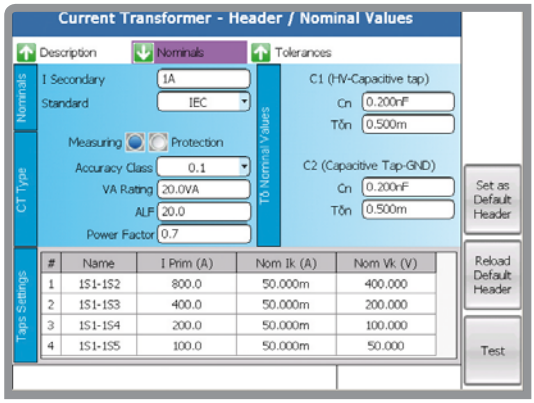
TDX 5000 - SIDE PANELS



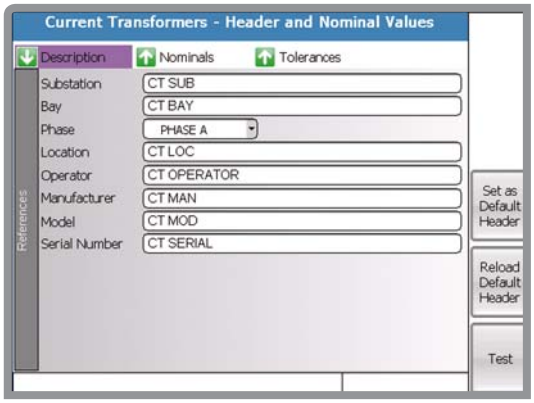
TEST HEADER

Before starting a test, all relevant test object data are input into the header, which is made of four screens. These data are used by the device for the following test execution. If, during tests, some results do not conform and nominal data are to be modifi ed, the change is made in the Header, so that consistent nominal data and the corresponding test results are saved together.

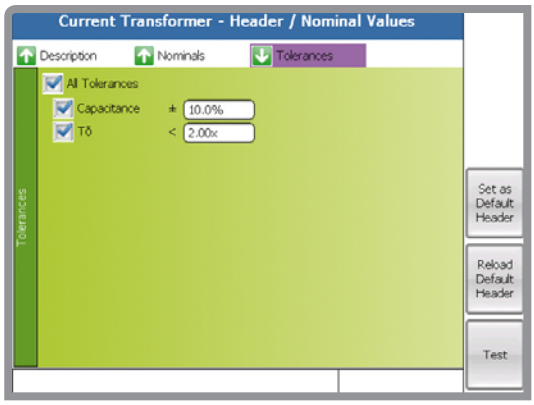
If the device is a PT, the Capacitance tests and the no-load current test can be pre-set together, to form a single Test Plan. The Test Plan can be saved and recalled; up to 64 different plans can be stored into memory.



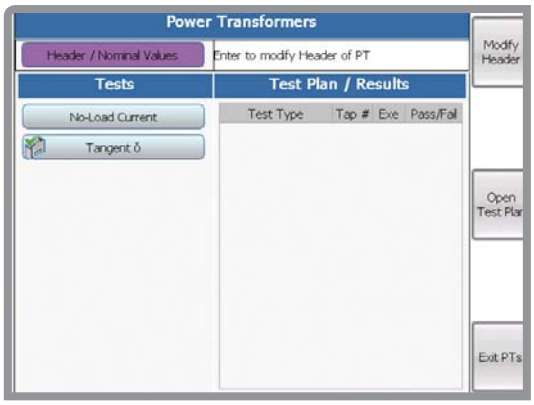
Nominal values window: from these nominal data, the program computes the nominal saturation knee.



Tests header window: test reference data.



Tolerances window allows setting the tolerances for each of the available tests.



Test selection window: it allows selecting the test to be performed.

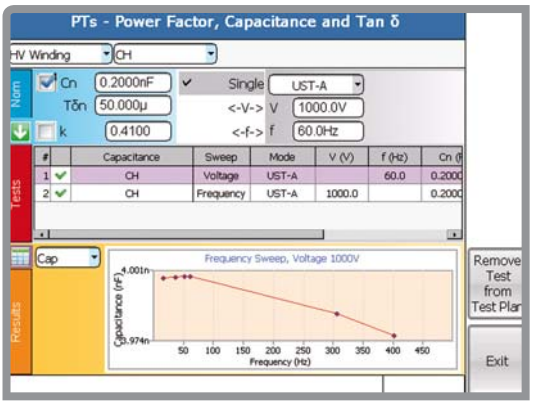
At the end of the programming, starting the first test will execute the complete sequence. During the test, test results are stored in the memory. The test set minimizes the test duration, in order to avoid over-heating the components. The same feature is available when controlling the test set via PC by PADS.

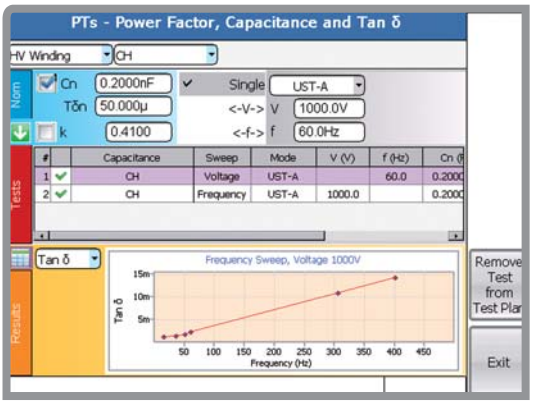
POWER FACTOR, CAPACITANCE AND TAN-DELTA FOR CT, VT, POWER TRANSFORMER AND CB

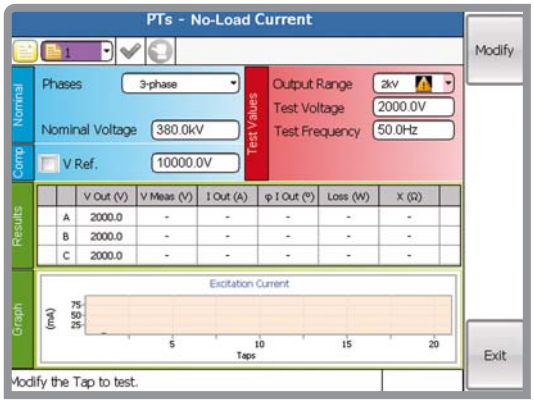
• POWER FACTOR, CAPACITANCE AND TAN DELTA

The test is performed connecting TDX 5000 to the high AC voltage source to test target.
Input parameters are: Winding, test voltage and frequency, test mode, and the nominal capacitance, PF, DF.
The display shows the following data:

- Test voltage, current and frequency
- Capacitance, Tan Delta and power factor
- Power data: active, reactive and apparent
- Impedance: module, argument and components.







• NO-LOAD CURRENT

The test is performed connecting TDX 5000 to the high AC voltage source to the test target.
Input parameters are: the tap number, the type of Tap changer, the test voltage and the frequency. The test set applies the high voltage and measures the output current during the test.
The display shows:

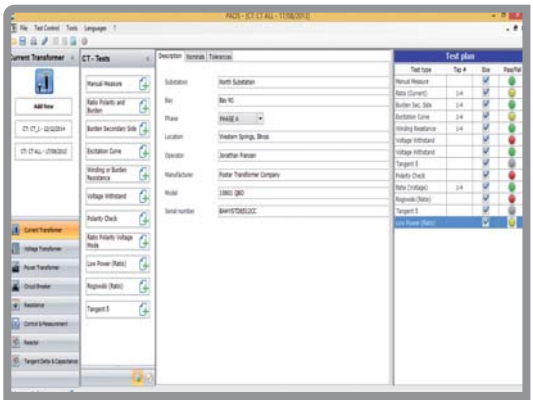
- The test voltage
- The current and the phase shift
- The power losses
- The reactance.

OTHER FUNCTIONS

- PADS SOFTWARE

The PADS software is a powerful application, included in the TDMS software, which provides connectivity to the instruments of the STS family. The software performs various tasks, such as:

- Edit and upload to the instrument the test headers
- Create and modify plans containing one or more tests
- Optionally remote control of the execution of test plans (start, interruption, results assessment)
- Download and save results of tests previously performed by the instrument
- Open and save results on the PC
- Print test results.



TDX 5000 SPECIFICATION

GENERATOR CHARACTERISTICS

MAX VOLTAGE OUTPUT V	CURRENT OUTPUT A	MAX OUTPUT DURATION T Max	FREQUENCY Hz
12000	300 mA	120 s	1 to 500
12000	125 mA	> 1 hour	1 to 500
12000	100 mA	steady	1 to 500

Note[1]: the maximum voltage output may decrease for frequency below 50hz and above 400Hz.
Note[2]: at 10 kV the output (current value and duration) has the same characteristic.

Voltage and current output metering accuracy and resolution

INTERNAL MEASURE	RESOLUTION	TYPICAL ACCURACY ± % (rdg) ± % (rg)	GUARANTEED ACCURACY ± % (rdg) ± % (rg)
12000 V AC	1V	±0.2%±0.5 V	<0.3%+1V
5 A AC (@ inputs A or B> 10 mA)	1 mA	±0.2%±1 mA	< 0.5%
<10 mA AC (@ inputs A or B)	0.1 µA	±0.2%±0.1 µA	<0.3%+0.1 µA

. Frequency range: 1 to 500 Hz.
. Connections: by a double shielded HV connector, two Ground sockets (case and external shield of HV cable), and two measurement sockets (A and B).

TEST MEASUREMENTS

- **Capacitance**

. Measurement range 1: from 1 pF to 5µF. Resolution: 6 digits. Accuracy, typical: ± 0.03% of the value ± 0.1 pF; guaranteed: < 0.1% of the value +1pF (from 45 to 70 Hz).
. Measurement range 2: from 5 µF to 200 µF. Resolution: 6 digits. Accuracy, tipical: ±0.1% of the value ±0.1 nF, guaranteed: <0.5% of the value ±1 nF.

- **Tan Delta or dissipation factor DF**

. Measurement range 1: from 0 to 10% (capacitive). Resolution: 5 digits; accuracy, typical: 0.05% of the value ± 0.005 %; guaranteed: 0.1% of the value ± 0.005 % (from 45 to 70 Hz, current < 10 mA).
. Measurement range 2: from 0 to 100%. Resolution: 5 digits; accuracy, typical: 0.3% of the value ± 0.01 %; guaranteed: 0.5% of the value ± 0.02 %.
. Measurement range 3: over 100%. Resolution: 5 digits; accuracy, typical: 0.5% of the value ± 0.03 %; guaranteed: 0.8% of the value ± 0.05 %.

- **Power factor PF (or cos(ϕ))**

. Measurement range 1: from 0 to 10% (capacitive). Resolution: 5 digits; accuracy, typical: 0.05% of the value ± 0.005 %; guaranteed: 0.1% of the value ± 0.005 % (from 45 to 70 Hz, current < 10 mA).
. Measurement range 2: from 0 to 100%. Resolution: 5 digits; accuracy, typical: 0.3% of the value ± 0.02 %; guaranteed: 0.5% of the value ± 0.02 %.

- **Impedance**

From 1kOhm to 1400 MOhm. Accuracy, typical 0.3% of the value ± 0.1%, guaranteed <0.5% of the value. Resolution: 6 digits.

- **Power**

. Measurement ranges: 10 kW, 100 kW, 1 MW. Resolution (5 digits): 0.1 mW; accuracy: <0.5% of the value ± 1 mW.
The same ranges and accuracies are applied to reactive and apparent power measurements.

- **Inductance**

. Measurement range 1: from 1 H to 10 kH. Resolution (5 digits): 0.1 mH; accuracy, typical: 0.3% of the value ± 0.5 mH; guaranteed: 0.5% of the value.
. Measurement range 2: from 100 H to 1 MH. Resolution (5 digits): 1 H; accuracy, typical: 0.3% of the value; guaranteed: <0.5% of the value.

- **Excitation current**

. Range 1: 10 mA. Resolution: 0.1 µA; accuracy, typical: 0.2% of the value ± 0.1µA; guaranteed: 0.3% of the value ± 0.1µA.
. Range 2: 300 mA. Resolution 1 mA; accuracy, typical: 0.2% of the value ± 1 mA; guaranteed: 0.5% of the value ± 0.5% of the range.

Output frequency

. AC output frequency range: 1 to 500 Hz

Max interference conditions at line

. Electrostatic: 15 mA rms of the interference current into any lead or cable with no loss of measurement accuracy. Applicable to a maximum ratio of interference current to specimen current 20:1.
. Electromagnetic: 500 µT, at 50 Hz in any direction.

Digital input

Binary input used only for RCTD - Compensating reactor option.

Display

The large graphic display has the following characteristics:
. Pixels: 640 x 480, coloured
. LCD type: TFT
. View area: 132 x 99 mm
. Backlight.

Local test set control

Local test control: by the START / STOP pushbutton. After the test selection, pressing it, the output is generated, according to the type of test. During ON, if a manual control test is selected, the operator adjusts the output at the desired value.
Test saving:
. Automatic save
. After operator confirmation.

OTHER CHARACTERISTICS

Communication interfaces

. Slave USB and ETHERNET for the PC connection
. USB port for the USB key.
Interfaces to external modules:
. Alarms to a flashing light
. Remote start input.

Mains supply

. 100-230 V ± 15%; 50-60 Hz
. Maximum supply current: 16 A.

Dimensions: 450 (W) x 530 (H) x 215 (D) mm.
Weight: 39 kg.

ACCESSORIES SUPPLIED

CONNECTION CABLES

. One mains supply cable, 2 m long.
. One grounding cable, 6 m long.
. One ETHERNET interface cable.
. One USB pen drive.
. 1 High voltage connection cable, 20 m long, 25 kV, with earth screen, for the connection to the device under test, terminated on the device side with an isolated banana plug and on the TDX 5000 side with two plugs: one for the HV and the other one for the ground. The cable is mounted on a wheel.
. 1 clamp, 25 mm opening, with a connector which mates with the HV cable.
. 1 bigger clamp, 40 mm opening, with a connector which mates with the HV cable.
. 2 shielded connection cables, 20 m long, for the connection to the metering points. Terminated on the TDX 5000 side with the metering connector and on the device side with a banana plug. Cables are mounted on wheels.
. 2 clamps, 25 mm opening, terminated with banana sockets, which allow connecting to the metering point.
. 2 Kelvin type clamps, 65 mm opening, with banana plugs, which allow connecting to the metering point.
. 1 hot collar cable, 1m long, with connector.

TRANSPORT CASE

The transport case allows delivering TDX 5000 with no concern about shocks up to a fall of 1 m. The case is supplied with handles and wheels. IP: IEC 60529.



OPTIONAL ACCESSORIES

FOLDABLE TROLLEY

The trolley eases the transport of TDX 5000.





CAP-CAL

RCTD - COMPENSATING REACTOR



RCTD

This module is useful for testing Tan Delta in rotating machines with TDX 5000 and allows increasing the test current and getting the maximum test voltage with high capacitive burdens. Each RCTD is composed by two inductors with a nominal value of 40H and a steady current of 0.4A. The maximum current on each inductor can be up to 1A for more than 10s. The inductors can be connected in parallel on the load in order to increase the test frequency. It is possible to connect two RCTD in parallel in order to have three or four inductors connected together (2 x 80 H total).

CAP-CAL CALIBRATOR MODULE

Purpose of the calibrator is to check the correctness of TDX 5000 measurement. The calibrator includes an extremely high accuracy high voltage capacitor, which comes with a certificate issued by ISA lab.

STOIL CELL FOR THE HV TEST OF THE DIELECTRIC OIL



OIL CELL

The option allows testing that the oil characteristics of isolation are met and that there is no contamination.
The option is made of a suitable glass container with electrodes; the electrodes are connected to TDX 5000 for the test execution. The test result, displayed by TDX 5000, is the oil Tan Delta.
Cell characteristics are the followings:

- Maximum test voltage: 12 kV
- Cell volume: about 1l • Capacitance of the empty cell: 60 pF.

DIGITAL THERMO HYGROMETER

Tan Delta tests are influenced by temperature and humidity. The option allows measuring these parameters and to input them into the test settings. Meter characteristics:
. Temperature range:- 10°C to 60°C.
. Temperature measurement accuracy: ± 0.4°C.
. Humidity measurement range: 5 % to 95% RH.
. Accuracy of humidity measurement: ± 2.5% RH, over the whole range.
. Dimensions: 141 x 71 x 27 mm. Weight: 150 g.

REMOTE SAFETY SWITCH

If it is desired to start the test remotely from the test set, the optional switch allows to do it, up to the distance of 20 m, which is the length of the cable provided.

WARNING STROBE LIGHT

The warning strobe light alerts when the test is completed, or when there are alarms. The light is self-powered, and turns on (flashes) upon the test set command. A siren is also included.

OPTIONAL SOFTWARE

PADS - Power Apparatus Diagnostic Software

PADS - Power Apparatus Diagnostic Software is a powerful software application, included in TDMS software, that allow the remote control of the STS family: STS 5000, STS 4000, TDX 5000. Please refer to PADS datasheet for more information.

APPLICABLE STANDARDS

The test set conforms to the EEC directives regarding Electromagnetic Compatibility and Low-Voltage instruments.
. **Electromagnetic Compatibility**: Directive no. 2014/30/UE. Applicable Standard: EN61326-1:2013.
. **Low Voltage Directive**: Directive n. 2014/35/UE. Applicable standards: CEI EN61010-1:2010. In particular:
. Input/output protection: IP 2X - IEC69529; IP 4X for HV output.
. Operating temperature: -10° to 55 °C; storage: -20 °C to 70 °C.
. Relative humidity: 5-95% without condensing.

ORDERING INFORMATION

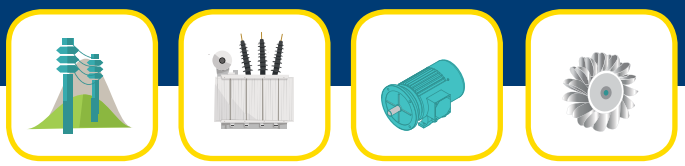
CODE	MODULE
65175	TDX 5000 - with TDMS software*, standard test cable kit and transport case
10176T	PADS software (trasfo)- Power transformer and Tan Delta test module
40175	CAP-CAL Calibration module
42175	Remote safety switch
44175	Digital thermo hygrometer
43175	Warning strobe light
47175	RCTD - Compensating reactor for TDX 5000
48175	Cable test kit for RCTD
38175	Transport case for RCTD
13175	STOIL Cell for the eletric test of insulating oil of the transformer
67175	Heavy duty transport case for TDX 5000
68175	Trolley for TDX 5000
66175	Cable test kit for TDX 5000

**PADS - Power Apparatus Diagnostic Software is NOT included into basic unit price. It should be expressly ordered.*

COMPARISON TABLE OF THE STS FAMILY

STS MODEL	HIGH CURRENT, AC & DC	HIGH VOLTAGE	LOW AC-DC OUTPUTS	TAN DELTA TESTS	OPTIONAL HIGH AC CURRENT WITH BUX 3000
STS 5000 [1]	✓	✓	✓	✓ *with TD 5000*	✓
STS 4000 [1]	NOT AVAILABLE	✓	✓	✓ *with TD 5000*	✓
TDX 5000	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	✓	NOT AVAILABLE

[1] *For USA and Germany, only TDX 5000 and STS 3000 light with TD 5000 are available.*



COMPARISON TABLE OF THE STS FAMILY TESTS

NO.	TEST OF	TEST DESCRIPTION	STS 5000	STS 4000	TDX 5000
1	CT	Ratio, Voltage mode	✓	✓	NOT AVAILABLE
2	CT	Ratio, polarity and burden with high AC current	✓	WITH BUX 3000	NOT AVAILABLE
3	CT	Burden; secondary side	✓	✓	NOT AVAILABLE
4	CT	Excitation curve	✓	✓	NOT AVAILABLE
5	CT	Winding or burden resistance	✓	✓	NOT AVAILABLE
6	CT	Voltage withstand	✓	✓	NOT AVAILABLE
7	CT	Remote polarity check	✓	NOT AVAILABLE	NOT AVAILABLE
8	CT	Rogowski coil transformers	✓	WITH BUX 3000	NOT AVAILABLE
9	CT	Low power transformers	✓	WITH BUX 3000	NOT AVAILABLE
10	CT	Tan(δ) measurements	WITH TD 5000	WITH TD 5000	✓
11	VT	Ratio; polarity	✓	✓	NOT AVAILABLE
12	VT	Burden, secondary side	✓	✓	NOT AVAILABLE
13	VT	Ratio, electronic transformers	✓	✓	NOT AVAILABLE
14	VT	Voltage withstand	✓	✓	NOT AVAILABLE
15	VT	Remote polarity check	✓	NOT AVAILABLE	NOT AVAILABLE
16	VT	Tan(δ) measurements	WITH TD 5000	WITH TD 5000	✓
17	PT	Ratio per TAP	✓	✓	NOT AVAILABLE
18	PT	Static and dynamic resistance of Tap Changer contacts	✓	✓	NOT AVAILABLE
19	PT	Excitation current	WITH TD 5000	WITH TD 5000	✓
20	PT	Short circuit impedance	✓	✓	NOT AVAILABLE
21	PT	Tan(δ) measurements	WITH TD 5000	WITH TD 5000	✓
22	CB	High DC current micro-Ohmmeter test	✓	NOT AVAILABLE	NOT AVAILABLE
23	CB	Tan(δ) measurements	WITH TD 5000	WITH TD 5000	✓
24	VT CB RELAY	Current threshold and timing	✓	✓	NOT AVAILABLE
25	R	Ground resistance and resistivity	✓	✓	NOT AVAILABLE
26	R	Step and touch voltages	✓	✓	NOT AVAILABLE
27	L	Measurement of line impedance and of the related parameters	✓	✓	NOT AVAILABLE
28	Capacitor Banks	Measurement of the capacitance	WITH TD 5000	WITH TD 5000	✓

isa we.know.how.

I.S.A. srl
via Prati Bassi 22
21020 Taino (VA) ITALY
T +39 0331 956081
F +39 0331 957091
isa@isatest.com
www.isatest.com

EN - TDX 5000
06/2016

The document is subject to change without notice. Always refer to our technical specification for more detailed information and as formal contract document.