



# T/1000

## Secondary Injection Relay Test Set

- MICROPROCESSOR CONTROLLED
- WITH PHASE ANGLE SHIFTER AND FREQUENCY GENERATOR
- DESIGNED FOR TESTING RELAYS AND TRANSDUCERS
- TEST RESULTS AND SETTINGS ARE SAVED INTO LOCAL MEMORY
- HIGH POWER OUTPUTS
- OSCILLOSCOPE FUNCTION FOR CURRENT AND VOLTAGE
- LARGE GRAPHICAL DISPLAY
- COMPACT AND LIGHTWEIGHT
- POSSIBILITY TO SYNCHRONIZE SEVERAL T/1000 TEST SETS

### Application

The relay test set **T/1000** is suited for the testing of the following types of relays:

RELAY TYPE	IEEE No
Distance relay	21
Synchronizing device	25
Under/over-voltage relay	27/59
Directional Power relay	32
Field relay	40
Reverse phase current relay	46
Phase sequence voltage relay	47
Incomplete sequence relay	48
Instantaneous over-current relay	50
Inverse time over-current relay	51
Power factor relay	55
Voltage balance relay	60
Ground detector relay	64
Directional over-current relay	67
Phase angle out of step relay	78
Automatic reclosing relay	79
Frequency relay	81
Pilot wire receiver relay	85
Lockout relay	86
Differential protection relay	87
Voltage directional relay	91
Power directional relay	92
Tripping relay	94

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The instrument contains three separate generators:

- . Main generator, that generates either a.c. current, a.c. voltage; d.c. voltage;
- . Auxiliary a.c voltage generator, that generates an independent, phase shiftable a.c voltage;
- . Auxiliary d.c. voltage generator, that generates the d.c. voltage that feeds the relay under test.

All outputs are adjustable and metered at the same time on the large, graphic LCD display. T/1000 can operate without connection to a PC. With the multi-purpose knob and the LCD display it is possible to enter the MENU mode, that allows to set many functions, that make T/1000 a very powerful testing device, with manual and semi-automatic testing capabilities, and with the possibility to transfer test results to a PC via the RS232 interface. These results can be recorded, displayed and analysed by the powerful X.PRO-3000 software, that operates with all WINDOWS versions, starting from WINDOWS 98 included.

## T/1000 Specification

### Main generator

The main generator has three outputs: currents, voltage a.c., voltage d.c.. The following specification apply to the separate usage of these outputs. It is possible to use them at the same time, provided that the total maximum load is not exceeded.

#### A.C. current outputs

RANGE A a.c.	CURRENT OUTPUT A	MAXIMUM POWER VA	LOAD TIME s	RECOVERY TIME min
100	30	300	STEADY	-
	100	800	60	15
	250	1000	1	5
40	12	300	STEADY	-
	40	800	60	15
10	5	400	STEADY	-
	10	800	60	15

#### A.C. voltage outputs

RANGE V a.c.	VOLTAGE OUTPUT V	MAXIMUM POWER VA	LOAD TIME s	RECOVERY TIME min
250	250	500	STEADY	-
	250	750	10	45

#### D.C. voltage outputs

RANGE V a.c.	VOLTAGE OUTPUT V	MAXIMUM POWER W	LOAD TIME s	RECOVERY TIME min
300	300	300	STEADY	-
	300	500	10	45

### Other features of main outputs

- . Zero crossing control. Main a.c. outputs are generated and stopped as the output waveform crosses zero.
- . High resolution adjustment control.
- . Overload alarm message.
- . Thermal protection.

### Auxiliary A.C. voltage output

- . The auxiliary a.c. voltage output is isolated from the main a.c. current and voltage.
- . Range selection: software driven, by the multi-function knob and LCD display.
- . Auxiliary voltage power: 30 VA, continuous duty, at full range; 40 VA for 1 minute.

#### Auxiliary A.C. voltage output

RANGE V	MAX POWER VA
62.5	40
125	40
250	40

### Phase angle shifting

- . Possibility to phase shift the auxiliary a.c. voltage output with respect to the main current or voltage.
- . Phase angle adjustment: via the multi-function knob.
- . Phase angle range: from 0° to 360°.
- . Adjustment resolution: 1° (degree).

### Frequency generator & frequency r.o.c.

- . Possibility to change the frequency of the auxiliary a.c. voltage output. Frequency generation characteristics:
- . Frequency range: 40 Hz to 500 Hz.
- . Frequency adjustment: 1 mHz.
- . Rate of change: 1 mHz/s to 99.99 Hz/s.

### Auxiliary D.C. voltage output

- . D.C. voltage range: 20...130 V or 20...240 V.
- . D.C. voltage power: 90 W at full range, continuous duty, with a current limit of 0.9 A @ 130 V and 0.45 A @ 240 V.

### Timer

The electronic digital timer has a fully automatic start and stop, both for make and break of the input, that can be either a clean contact or a contact under voltage.

RANGE	RESOLUTION	ACCURACY
From 0 to 9.999 s	1 ms	± (1 ms + 0.005%)
From 10.0 to 99.99 s	10 ms	± (10 ms + 0.005%)
From 100.0 to 99999.9 s	100 ms	± (100 ms + 0.005%)

. Metering range, in cycles:

RANGE	RESOLUTION	ACCURACY
From 0 to 999.9 cycles	0.1 cycles	$\pm (1 \text{ ms} + 0.005\%)$
From 1000 to 4999995 cycles@50 Hz	1 cycle	$\pm (10 \text{ ms} + 0.005\%)$
From 1000 to 5999994 cycles@60 Hz	1 cycle	$\pm (100 \text{ ms} + 0.005\%)$

. Possibility to test automatic recloser.

. Maximum number of reclosing commands: 99.

### Auxiliary output contact

. Contacts range: 5 A; 250 V a.c.; 120 V d.c.

## Outputs Current and Voltage Measurement

. The following outputs are displayed at the same time on the LCD:

Current measurement

OUTPUT	RANGE	RESOLUTION	ACCURACY
10 A	1.999 A	1 mA	$\pm (1\% + 5 \text{ mA})$
	19.99 A	10 mA	$\pm (1\% + 20 \text{ mA})$
40 A	7.999 A	4 mA	$\pm (1\% + 20 \text{ mA})$
	79.99 A	40 mA	$\pm (1\% + 80 \text{ mA})$
100 A	19.99 A	10 mA	$\pm (1\% + 50 \text{ mA})$
	199.9 A	100 mA	$\pm (1\% + 200 \text{ mA})$
	249.9 A	100 mA	$\pm (1\% + 200 \text{ mA})$

Voltage measurement

OUTPUT	RANGE	RESOLUTION	ACCURACY
250 V a.c.	19.99 V	10 mV	$\pm (1\% + 50 \text{ mV})$
	199.9 V	100 mV	$\pm (1\% + 200 \text{ mV})$
	299.9 V	300 mV	$\pm (1\% + 300 \text{ mV})$
300 V d.c.	19.99 V	10 mV	$\pm (0.5\% + 50 \text{ mV})$
	199.9 V	100 mV	$\pm (0.5\% + 200 \text{ mV})$
	399.9 V	300 mV	$\pm (0.5\% + 300 \text{ mV})$
65,130 V a.c.	19.99 V	10 mV	$\pm (1\% + 20 \text{ mV})$
	199.9 V	100 mV	$\pm (1\% + 200 \text{ mV})$
260 V a.c.	19.99 V	10 mV	$\pm (1\% + 20 \text{ mV})$
	199.9 V	100 mV	$\pm (1\% + 200 \text{ mV})$
	299.9 V	300 mV	$\pm (1\% + 300 \text{ mV})$
130 V d.c.	19.99 V	10 mV	$\pm (0.5\% + 20 \text{ mV})$
	199.9 V	100 mV	$\pm (0.5\% + 200 \text{ mV})$
260 V d.c.	19.99 V	10 mV	$\pm (0.5\% + 20 \text{ mV})$
	199.9 V	100 mV	$\pm (0.5\% + 200 \text{ mV})$
	299.9 V	300 mV	$\pm (0.5\% + 300 \text{ mV})$

### Angle and frequency measurement

. Via the multi-function menu knob it is possible to select the measurement of angle or frequency.

. Readings, resolution and accuracy: see table.

MEASUREMENT	RANGE	RESOLUTION	ACCURACY
PHASE	0-360	1°	1° $\pm$ 1 DIGIT
FREQUENCY	40.000-499.999	1 mHz	$\pm(0.1\% + 1 \text{ mHz})$

### Other measurement

MEASUREMENT	UNIT
ACTIVE POWER, $P = I \cdot V \cdot \cos(\varphi)$	W
REACTIVE POWER, $Q = I \cdot V \cdot \sin(\varphi)$	VAR
Apparent Power, $S = I \cdot V$	VA
IMPEDANCE, $Z = V/I$	Ohm, °
ACTIVE IMPEDANCE COMPONENT, $R = Z \cdot \cos(\varphi)$	Ohm
REACTIVE IMPEDANCE COMPONENT, $X = Z \cdot \sin(\varphi)$	Ohm

## External inputs measurement

### Test of transducers

. It is possible to meter current or voltage input.

### External current measurement

. Maximum input current: 10 A, a.c. or d.c.

. Range, resolution, accuracy: see table below.

RANGE	RESOLUTION	ACCURACY
0.02 A d.c.	0.1 mA	$\pm (0.5\% + 0.1 \text{ mA})$
1.999 A a.c.	1 mA	$\pm (1\% + 2 \text{ mA})$
9.99 A a.c.	10 mA	$\pm (1\% + 20 \text{ mA})$
1.999 A d.c.	1 mA	$\pm (0.5\% + 2 \text{ mA})$
9.99 A d.c.	10 mA	$\pm (0.5\% + 20 \text{ mA})$

### External voltage measurement

. Maximum input voltage: 600 V, a.c. or d.c.

. Range, resolution and accuracy: see table below.

RANGE	RESOLUTION	ACCURACY
9.999 V a.c.	2 mV	$\pm (1\% + 10 \text{ mV})$
99.99 V a.c.	10 mV	$\pm (1\% + 20 \text{ mV})$
599.9 V a.c.	100 mV	$\pm (1\% + 200 \text{ mV})$
9.999 V d.c.	2 mV	$\pm (0.5\% + 10 \text{ mV})$
99.99 V d.c.	10 mV	$\pm (0.5\% + 20 \text{ mV})$
599.9 V d.c.	100 mV	$\pm (0.5\% + 200 \text{ mV})$

## Other characteristics

### T/1000 local memory

. Test settings can be stored and recalled from the T/1000 local memory: up to 10 test settings.

. Test results can be saved into a permanent local memory: up to 500 test results saved.

. When the Pc is connected setting can also be created and transferred into T/1000 using the software X.PRO 3000.

. When the PC is connected test results can be transferred to the PC via RS232 port using the software X.PRO 3000, for saving and printing.

. Set of resistors, for the test of low impedance relays.

Available values:

RESTORE OHM	POWER W	MAX CURRENT A
0,5	50	10
1	50	7
22	50	2.15
470	50	0.33
1000	50	0.22
2200	50	0.15

**Serial interface**

Serial interface for connection to PC:

- . Interface: serial RS232; baud rate 57600 baud.

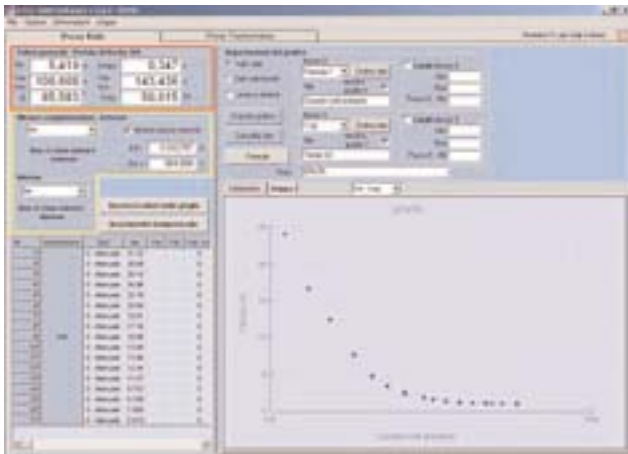
**Power supply**

- . Mains supply: 230 V ± 15%; 50-60 Hz.
- . Maximum supply current: 5 A.

**Standard accessories**

The instrument comes complete with the following items:

- . Mains cable;
- . User's manual;
- . Spare fuses (no. 5), T5A.
- . Software X.PRO 3000 with serial cable.



**Optional accessories**

- . Set of test cables.
- . Heavy duty aluminium transport case.

**D/1000 Differential relay test module**

The differential relay test module D/1000 allows for the test of the differential relay curve, and also of the harmonic restraint characteristic.

The module performances are the followings.

- . Input: from the test set auxiliary AC voltage output.
- . Output: 0 to 5 A CA.
- . Output power: 5 VA, that corresponds to a maximum load of 0,2 Ohm.
- . Dimension: 325 x 290 x 290 mm
- . Weight: 7 kg.

**Weight and dimension**

- . Dimensions: 380 (w) x 300 (d) x 240 (h) mm.
- . Weight: 19 kg.

**Case**

Alluminium case with cover and handle.



**Applicable Standards**

The test set conforms to the EEC directives regarding Electromagnetic Compatibility and Low Voltage instruments.

A) Electromagnetic Compatibility:

Directive no. 89/336/CEE dated may 3, 1989, modified by the directive 92/31/CEE dated may 5, 1992.

B) Low Voltage Directive:

Directive n. 73/23/CEE, modified by the directive 93/68/CEE.

Applicable standards, for a class I instrument, pollution degree 2, Installation category II:

- . CEI EN 61010-1. In particular:
- . Inputs/outputs protection: IP 2X - CEI 70-1.
- . Operating temperature: 0 to 50 °C; storage: -40 °C to 70 °C.
- . Relative humidity: 10 - 80% without condensing.

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