T3000

Substation Maintenance and Commissioning Test Equipment

www.isatest.com
Substation maintenance and commissioning test equipment

- Multi function system for testing substation equipment such as: current, voltage and power transformers, all type of protection relays, energy meters and transducers
- Primary injection testing capabilities
- 3000 V AC high-pot test
- Generates up to 800 A (option: 2000 - 3000 - 4000 A)
- Microhmmeter function (option): up to 400 A DC
- Large graphic display
- Test results and settings are saved in the local memory
- RS232 interface for PC connection
- Compact and lightweight

Description

T 3000 is a unique solution for all testing operations during commissioning and maintenance of substations, as it allows to perform the test of over-current relays, current and voltage transformers. In addition, T 3000 incorporates a powerful multi-meter and phase angle meter, and oscilloscope functions.

APPLICATION

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

<table>
<thead>
<tr>
<th>N.</th>
<th>TEST</th>
<th>TEST DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CT</td>
<td>Ratio, Voltage mode</td>
</tr>
<tr>
<td>2</td>
<td>CT</td>
<td>Ratio, polarity and burden, Current mode</td>
</tr>
<tr>
<td>3</td>
<td>CT</td>
<td>Burden; secondary side</td>
</tr>
<tr>
<td>4</td>
<td>CT</td>
<td>Excitation curve</td>
</tr>
<tr>
<td>5</td>
<td>CT</td>
<td>Winding or burden resistance</td>
</tr>
<tr>
<td>6</td>
<td>CT</td>
<td>Voltage withstand</td>
</tr>
<tr>
<td>7</td>
<td>CT</td>
<td>Polarity by impulses</td>
</tr>
<tr>
<td>8</td>
<td>VT</td>
<td>Ratio; polarity</td>
</tr>
<tr>
<td>9</td>
<td>VT</td>
<td>Burden, secondary side</td>
</tr>
<tr>
<td>10</td>
<td>VT</td>
<td>Ratio, electronic transformers</td>
</tr>
<tr>
<td>11</td>
<td>VT</td>
<td>Voltage withstand</td>
</tr>
<tr>
<td>12</td>
<td>VT</td>
<td>Secondary over-current protection</td>
</tr>
<tr>
<td>13</td>
<td>PT</td>
<td>Ratio per TAP</td>
</tr>
<tr>
<td>14</td>
<td>PT</td>
<td>Static and dynamic TAP Changer resistance test</td>
</tr>
<tr>
<td>15</td>
<td>GR</td>
<td>Earth resistance</td>
</tr>
<tr>
<td>16</td>
<td>GR</td>
<td>Soil resistivity</td>
</tr>
</tbody>
</table>

RELAY TYPE

<table>
<thead>
<tr>
<th>IEEE NO</th>
<th>RELAY TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (3 sets)</td>
<td>21</td>
</tr>
<tr>
<td>Synchronizing</td>
<td>25</td>
</tr>
<tr>
<td>Thermal</td>
<td>26</td>
</tr>
<tr>
<td>Over/under-voltage</td>
<td>27/59</td>
</tr>
<tr>
<td>Power, varmetric or wattmetric</td>
<td>32/92</td>
</tr>
<tr>
<td>Under current</td>
<td>37</td>
</tr>
<tr>
<td>Reverse phase current</td>
<td>46</td>
</tr>
<tr>
<td>Instantaneous overcurrent</td>
<td>50</td>
</tr>
<tr>
<td>Ground fault</td>
<td>50N</td>
</tr>
<tr>
<td>Timed overcurrent</td>
<td>51</td>
</tr>
<tr>
<td>Circuit breaker</td>
<td>52</td>
</tr>
<tr>
<td>Power factor</td>
<td>55</td>
</tr>
<tr>
<td>Directional overcurrent</td>
<td>67</td>
</tr>
<tr>
<td>Directional ground fault</td>
<td>67N</td>
</tr>
<tr>
<td>Automatic reclose</td>
<td>79</td>
</tr>
</tbody>
</table>

RELAY TYPE

<table>
<thead>
<tr>
<th>IEEE NO</th>
<th>RELAY TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>81</td>
</tr>
<tr>
<td>Frequency rate of change</td>
<td>81</td>
</tr>
<tr>
<td>Motor protection</td>
<td>86</td>
</tr>
<tr>
<td>Differential (pick-up)</td>
<td>87</td>
</tr>
<tr>
<td>Directional voltage</td>
<td>91</td>
</tr>
<tr>
<td>Tripping relay</td>
<td>94</td>
</tr>
</tbody>
</table>

OTHER DEVICES

- Voltage regulation
- Timers
- Transducers
- Energy meters
CURRENT TRANSFORMER TESTS

- **CT RATIO AND POLARITY - VOLTAGE METHOD**
  OUTPUT: 90V, 250V or 3000 V AC.
  MEASUREMENT: 10 V AC.

- **CT RATIO, POLARITY AND BURDEN – CURRENT METHOD**
  OUTPUT: 800 A AC.
  MEASUREMENT: 10 A AC, 10 V AC.

- **CT BURDEN SECONDARY SIDE:**
  OUTPUT: 10 A or 40 A AC.
  MEASUREMENT: 10 V AC.

- **CT EXCITATION CURVE**
  OUTPUT: 90V, 250V or 3000 V AC.
  Internal measurement.
• WINDING RESISTANCE
OUTPUT: 6 A DC.
MEASUREMENT: 10 V DC.

- [01] Winding or burden resistance
- Temperature compensation
  - Ambient temperature Reference temperature
  - Enabled
    - Fahrenheit (°F)
    - Celsius (°C)

  - Results
    - I dc: 4.14 A
      - React. Comp.
    - V de: 6.507 V
      - React.

• VOLTAGE WITHSTAND
OUTPUT: 3000 V AC.
Internal measurement.

- [01] Voltage withstand
  - Minimum values
    - Max V: 2000 V
    - Max I: 20 mA

  - Results
    - I AC: 0.90 mA
    - Type: Low
    - Time: 56.4 s

VOLTAGE TRANSFORMER TESTS

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

- Ratio and polarity
  - Nominal values
    - Primary voltage: 138.8 V
    - Secondary voltage: 198 V

  - Results
    - Ratio: 138.8 V
    - Ratio’s Error: 1.0075
    - Polarity: OK

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

- Burden secondary side
  - Nominal values
    - Secondary voltage: 198 V

  - Results
    - Current: 0.15 A
    - Voltage: 67.00 V
    - P: F: 0.985
    - V: 8.67

• VOLTAGE WITHSTAND
OUTPUT: 3000 V AC.
Internal measurement.

- Voltage withstand
  - Minimum values
    - Max V: 2000 V
    - Max I: 20 mA

  - Results
    - I AC: 2.3 mA
    - Type: Low
    - Time: 45.8 s
• **RATIO OF ELECTRONIC VOLTAGE TRANSFORMERS**  
  OUTPUT: 3000 V AC.  
  MEASUREMENT: 10 V AC.

```
<table>
<thead>
<tr>
<th>Primary voltage</th>
<th>Secondary voltage</th>
<th>Ratio</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 V</td>
<td>1.00 V</td>
<td>9803</td>
<td>2.00</td>
</tr>
</tbody>
</table>
```

**POWER TRANSFORMER TESTS**

• **RATIO PER TAP**  
  OUTPUT: 3000 V AC.  
  MEASUREMENT: LOW or HIGH AC VOLTAGE - 10 V AC OR 600 V AC.

```
<table>
<thead>
<tr>
<th>Primary voltage</th>
<th>Secondary voltage</th>
<th>Voltage</th>
<th>Ratio</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>138.8 V</td>
<td>196 V</td>
<td>1508 V</td>
<td>160.8775</td>
<td>1.099453</td>
</tr>
</tbody>
</table>
```

• **STATIC AND DYNAMIC TAP CHANGER RESISTANCE TEST**  
  OUTPUT: 6 A DC.  
  MEASUREMENT: 10 V DC.

**PROTECTIVE RELAY TESTS**

• **PRIMARY INJECTION**  
  OUTPUT: 800 A.  
  INPUT: TIMER.

<table>
<thead>
<tr>
<th>IAC</th>
<th>AC Aux</th>
<th>DC Aux</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>605.0 A</td>
<td>57.8 V</td>
<td>110.0 V</td>
<td>10.50 s</td>
</tr>
</tbody>
</table>

Ext I —
Ext V —

• **SECONDARY INJECTION**  
  OUTPUT: 800 A, 40 A or 10 A.  
  INPUT: TIMER.

<table>
<thead>
<tr>
<th>IAC</th>
<th>AC Aux</th>
<th>DC Aux</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.75 A</td>
<td>57.8 V</td>
<td>110.0 V</td>
<td>1.533 s</td>
</tr>
</tbody>
</table>

Ext I —
Ext V —
SYSTEM DESCRIPTION

T 3000 contains three independent generators:

- Main generator. It has six outputs: High AC current; Low AC current; Low DC current; Current impulses; High AC voltage; Low AC voltage.
- Auxiliary AC voltage generator: it generates an independent, phase adjustable AC voltage.
- Auxiliary DC voltage generator, to feed the relay under test.

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 3000 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 waveforms;
- Two independent measurement inputs, for current and voltage and with High and Low inputs each; they 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;
- An auxiliary output contact, that follows START and STOP inputs, allows simulating the circuit breaker.

The instrument is housed in a transportable aluminium box, which is provided with removable cover and handles for ease of transportation.

TECHNICAL SPECIFICATION

The 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
- PRIMARY INJECTION
- RELAY TESTING: ELECTRO-MECHANICAL (HIGH POWER) AND NUMERIC (LOW POWER)

Low AC current output

APPLICATION:

- CT TESTING: BURDEN, SECONDARY SIDE
- VT TESTING: OVERCURRENT PROTECTION
- OVER-CURRENT RELAY TESTING

<table>
<thead>
<tr>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>LOAD TIME</th>
<th>RECOVERY TIME min</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>600</td>
<td>steady</td>
<td>-</td>
</tr>
<tr>
<td>150</td>
<td>800</td>
<td>15 min</td>
<td>30</td>
</tr>
<tr>
<td>200</td>
<td>1000</td>
<td>4 min</td>
<td>15</td>
</tr>
<tr>
<td>400</td>
<td>1600</td>
<td>15 s</td>
<td>5</td>
</tr>
<tr>
<td>600</td>
<td>2000</td>
<td>5 s</td>
<td>3</td>
</tr>
<tr>
<td>800</td>
<td>2000</td>
<td>1 s</td>
<td>2</td>
</tr>
</tbody>
</table>

HIGH POWER RANGE

<table>
<thead>
<tr>
<th>RANGE A</th>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION</th>
<th>RECOVERY TIME min</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>12</td>
<td>300</td>
<td>steady</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>15 min</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>4 min</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>800</td>
<td>15 s</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>5 s</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>1000</td>
<td>1 s</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>400</td>
<td>steady</td>
<td>-</td>
</tr>
<tr>
<td>7.5</td>
<td>15 min</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>800</td>
<td>60 s</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>30 s</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1000</td>
<td>15 s</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

LOW POWER RANGE

<table>
<thead>
<tr>
<th>RANGE A</th>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION</th>
<th>RECOVERY TIME min</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>12</td>
<td>60</td>
<td>steady</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>10 min</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>60 s</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>1 s</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>60</td>
<td>steady</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>10 min</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>60 s</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.5 s</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• SCOPE FUNCTION: OUTPUT: ANY. INPUT: V and I.
Low DC current output
APPLICATION:
- CT TESTING: WINDING RESISTANCE, BURDEN RESISTANCE
- PT TESTING: TAP-CHANGER CONTACT RESISTANCE

<table>
<thead>
<tr>
<th>CURRENT OUTPUT A</th>
<th>LOAD RESISTANCE Ohm</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION min</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>steady</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>18</td>
<td>steady</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>8</td>
<td>steady</td>
</tr>
</tbody>
</table>

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

3000 V version
- APPLICATION: 1A CT’S

<table>
<thead>
<tr>
<th>VOLTAGE OUTPUT V</th>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION min</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
<td>0.2</td>
<td>600</td>
<td>steady</td>
</tr>
<tr>
<td>2500</td>
<td>0.6</td>
<td>1500</td>
<td>1</td>
</tr>
</tbody>
</table>

1200 V version
- APPLICATION: 5A CT’S

<table>
<thead>
<tr>
<th>VOLTAGE OUTPUT V</th>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION min</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>0.5</td>
<td>600</td>
<td>steady</td>
</tr>
<tr>
<td>1200</td>
<td>1.5</td>
<td>1800</td>
<td>1</td>
</tr>
</tbody>
</table>

Low AC voltage output
APPLICATION:
- CT TESTING: RATIO WITH VOLTAGE METHOD, SATURATION CURVE

<table>
<thead>
<tr>
<th>VOLTAGE OUTPUT V</th>
<th>CURRENT OUTPUT A</th>
<th>OUTPUT POWER VA</th>
<th>MAX TEST DURATION min</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>0.5</td>
<td>125</td>
<td>steady</td>
</tr>
<tr>
<td>220</td>
<td>1.15</td>
<td>250</td>
<td>3</td>
</tr>
</tbody>
</table>

Auxiliary AC Voltage
APPLICATION:
- RELAY TESTING

<table>
<thead>
<tr>
<th>RANGE V</th>
<th>MAX CURRENT mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>500</td>
</tr>
<tr>
<td>130</td>
<td>250</td>
</tr>
<tr>
<td>260</td>
<td>125</td>
</tr>
</tbody>
</table>

Phase angle shifter
- Phase angle adjustment: via the multi-function knob.
- Phase angle range: from 0° to 360°.
- Adjustment resolution: 1° (one degree).

Frequency & frequency rate of change generator
- Frequency range: 40 Hz to 500 Hz.
- Frequency adjustment: 1 mHz, via control knob.
- Frequency ROC range: from 0.01 Hz/s to 99.99 Hz/s.

Auxiliary DC Voltage
- DC voltage ranges: 130 V or 240 V.
- DC 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
Available measurements:
- Timer start: at test start, or by an external contact;
- Metering of elapsed time between START and STOP;
- Current generation elapsed time.
- Time can be metered as seconds or cycles.

- Inputs: free of voltage or with voltage.
  - Programmable voltage threshold: 24 V or 80 V.
  - Metering range, in seconds: from 0 to 9.999 s; 10.00 to 99.99 s; 100.0 to 9999 s.
  - Metering range, in cycles: from 0 to 1000.0 cycles; from 1000 to 5000 cycles.
  - Counting mode: this mode is foreseen for the test of energy meters. Maximum input frequency: 10 kHz.

Auxiliary binary Output
Contact range: 5 A; 250 V AC; 120 V DC.
Measuring Section
Output measurements
Current and voltage AC and DC outputs measurement accuracy: ± 0.5%.

The following measurements are calculated from T 3000 generated outputs:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase angle</td>
<td>1°</td>
</tr>
<tr>
<td>Frequency</td>
<td>1 mHz</td>
</tr>
</tbody>
</table>

Other measurements available on the T 3000, calculated from external inputs.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE POWER</td>
<td>P</td>
</tr>
<tr>
<td>REACTIVE POWER</td>
<td>Q</td>
</tr>
<tr>
<td>APPARENT POWER</td>
<td>S</td>
</tr>
<tr>
<td>POWER FACTOR</td>
<td>p.f.</td>
</tr>
<tr>
<td>IMPEDANCE</td>
<td>Z and phase</td>
</tr>
<tr>
<td>ACTIVE IMPEDANCE COMPONENT</td>
<td>R</td>
</tr>
<tr>
<td>REACTIVE IMPEDANCE COMPONENT</td>
<td>X</td>
</tr>
<tr>
<td>FREQUENCY</td>
<td>f</td>
</tr>
<tr>
<td>PHASE ANGLE IEXT to V AUX</td>
<td></td>
</tr>
<tr>
<td>PHASE ANGLE VEXT to V AUX</td>
<td></td>
</tr>
<tr>
<td>RESISTANCE</td>
<td>R</td>
</tr>
</tbody>
</table>

Ratio Measurement Accuracy
Ratio: 0.1 to 9999; 0.5% typical; 1% max error.

Resistance
Up to 250 Ohm; 0.5% typical; 1% max error.

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

Graphic Display
The large graphic 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 3000 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. Test settings can be stored and recalled from the memory. Up to 10 settings can be stored and recalled.

TDMS Software
When the PC is connected, settings can be created and transferred into T 3000 using TDMS. TDMS is a user friendly software that allows, via a graphical interface, to control the set-up of T 3000 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 110 V ± 10%; 50-60 Hz; to be specified at order. (There are power reductions for mains voltage below 220V).
- Dimensions: 455 (W) x 325 (D) x 290 (H) mm.
- Weight: 34 kg.

The instrument comes complete with the following items:
- User’s manual;
- Spare fuses (no. 5), T16A;
- Software TDMS with user manual.
- Set of connection cables, included in a suitable transport case with wheels and handle.

STANDARD ACCESSORIES

Connection cable and test connectors
- N. 1 Mains supply cable, 2 m long.
- N. 1 Interface cable for RS232 port.
- N. 2 High current connection cables, 100 sq. mm, 4 m long, for tests up to 800 A, terminated on one side with an high current male connector and the other side with a high current female connector.
- N. 2 High current connection cables, 100 sq. mm, 0.5 m long, for tests up to 800 A, terminated on one side with an high current male connector, and on the other side with a clamp.
- N. 2 High voltage connection cables, 4 m long, 5 kV, with earth screen, terminated on one side with an HV connector, and on the other side with safety banana plugs.
- N. 2 Low current connection cables, 10 sq. mm, 4 m long, terminated on one side with the high current connector, and on the other side with a 4 mm banana plug.
- N. 2 Low current connection cables, 2.5 sq. mm, 10 m long, terminated on both sides with a 4 mm banana plug.
- N. 8 Adapters for relay connection. Adapters are 20 cm long, and are terminated on one side with a banana socket and on other side with a pin terminator.
- N. 4 Clamps to connect low voltage or low current or measurements.

- N. 1 Cable for low voltage measurement connection, shielded, 10 m long, terminated on one side with the measurement connector, and on the other side with two clamps.
- N. 1 Cable for the 600 V measurement connection, shielded, 10 m long, terminated on one side with three 4 mm banana plugs, and on the other side with two clamps.
- N. 1 Grounding cable, 8 m long, terminated on one side with a 4 mm banana plug, and on the other side with an earth connection clamp.
- N. 6 Cables 2 meters long, terminated on both sides with banana plugs. Colours Black.
- N. 2 Cables 2 meters long, terminated on both sides with banana plugs. Colours Blue.
- N. 4 Cables 2 meters long, terminated on both sides with banana plugs. Colours Red.
- N. 4 Crocodile Clamps (2 black and 2 red).
- N. 1 Connection Cables Transport case.

OPTIONAL ACCESSORIES

Thermal printer
Optional thermal printer, for the printout of the V-I curve in the CT saturation test and other test results. Thermal Paper 112 mm wide.

Transit case
Heavy duty aluminium transit case with wheels; it allows delivering T 3000 with no concern about transport shocks. Heavy duty transport case in black plastics is also available.

Current clamp
The current clamp allows to avoid opening the secondary current circuit when performing the primary test of CT burden.
OPTIONAL MODULES

High IDC Module - 400 A
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 3000; 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: 100.0 µOhm; 1.000, 10.00, 100.0 mOhm; 1.000 Ohm, auto-ranging. Connection cables are included with the option.

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

FT 1000 current filter
It is connected in series to the current output and guarantees a sinusoidal waveform also when testing current relays with heavily saturating burdens, that tend to distort the current waveform.

Earth resistance and resistivity test kit
The test of earth resistance and resistivity is included in T 3000 as a standard feature. The option is referred to the kit of connection cables and auxiliary spikes that allows executing these tests.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>CODE</th>
<th>MODULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10102</td>
<td>T 3000 - 3000 V OUTPUT - 230 V complete with TDMS software and test cable kit</td>
</tr>
<tr>
<td>20102</td>
<td>T 3000 - 3000 V OUTPUT - 115 V complete with TDMS software and test cable kit</td>
</tr>
<tr>
<td>30102</td>
<td>T 3000 - 1200 V OUTPUT - 230 V complete with TDMS software and test cable kit</td>
</tr>
<tr>
<td>40102</td>
<td>T 2000 - 1200 V OUTPUT - 115 V complete with TDMS software and test cable kit</td>
</tr>
<tr>
<td>17102</td>
<td>Aluminium transport case</td>
</tr>
<tr>
<td>24102</td>
<td>Plastics transport case</td>
</tr>
<tr>
<td>16102</td>
<td>Current Clamp 1/1000 Max 100A</td>
</tr>
<tr>
<td>14102</td>
<td>Thermal Printer 112 mm</td>
</tr>
<tr>
<td>13102</td>
<td>High IDC module 400 A</td>
</tr>
<tr>
<td>43102</td>
<td>Universal scanning head SH-2003</td>
</tr>
<tr>
<td>40093</td>
<td>D 1000 differential relay est module</td>
</tr>
<tr>
<td>19102</td>
<td>Earth Resistance and Soil Resistivity Kit</td>
</tr>
<tr>
<td>16093</td>
<td>FT 100</td>
</tr>
<tr>
<td>26102</td>
<td>SU 3000 Safety grounding unit fir line impedance measurement</td>
</tr>
</tbody>
</table>

APPLICABLE STANDARDS

High Current Booster

The current output of T 3000 can be increased to up to 4000 A with a new type of optional booster controlled by the T 3000 control unit. The BU 2000 option is an innovative design concept that allows to avoid the power losses due to long cables connections. To achieve this, the BU 2000 transformer is placed very close to the device under test (CT primary side, Circuit Breaker main contacts), thus avoiding losses on the high current cables. The BU 2000 is then connected with a long (20 m) low current cable to T 3000 unit. The option can use one, two or four transformers, as a function of the maximum test current and/or the test duration (see table below).

In case of 2 to 4 BU 2000 units, an Interposing Module is necessary.

<table>
<thead>
<tr>
<th>Number of transformers</th>
<th>Weight Kg</th>
<th>Number of turns</th>
<th>Maximum current A</th>
<th>MAX ON s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MAIN</td>
<td>19.5</td>
<td>3</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>3 MAIN</td>
<td>3</td>
<td>2</td>
<td>2000</td>
<td>6</td>
</tr>
<tr>
<td>1 MAIN + 2 MAIN</td>
<td>29.5</td>
<td>2</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>1 AUX + 2 AUX +</td>
<td>2000</td>
<td>2</td>
<td>2000</td>
<td>27</td>
</tr>
<tr>
<td>Interposing</td>
<td>3000</td>
<td>2</td>
<td>3000</td>
<td>6</td>
</tr>
<tr>
<td>1 MAIN + 3 MAIN</td>
<td>49.5</td>
<td>2</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>3 AUX + 2 AUX +</td>
<td>2000</td>
<td>2</td>
<td>2000</td>
<td>27</td>
</tr>
<tr>
<td>Interposing</td>
<td>4000</td>
<td>2</td>
<td>4000</td>
<td>2</td>
</tr>
<tr>
<td>1 MAIN + 3 AUX + 1 AUX</td>
<td>1000</td>
<td>1</td>
<td>1000</td>
<td>INFINITE</td>
</tr>
<tr>
<td>Interposing</td>
<td>2000</td>
<td>1</td>
<td>2000</td>
<td>900</td>
</tr>
<tr>
<td>1 MAIN + 3 AUX +</td>
<td>3000</td>
<td>1</td>
<td>3000</td>
<td>100</td>
</tr>
</tbody>
</table>

BU 2000 Main Module
- Supply voltage: 230 V.
- Voltage output (one turn): 0.91 V.
- Steady power: 1000 VA.
- Weight: 11 kg.
- Dimensions: external diameter 190 mm; height 120 mm.
- Connection of the transformer: by a cable, 20 m long, terminated with connectors on both sides.
- Output current metering: by a current transformer with ratio 1000/1. Accuracy class: 0.5%.
- Connection of the CT: by a cable, 20 m long, that includes a shunt, rated 0.1 Ohm, 25 W, accuracy 0.1%. The cable is terminated with a connector for the connection to the 10 V input of T 2000.

BU 2000 Auxiliary Module
- Supply voltage: 230 V.
- Voltage output (one turn): 0.89 V.
- Steady power: 1000 VA.
- Weight: 10 kg.
- Dimensions: external diameter 190 mm; height 120 mm.

The option is also provided with two high current screw-driven clamps for the connection to high bars and with four high current clamps for the connection to bars located in narrow places.
BU 2000 Interposing Module

- Mains connection: by a 64 A rated connector, provided.
- Power-on: by means of a circuit breaker rated 63 A.
- Coarse current adjustment: by means of a four-position selector switch.
- Connections to T 2000: power supply cord; Variable voltage output; auxiliary contact, timer START input.
- Capable to drive up to four transformers.
- Weight: 5 kg.
- Dimensions: 33 x 30 x 20 cm (WHD).

NOTE: in case of one transformer, the BU 2000 INTERPOSING MODULE is not necessary.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>CODE</th>
<th>MODULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50102</td>
<td>BU 2000 - External Advanced Booster up to 2000 A: (1) Main Module with high current clamps and high current cables, connecting cables.</td>
</tr>
<tr>
<td>51102</td>
<td>BU 2000 - External Advanced Booster up to 3000 A: Main Module with high current clamps, high current cables, Auxiliary Module (1), Interposing Module, connecting cables.</td>
</tr>
<tr>
<td>52102</td>
<td>BU 2000 - External Advanced Booster up to 4000 A: Main Module with high current clamps, high current cables, Auxiliary Modules (3), Interposing Module, connecting cables.</td>
</tr>
<tr>
<td>53102</td>
<td>BU 2000 - Interposing Module</td>
</tr>
<tr>
<td>54102</td>
<td>BU 2000 - Auxiliary Module</td>
</tr>
<tr>
<td>55102</td>
<td>Heavy Duty plastic transport case for BU 2000 (50102)</td>
</tr>
<tr>
<td>56102</td>
<td>Heavy Duty plastic transport case for BU 2000 (51102; 52102)</td>
</tr>
</tbody>
</table>