

- 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)

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 resistività |

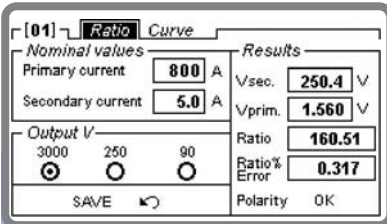
A P P L I C A T I O N

T2000 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 T2000 incorporates a powerful multi-meter and phase angle meter, with oscilloscope functions.

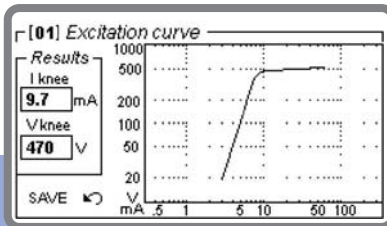
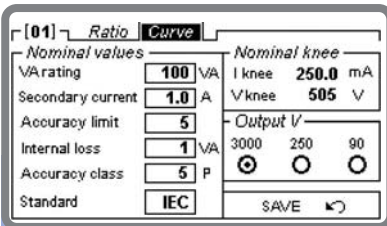


Typical application
Test of Current Transformer

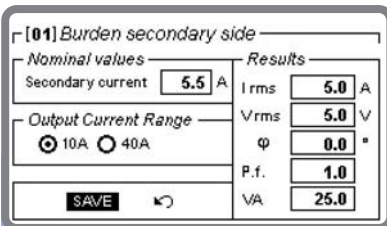
- CT RATIO V AND POLARITY - VOLTAGE METHOD
USED OUTPUT: 90 V, 250 V or 3000 V AC.
USED INPUT: LOW AC VOLTAGE - 10 V AC.



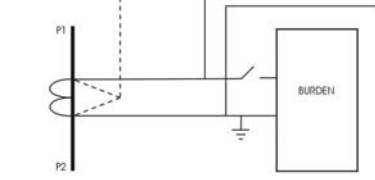
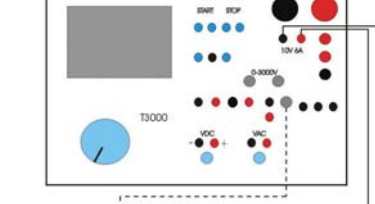
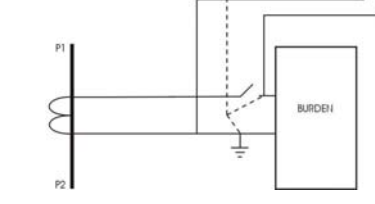
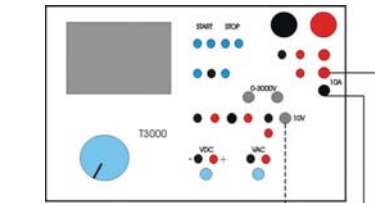
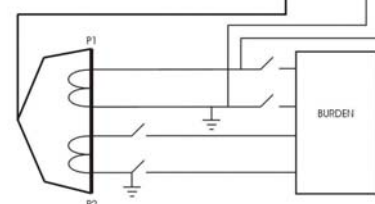
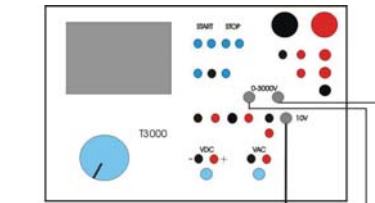
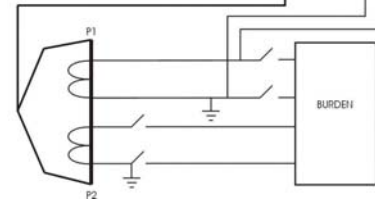
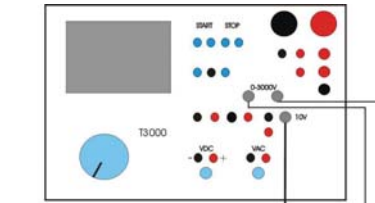
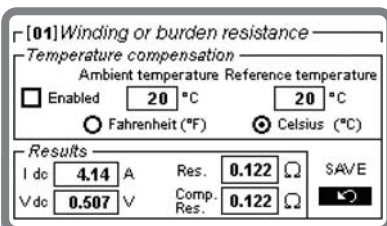
- CT EXCITATION
USED OUTPUT: 90 V, 250 V or 3000 V AC.
USED INPUT: Internal measurement.



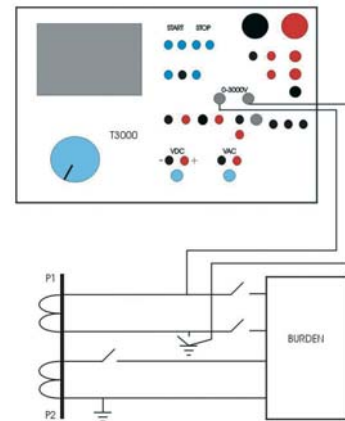
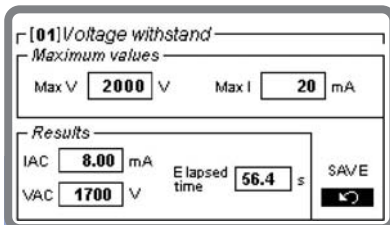
- CT BURDEN SECONDARY SIDE:
USED OUTPUT: 10 A or 40 A AC.
USED INPUT: LOW AC VOLTAGE - 10 V AC.



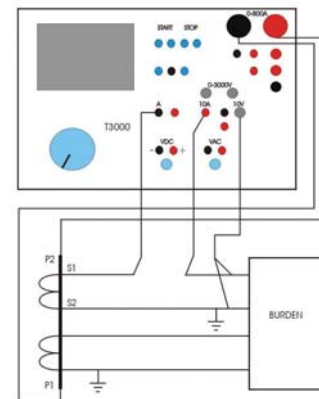
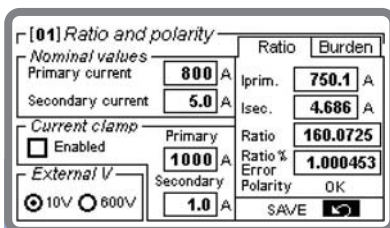
- WINDING RESISTANCE:
USED OUTPUT: 6 A DC.
USED INPUT: 10 V DC.



- VOLTAGE WITHSTAND:
USED OUTPUT: 3000 V AC.
USED INPUT: Internal measurement.

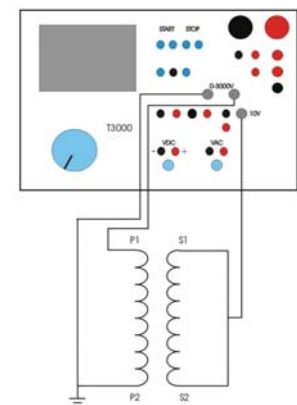
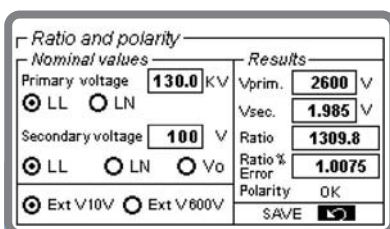


- CT RATIO AND POLARITY - CURRENT METHOD
USED OUTPUT: 800 A AC.
USED INPUT: LOW AC CURRENT - 10 A AC.

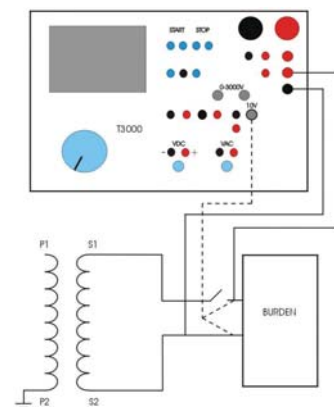
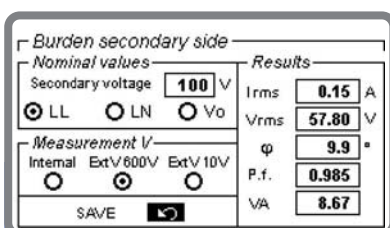


Typical application Test of Voltage Transformer

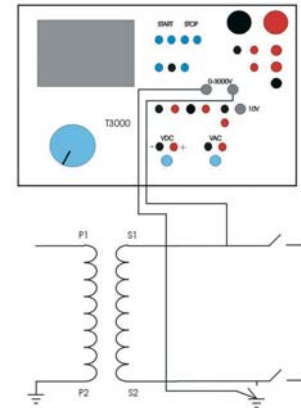
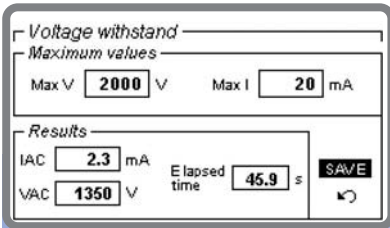
- VT RATIO AND POLARITY
USED OUTPUT: 3000 V AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.



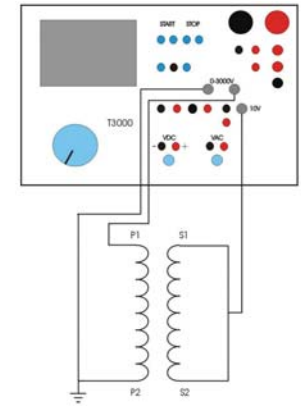
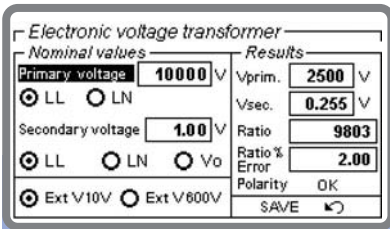
- VT BURDEN
USED OUTPUT: 10 A AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.



- VOLTAGE WITHSTAND
USED OUTPUT: 3000 V AC.
USED INPUT: Internal measurement.

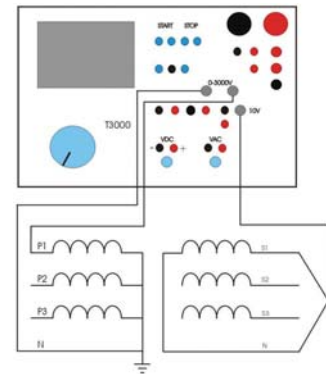
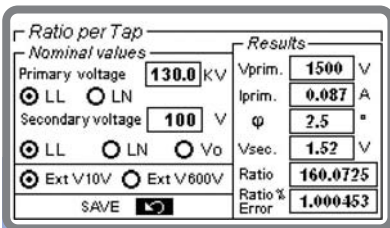


- RATIO OF ELECTRONIC VOLTAGE TRANSFORMER
USED OUTPUT: 3000 V AC.
USED INPUT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.

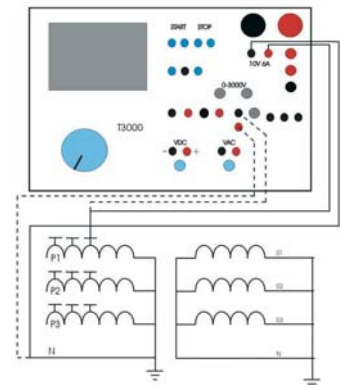
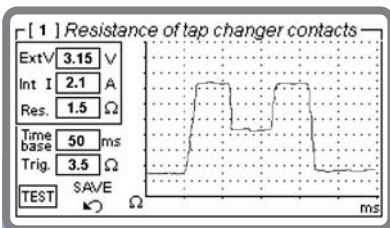


Typical application
Power Transformer

- 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

T2000 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 T2000 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.

T2000 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 |
| 10 | 60 | 1000 | 1 | 2 |
| | 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 | - |

Current impulses output

APPLICATION:

- . CT TESTING: POLARITY TEST WITH IMPULSE METHOD
- . Current range: from 0 to 10 A peak.

High AC voltage output

Two version are available: 3000V or 1200V output

APPLICATION:

- . CT TESTING: EXCITATION CURVE, VOLTAGE WITHSTAND
- . VT TESTING: RATIO, POLARITY, ELECTRONIC VOLTAGE TRANSFORMER
- . PT TESTING: RATIO PER TAP

HIGH POWER RANGE

3000 V version

| VOLTAGE OUTPUT V | CURRENT OUTPUT A | OUTPUT POWER VA | LOAD TIME min | RECOVERY TIME min |
|------------------|------------------|-----------------|---------------|-------------------|
| 3000 | 0.2 | 600 | STEADY | - |
| | 0.6 | 1800 | 1 | 8 |

In alternative

1200V version

| VOLTAGE OUTPUT V | CURRENT OUTPUT A | OUTPUT POWER VA | LOAD TIME min | RECOVERY TIME min |
|------------------|------------------|-----------------|---------------|-------------------|
| 1200 | 0.5 | 600 | STEADY | - |
| 1200 | 1.5 | 1800 | 1 | 8 |

LOW POWER RANGE

| VOLTAGE OUTPUT V | CURRENT OUTPUT A | OUTPUT POWER VA | LOAD TIME min | RECOVERY TIME min |
|------------------|------------------|-----------------|---------------|-------------------|
| 600 | 0.1 | 60 | STEADY | - |
| 500 | 0.2 | 120 | 1 | 8 |

Low AC voltage output

APPLICATION:

- . CT TESTING: RATIO WITH VOLTAGE METHOD
- . VT TESTING: BURDEN SECONDARY SIDE

| VOLTAGE V AC | VOLTAGE OUTPUT A | OUTPUT POWER VA | LOAD TIME min | RECOVERY TIME min |
|--------------|------------------|-----------------|---------------|-------------------|
| 250 | 250 | 125 | STEADY | - |
| | 200 | 200 | 3 | 9 |

Measuring Section

Output measurements

Current and voltage AC and DC outputs measurement

accuracy: $\pm 0.5\%$.

Phase angle measurement accuracy: 1° .

Frequency accuracy: 1 mHz.

Other measurements available on T2000:

The following measurement are calculated from the T2000 generated outputs:

External Inputs Measurement

Current measurements

- . Two inputs: 20 mA AC or DC or 10 A AC.

- . Accuracy: 0.5%

Possibility to display the current waveform.

Voltage measurement

- . Two inputs: 10 V or 600 V, AC or DC.

- . Accuracy: 0.5%

Possibility to display the voltage waveform.

Other measurements available on the T2000 calculated from external inputs.

Ratio Measurement

- Ratio: 0.1 to 999; 0.1%
- Ratio: 999 to 3000; 0.3%
- Ratio: 3000 to 9999; 1%

Scope Function

T2000 has an additional oscilloscope function that allows to display current and voltage waveforms.

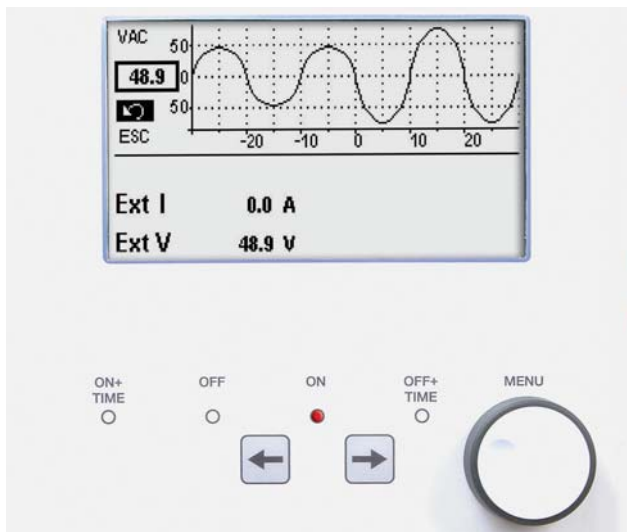
Graphical display

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 T2000 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

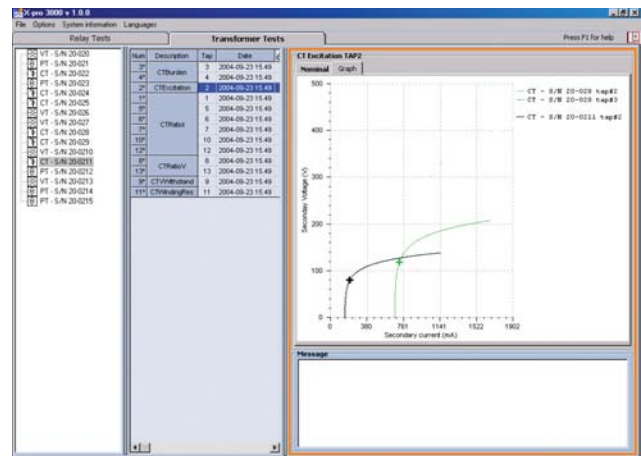
When the PC is connected, settings can be created and transferred into T2000 using TDMS. TDMS is a user friendly software that allows via a graphical

interface, to control the set-up of T2000 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 \pm 10%; 50-60 Hz, OR 115 V \pm 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 T2000

Connection cables and test connectors

- One Mains supply cable, 2 m long.
- One 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.
- One Interface cable for RS232 port.
- Two High voltage connection cables, 4 m long, 5 kV, with earth screen. Terminated on both sides with HV connectors.
- Two Clamps for the HV connection.
- Two 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.
- Two Low current connection cables, 10 sq. mm, 4 m long. Terminated on both sides with a 4 mm banana plug.

- Four Clamps to connect low voltage or low current or measurements.
- One 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 TDMS 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 T2000 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

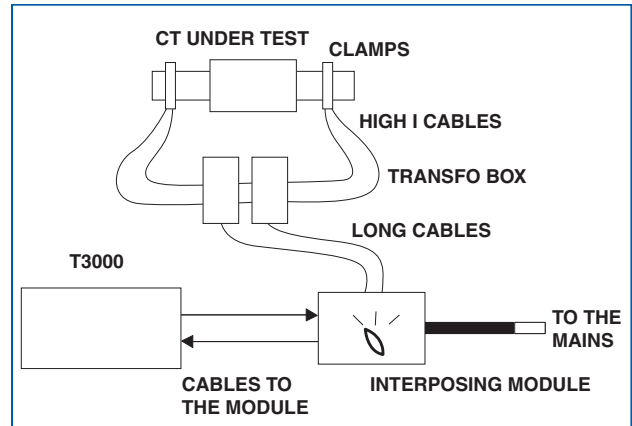
Very High Current Booster BU2000 for T2000 Test sets

The very high current booster option allows performing high current primary injections with currents up to 4000 A.

The Current Booster BU2000 for T3000 and T2000 Test sets is designed around the concept to avoid wasting power on the connection cables, by putting the power transformers as close as possible to the test object. This approach is particularly useful when the test is performed on CT's in the field, that are from 5 to 10 meters above the ground. The solution is sound because the weight of transformer plus cable plus clamps is comparable to the weight of the connection cables.

The higher the test current, the higher the weight of the transformers, but also the higher the weight of the connection cables. With this solution, the connection cable to the power source is much lighter, does not pose any major problem of voltage drop, and can be any length.

The following drawing shows the connections between T3000, the IM2000 Interposing Module and the transformers (up to 4).



The following table summarizes the available configurations and the corresponding performances.

| Number of transformers No | Weight Kg | Maximum load mOhm | Maximum current A | Duty cycle s |
|---------------------------|-----------|-------------------|-------------------|--------------|
| 1 | 19.5 | 1.5 | 1000 | 100 |
| | | 0.15 | 2000 | 6 |
| 2 | 29.5 | 2.4 | 1000 | 900 |
| | | 0.6 | 2000 | 27 |
| | | 0 | 3000 | 6 |
| 4 | 49.5 | 6 | 1000 | 900 |
| | | 2.4 | 2000 | 27 |
| | | 0.8 | 3000 | 6 |
| | | 0.6 | 4000 | 2 |
| | | 2.6 | 1000 | INFINITE |
| | | 0.6 | 2000 | 900 |
| | | 0 | 3000 | 100 |

For more detailed technical information please see the BU2000 data sheet.

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 T2000; 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

The current booster module allows performing high current primary tests. The option is connected to the high AC current output of T2000, and boosts the output current on two ranges: 1000 A or 2000 A. Output characteristics are the following.

| 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 |

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 on 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 | MODULE |
|-------|---|
| | T2000 |
| 10110 | complete with software TDMS. 3000 V OUTPUT - Power supply 230 V \pm 10% |
| 15110 | Test cables kit |
| 20110 | complete with software TDMS. 3000 V OUTPUT - Power supply 115 V \pm 10%. 3000 V OUTPUT - Power supply 230 V \pm 10% |
| 15110 | Test cables kit |
| 30110 | complete with software TDMS. 1200 V OUTPUT - Power supply 230 V \pm 10% |
| 15110 | Test cables kit |
| 40110 | complete with software TDMS. 1200 V OUTPUT - Power supply 115 V \pm 10% |
| 15110 | Test cables kit |

| CODE | MODULE |
|-------|--|
| | T2000E |
| 50110 | complete with software TDMS. 1200 V OUTPUT - Power supply 230 V ± 10% |
| 16110 | Test cables kit |

Option for T2000

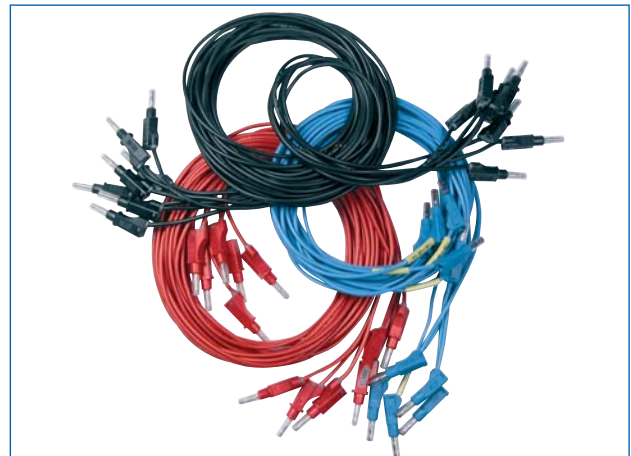
| CODE | MODULE |
|-------|--|
| 17102 | Transit case |
| 16102 | Current Clamp |
| 14102 | Thermal Printer 4.5" |
| 13102 | High I DC module 400 A |
| 12102 | Current Booster 2000 A |
| 50102 | BU2000 - External Advanced Booster up to 2000 A: (1) Main Module with high current clamps and high current cables, 20m connecting cables. |
| 51102 | BU2000 - External Advanced Booster up to 3000 A: Main Module with high current clamps, high current cables, Auxiliary Module (1), Interposing Module, connecting cables. |
| 52102 | BU2000 - External Advanced Booster up to 4000 A: Main Module with high current clamps, high current cables, Auxiliary Module (3), Interposing Module, connecting cables. |
| 53102 | BU2000 - Interposing Module |
| 54102 | BU200 - Auxiliary Module |
| 55102 | BU2000 (50102) - Heavy Duty Transport case |
| 56102 | BU2000 (51102; 52102) - Heavy Duty Transport case |
| 19102 | Earth Resistance and Soil Resistivity Kit |
| 16093 | FT1000 |



T2000 - Transit case for Cables



T2000 - Current Clamp



T2000 - Set of Test Leads

T2000 ACCESSORIES



T2000 - Transit case



T2000 - High voltage Test Cables



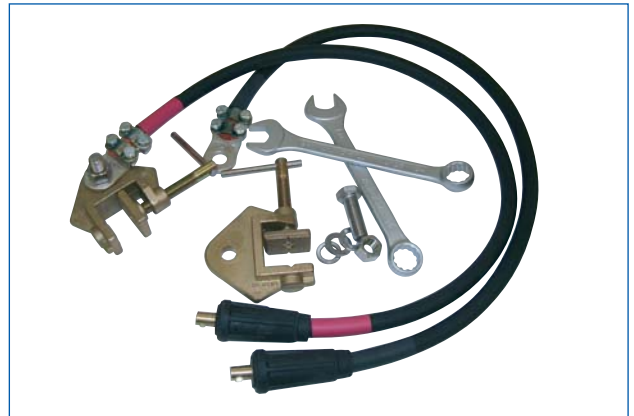
T2000 - Grounding Cable



T2000 - Serial Cable



T2000 - Low current Cables



T2000 - High current Cables with Clamps and mounting Kit



T2000 - Measuring Cable



T2000 - High current Cables