T/2000

Transformer Test Set

- MULTI FUNCTION SYSTEM FOR TESTING: CURRENT, VOLTAGE AND POWER TRANSFORMERS
- CURRENT TRANSFORMER EXCITATION, RATIO AND POLARITY TEST SET
- PRIMARY INJECTION TESTING CAPABILITIES
- 3000 V AC HIGH-POT TEST
- GENERATES UP TO 800A AND 3000V
- LARGE GRAPHICAL DISPLAY
- TEST RESULTS AND SETTINGS ARE SAVED INTO LOCAL MEMORY
- RS232 INTERFACE FOR PC CONNECTION
- COMPACT AND LIGHTWEIGHT (26 KG)

Application

T/2000 is a unique solution for all testing operations during commissioning and maintenance of substations, as it allows performing the test of current voltage and power transformers.
In addition **T/2000** incorporates a powerful multi-meter and phase angle meter, with oscilloscope functions.

The following table lists the tests that can be performed on Current transformers (CT), Voltage Transformers (VT) and Power Transformers (PT).

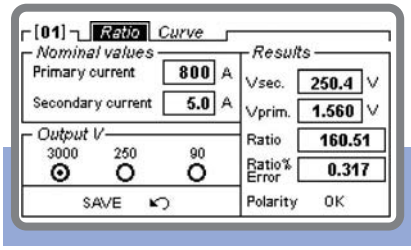
N.	TEST	TEST DESCRIPTION
1	CT	Ratio, polarity and burden, Current mode
2	CT	Burden; secondary side
3	CT	Excitation curve
4	CT	Winding or burden resistance
5	CT	Voltage withstand
6	CT	Polarity by impulses
7	CT	Ratio, Voltage mode
8	VT	Ratio; polarity
9	VT	Burden, secondary side
10	VT	Ratio, electronic transformers
11	VT	Voltage withstand
12	VT	Secondary over-current protection
13	PT	Ratio per TAP
14	PT	Resistance of TAP Changer contacts
15	GR	Earth resistance
16	GR	Soil resistivity

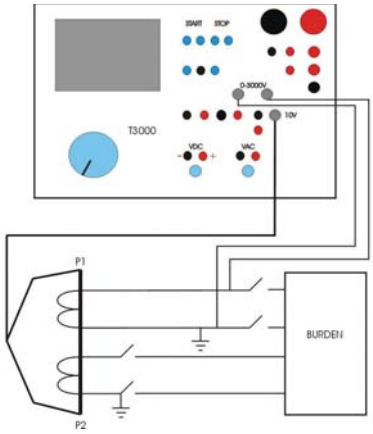
Typical application

Test of Current Transformer

- CT RATIO V AND POLARITY - VOLTAGE METHOD

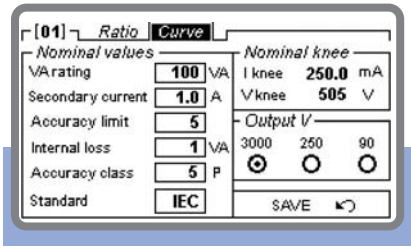
USED OUTPUT: 90V, 250V or 3000 V AC.
USED INPUT: LOW AC VOLTAGE - 10 V AC.

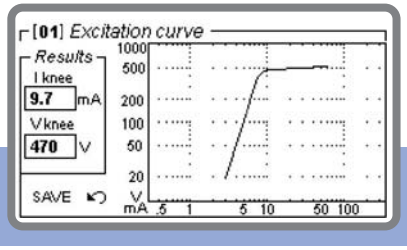


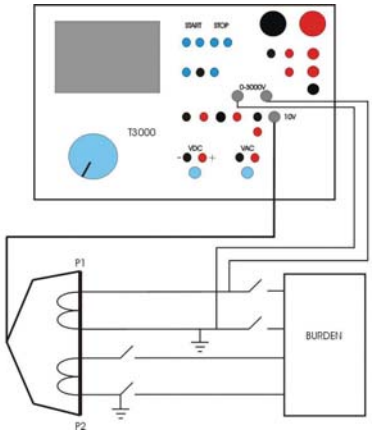


- CT EXCITATION

USED OUTPUT: 90V, 250V or 3000 V AC.
USED INPUT: Internal measurement.

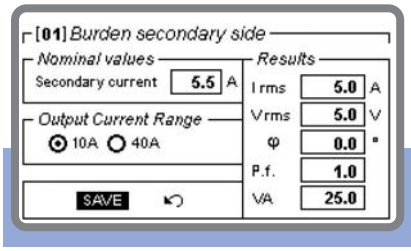


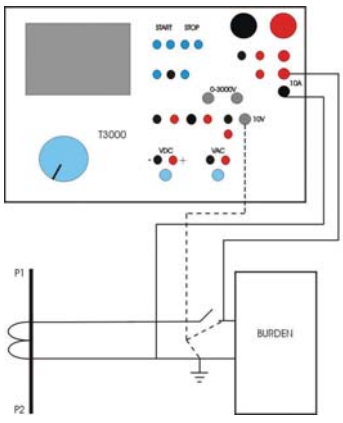




- CT BURDEN SECONDARY SIDE:

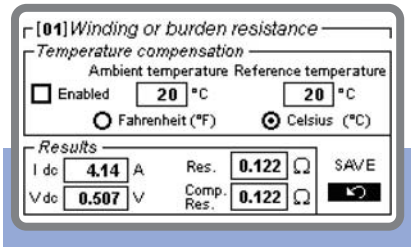
USED OUTPUT: 10 A or 40 A AC.
USED INPUT: LOW AC VOLTAGE - 10 V AC

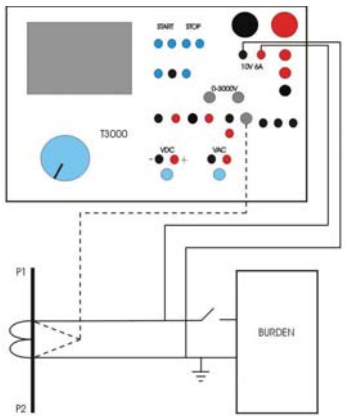




- WINDING RESISTANCE:

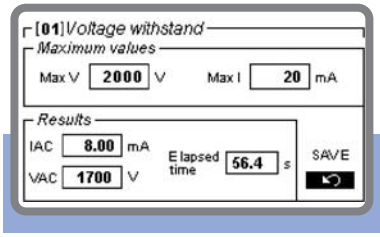
USED OUTPUT: 6 A DC
USED INPUT: 10 V DC

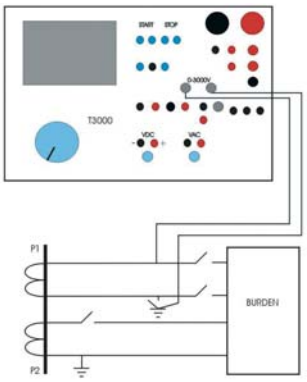




• VOLTAGE WITHSTAND:

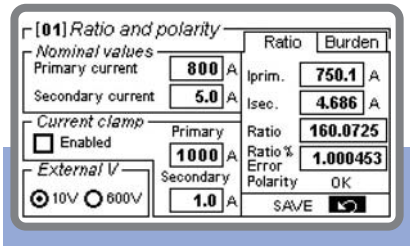
USED OUTPUT: 3000 V AC
USED INPUT: Internal measurement.

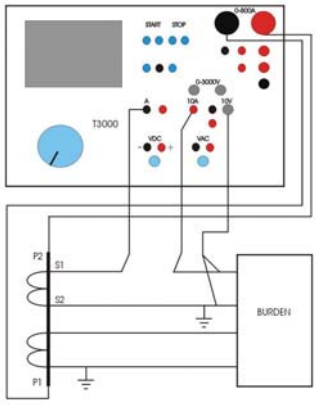




• CT RATIO AND POLARITY – CURRENT METHOD

USED OUTPUT: 800 A AC
USED INPUT: LOW AC CURRENT - 10 A AC.



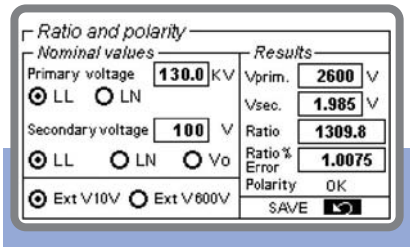


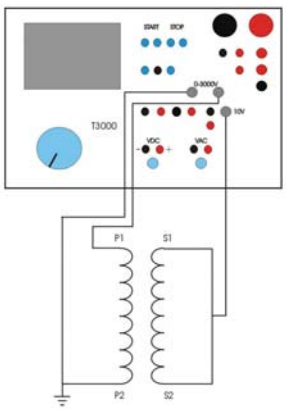
Typical application

Test of Voltage Transformer

• VT RATIO AND POLARITY

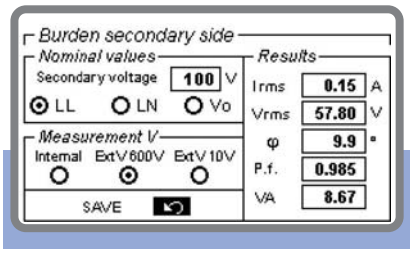
USED OUTPUT: 3000 V AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.

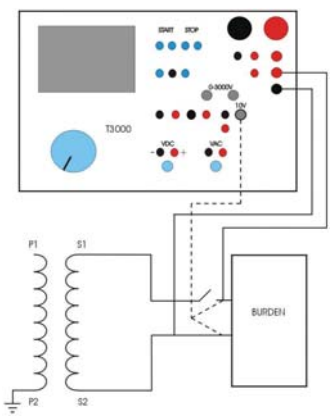




• VT BURDEN

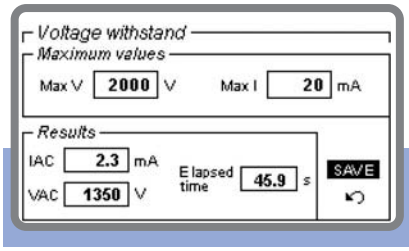
USED OUTPUT: 10 A AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.

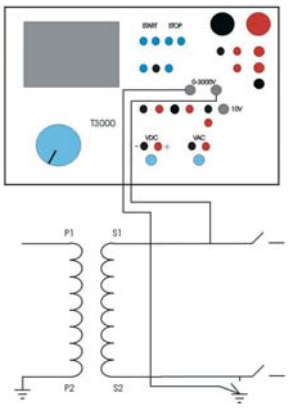




- VOLTAGE WITHSTAND

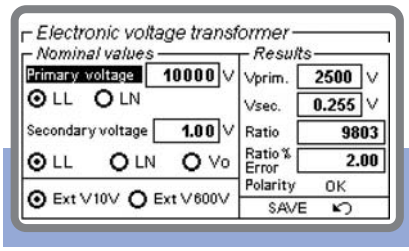
USED OUTPUT: 3000 V AC
USED INPUT: Internal measurement.

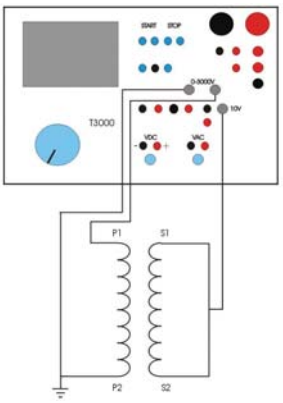




- RATIO OF ELECTRONIC VOLTAGE TRANSFORMER

USED OUTPUT: 3000 V AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.



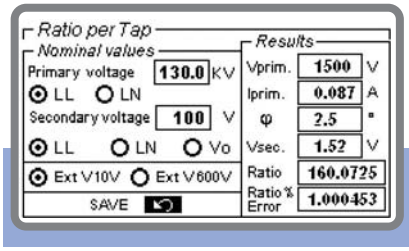


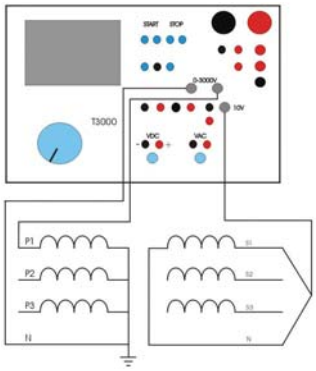
Typical application

Power Tranformer

- RATIO PER TAP

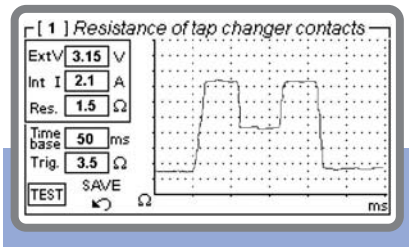
USED OUTPUT: 3000 V AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.

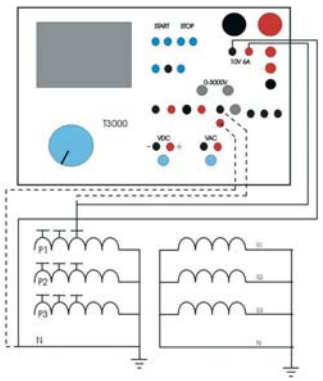




- TAP CHANGER RESISTANCE AND CONTINUITY

USED OUTPUT: 6 A DC
USED INPUT: 10 V DC





System Description

T/2000 contains one generator:

- Main generator. It has six outputs: High AC current; Low AC current; Low DC current; Current impulses; High AC voltage; Low AC voltage 1.

All outputs are adjustable and metered on the large, graphic LCD display. With the multi-purpose control knob and the graphic LCD display it is possible to enter the MENU mode, that allows to control all functions, and makes T/2000 the most powerful testing device, with manual and 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 TDMS software, which operates with all WINDOWS versions, starting from WINDOWS 98 included.
Additional features are:
. Oscilloscope function: it is possible to display the current and voltage waveform measured;
. Two independent measurement inputs, for current and voltage, and with High and Low inputs each, allow measuring CT or VT outputs or any other source;
. The optional thermal printer gives the immediate printout of the CT saturation curve and other test results;
The instrument is housed in a transportable aluminium box, which is provided with removable cover and handles for ease of transportation.

NOTE: WINDOWS is a trademark of MICROSOFT inc.

T/2000 Specification

Main Generator

The main generator has six outputs: High AC current; Low AC current; Low DC current; Current impulses; High AC voltage; Low AC voltage. Output adjustment is performed via a knob. The following specification applies to the separate usage of these outputs.

High AC current output

APPLICATION:
. CT TESTING: RATIO, POLARITY, BURDEN
. RELAY TESTING,
. PRIMARY INJECTION

HIGH POWER RANGE

CURRENT OUTPUT A	OUTPUT POWER VA	LOAD TIME s	RECOVERY TIME min
100	600	STEADY	-
150	800	15 min	30
200	1000	4 min	15
400	1600	15	5
600	2000	5	3
800	2000	1	2

LOW POWER RANGE

CURRENT OUTPUT A	OUTPUT POWER VA	LOAD TIME s	RECOVERY TIME min
30	60	STEADY	-
50	60	10 min	10

Low AC current output

APPLICATION:
. CT TESTING: BURDEN, SECONDARY SIDE
. VT TESTING: OVERCURRENT PROTECTION

HIGH POWER RANGE

RANGE A AC	CURRENT OUTPUT A	OUTPUT POWER VA	LOAD TIME s	RECOVERY TIME min
40	12	300	STEADY	-
	18		15 min	30
	24		4 min	15
	36	800	15	5
	48		5	3
	60	1000	1	2
10	5	400	STEADY	-
	7.5		15 min	30
	10	800	60	15
	15		30	10
	20	1000	15	5

LOW POWER RANGE

RANGE A AC	CURRENT OUTPUT A	OUTPUT POWER VA	LOAD TIME s	RECOVERY TIME min
40	12	60	STEADY	-
	18		10 min	30
	24		60	10
	36		1	2
10	5	60	STEADY	-
	6		10 min	45
	7		60	2
	10		1	2

Low DC current output

APPLICATION:
. CT TESTING: WINDING RESISTANCE, BURDEN RESISTANCE
. PT TESTING: TAP-CHANGER CONTACT RESISTANCE

CURRENT OUTPUT A	LOAD RESISTANCE Ohm	OUTPUT POWER W	LOAD TIME min	RECOVERY TIME min
6	0	0	STEADY	-
3	2	18	STEADY	-
1	8	8	STEADY	-

Scope Function

T/2000 has an additional oscilloscope function that allows to display current and voltage waveforms.

Graphical display

The large graphical display has the following characteristics:
- Pixels: 240x128;
- backlight colour: white;
- LCD type: FSTN;
- View area: 135x80 mm.

Local Memory

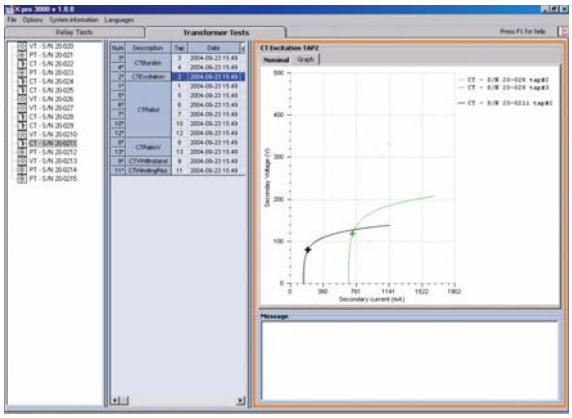
Test results can be stored in the T/2000 local memory (up to 500 results may be stored).
At the end of test, settings and test results can be transmitted to a PC provided with TDMS.
The software allows saving test results and examining them. TDMS is also a powerful report editor that allows to prepare professional test reports.
Test settings can be stored and recalled from the memory. Up to 10 settings can be stored and recalled.

Software

When the PC is connected, settings can be created and transferred into T/2000 using TDMS.
TDMS is a user friendly software that allows via a graphical interface, to control the set-up of T/2000 and to download test results.
TDMS is also a powerful report editor that allows to create professional Test Reports that can be exported in Access format.

Other Characteristics

- Interface: serial RS232; baud rate 57600 baud
- Mains supply: 230 V ± 10%; 50-60 Hz, OR 115 V ± 10%; 50-60 Hz; to be specified at order. (There are power reduction for mains voltage below 220V).
- Dimensions: 450 (W) x 320 (D) x 240 (H) mm.
- Weight: 26 kg.



Software TDMS - CT test

Accessories

THE FOLLOWING ACCESSORIES ARE SUPPLIED WITH T/2000

Connection cables and test connectors

- N 1 Mains supply cable, 2 m long.
- N. 1 Grounding cable, 4 m long, terminated on one side with a 4 mm banana plug, and on the other side with an earth connection clamp.
- N. 1 Interface cable for RS232 port.
- N. 2 High voltage connection cables, 4 m long, 5 kV, with earth screen. Terminated on both sides with HV connectors.
- N. 2 Clamps for the HV connection.
- N. 2 High current connection cables, 100 sq. mm, 4 m long. Terminated on one side with the high current connector, and on the other side with the high current clamp.
- N. 2 Low current connection cables, 10 sq. mm, 4 m long. Terminated on both sides with a 4 mm banana plug.
- N. 4 Clamps to connect low voltage or low current or measurements.
- N. 1 Cable for low voltage or low current connection, shielded, 4 m long. Terminated on one side with the measurement connector, and on the other side with two 4 mm banana plugs.
- Voltage outputs (4 cables: 2 red and 2 black);
- Measurement inputs (4 cables: 2 red and 2 black);
- The instrument comes complete with the following items: User's manual; Spare fuses (no. 5), T16A; Software X.PRO-3000 with user manual.

Optional accessories

Thermal printer: The optional thermal printer, for the printout of the V-I curve in the CT saturation test and other test results. Thermal Paper 48 mm wide.
Transit case: Heavy duty aluminium transit case with wheels allows delivering T/2000 with no concern about transport shocks.
Current clamp: The current clamp allows to avoid the opening the secondary current circuit when performing the primary test of CT burden.
Earth resistance and soil resistivity kit.
Complete kit including cables, drums and spikes.

Optional Modules

High IDC module - 400A

The high DC current module allows the measurement of the low contact resistance of high voltage breakers or of joints. The option is connected to the high AC current output of T/2000; the current measurement is connected to the low DC current measurement input; the drop voltage is connected to the low voltage measurement input. DC current output is: 100 A steady; 200 A for 4 minutes; 400 A for 15 s.
The selection of this function is performed via menu; the screen displays: test current; joint voltage; contact resistance. Resistance measurement ranges: µOhm 100.0, 1.000, 10.00, 100.0 mOhm; 1.000 Ohm, auto-ranging.
The connection cables are included with the option.

Current booster - 2000A AC

RANGE A	OUTPUT A	POWER VA	TEST DURATION
1000	500	800	4 min
	1000	1400	15 s
2000	1000	800	4 min
	2000	1200	15 s

The current booster module allows performing high current primary tests. The option is connected to the high AC current output of T/2000, and boosts the output current on two ranges: 1000 A or 2000 A.
Current output is measured by connecting the option to the external high current measurement.
The selection of this function is performed via menu; the screen displays the output current as kA.
The connection cables are included with the option.

Safety Features and Protections

- Fuse on the mains supply.
- At power-on, a diagnostic sequence controls:
  . Key microprocessor board components;
  . Auxiliary supply voltages.
  If something is wrong, the operator is alerted by a message.
- Emergency pushbutton: if pressed, all main outputs are removed.
- The high voltage output has the following protections:
  . Confirmation key: if not turned, the HV output is not generated;
  . The HV is generated only if selected.
- Thermal NTC sensor on the main and auxiliary transformers. In case of over-temperature, an alarm message is displayed.
- Thermal sensors or the SCR that controls current injection, and of the internal temperature. In case of over-temperature, an alarm message is displayed.
- If maximum current limits and time duration of power transformer generators are reached, the generation is interrupted, and the operator is warned by an alarm message.
- The DC current source is protected against over-voltages. In addition, the output is automatically kept to zero as test stops, so that any residual energy on the external load is discharged.
- The 20 mA measurement input is protected by a thermal switch against wrong connections: in case of error the PTC goes to high impedance. The switch self-restores to the normal value in some minutes.

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.

Ordering information:

CODE	MODEL
	T-2000
10110	complete with software TDMS. 3000 V OUTPUT - Power supply 230 V ± 10%
15110	Test cables kit
20110	complete with software TDMS. 3000 V OUTPUT - Power supply 115 V ± 10%. 3000 V OUTPUT - Power supply 230 V ± 10%
15110	Test cables kit
30110	complete with software TDMS. 1200 V OUTPUT - Power supply 230 V ± 10%
15110	Test cables kit
40110	complete with software TDMS. 1200 V OUTPUT - Power supply 115 V ± 10%
15110	Test cables kit

CODE	MODEL
	T-2000E
50110	complete with software TDMS. 1200 V OUTPUT - Power supply 230 V ± 10%
16110	Test cables kit

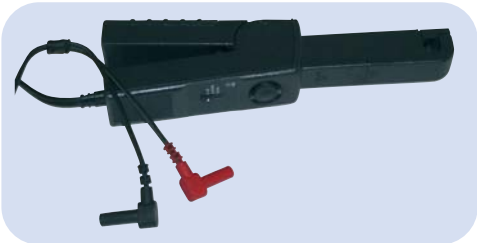
Option for T-2000

CODE	MODEL
17102	Transit case
16102	Current Clamp
14102	Thermal Printer 4.5"
13102	High I DC module 400 A
12102	Current Booster 2000 A
19102	Earth Resistance and Soil Resistivity Kit
41024	FT/100

T/2000 Accessories

T/2000 Transit case

T/2000
Transit case
for Cables



T/2000
Current Clamp

T/2000
Set of
Test Leads

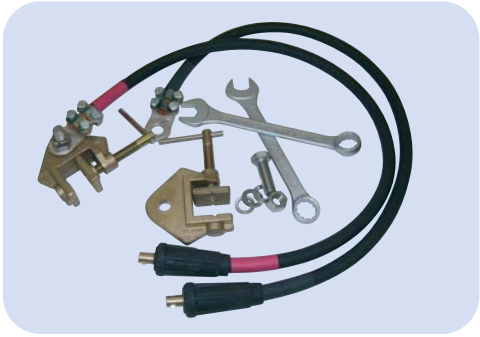
T/2000
High voltage
Test Cable

T/2000
Grounding
Cable

T/2000
Low current
Cables

T/2000
Measuring
Cable

T/2000
Serial Cable



T/2000
High current
Cables with
Clangs and
mounting Kit

T/2000
High current
Cables

ISA srl
Via Bergamo, 41
21020 TAINO (Va) Italy
Tel. + 39 0331 956.081
Fax + 39 0331 957.091
Web site: www.isatest.com
E-Mail: isa@isatest.com

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