TRAX
Transformer and Substation Test System

Replaces need for multiple test sets
Saves time by eliminating need for multiple instruments learning
User-friendly interface reduces training and testing time
Portable and compact system components for easy shipping
“State of the art” measurement methods for advanced diagnostic testing

DESCRIPTION
TRAX is a multi-function test system for transformer substation testing. The test system replaces numerous individual testing devices which makes testing with TRAX a time saving and cost effective alternative to conventional measurements using separate instruments.

TRAX is a unique test system for testing power, distribution and instrument transformers, as well as a variety of other substation components. Providing up to 800 A (TRAX 279/280) and 2200 V (2000 A and 12 kV with accessories) with a frequency range adjustable from 5 Hz (1 Hz with tan delta unit) to 500 Hz, TRAX can be used with an integrated touch screen or external computer device with web browser.

Variable levels of voltage and current can be generated and measured with high precision, allowing TRAX to be used for a wide range of applications such as turns ratio, excitation current, winding and contact resistance, impedance, tan delta/power factor testing and various primary tests for LV, MV and HV electrical apparatus including but not limited to:

- Power & distribution transformers
- Instrument transformers
- Bushings
- LV, MV and HV circuit-breakers
- Busbars
- Protection relays
- Grounding systems

TRAX is designed to be a complete solution in transformer testing. With its 4800 VA power capability it is a high efficiency, high accuracy and excellent performance transformer test system.
FEATURES AND BENEFITS
- One unit multi function system for transformer/substation testing
  - Replaces need for multiple test sets
  - Saves time by eliminating need for multiple instruments learning
  - User-friendly interface reduces training and testing time
  - Portable and compact system components for easy shipping
- Outstanding flexibility for selecting output current or voltage signals for various tests
  - AC current up to 2000 A (with TCX 200)
  - DC current up to 100 A
  - AC voltage up to 12 kV (with TDX 120)
  - DC voltage up to 300 V
- State of the art measurement methods for advanced diagnostic testing, e.g.
  - 3-phase Power transformer measurements of:
    - Turns ratio
    - Winding resistance
    - Load tap-changer continuity, timing and dynamic resistance (patent pending)
    - Excitation current
    - Leakage reactance/short-circuit impedance
    - Demagnetization
    - 3-phase transformer measurements without manual cable reconnections (with TSX300)
  - CT and VT testing
  - HV tan delta/power factor (with TDX 120)
- Compact and lightweight
  - 26 kg TRAX 220 (main unit), shipping weight <32 kg
  - Smart cable technology for reducing cable weight

USER INTERFACE
TRAX user interface architecture is based on a number of individual instruments/apps where only the necessary functionality is displayed by default. For manual testing a generic instrument is available where the user selects output, measurement inputs and how the data should be processed.

For testing complete components (e.g. power transformers), measurement results from multiple instruments can be collected and presented in one report.
Winding resistance

Turns ratio

Excitation current

Oscilloscope
APPLICATION

A variety of voltage and current levels can be generated and measured with high precision which allows the multi-function test set to be used for a wide range of applications. Examples are:

- **Power transformer**
  - Ratio and phase
  - Winding resistance
    - Single phase up to 100 A
    - Three-phase/six windings up to 16 A
  - Tap changer testing (single-phase or three-phase)
  - Continuity
  - Dynamic current
  - Dynamic voltage
  - Dynamic resistance (new patent pending method)
  - Demagnetization (adaptive method for fast and efficient process)
  - Magnetic balance
  - Excitation current
  - Leakage reactance/short-circuit impedance
  - Zero-sequence impedance
  - Frequency response of stray losses (FRSL)
  - Tan delta/power factor with individual temperature correction (ITC) and voltage dependence detection (VDD)
  - Capacitance

- **Current transformer**
  - Ratio, burden and polarity
  - Phase and magnitude error
  - Excitation curve (knee - point)
  - Winding resistance
  - Secondary burden
  - Dielectric withstand voltage

- **Voltage transformer**
  - Ratio and polarity
  - Phase and magnitude error
  - Secondary burden
  - Dielectric withstand voltage

- **Resistance testing**
  - Contact resistance
  - DualGround™ measurements

- **Circuit breaker testing**
  - Main and resistor contact timing
  - Motion
  - Operating voltage
  - Coil current
  - Contact resistance

- **Primary testing**
  - Circuit breakers
  - General primary injection tests

- **Protection relays**
  - Relay timing

- **AC insulation testing**
  - Tan delta/Power factor
  - Capacitance
  - Tip-up testing
  - 1-505 Hz frequency range

SPECIFICATIONS TRAX

Specifications are valid at nominal input voltage and an ambient temperature of +25°C ±5°, (77°F). Specifications are subject to change without notice.

**Environment**

<table>
<thead>
<tr>
<th>Application field</th>
<th>For use in high-voltage substations and industrial environments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
</tr>
<tr>
<td>Operating</td>
<td>-20°C to +55°C (-4°F to +131°F)</td>
</tr>
<tr>
<td>Storage</td>
<td>-20°C to +70°C (-4°F to +158°F)</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>&lt; 90%RH, non-condensing</td>
</tr>
</tbody>
</table>

**CE- marking**

<table>
<thead>
<tr>
<th>EMC</th>
<th>2004/108/EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVD</td>
<td>2006/95/EC</td>
</tr>
</tbody>
</table>

**General**

<table>
<thead>
<tr>
<th>Mains input</th>
<th>100-240 V, 50/60 Hz (± 10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input current</strong></td>
<td>≤ 16 A continuous</td>
</tr>
<tr>
<td></td>
<td>Short-term up to 30 A &lt; 60 s</td>
</tr>
<tr>
<td><strong>Main fuses</strong></td>
<td>F1 and F2, 25 A</td>
</tr>
<tr>
<td><strong>GROUND</strong></td>
<td>TEST GROUND</td>
</tr>
<tr>
<td></td>
<td>To be connected to the test object ground before connecting any other cables to the unit.</td>
</tr>
<tr>
<td><strong>GROUND</strong></td>
<td>GROUND</td>
</tr>
<tr>
<td></td>
<td>For connecting an additional ground between the main unit and accessories or to ground external objects e.g. optional trolley</td>
</tr>
</tbody>
</table>

**Dimensions**

<table>
<thead>
<tr>
<th>TRAX 219</th>
<th>475 x 315 x 330 mm (excl. handles) (18.7” x 12.4” x 13”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAX 220</td>
<td></td>
</tr>
<tr>
<td>TRAX 279</td>
<td></td>
</tr>
<tr>
<td>TRAX 280</td>
<td></td>
</tr>
</tbody>
</table>

**Display**

<table>
<thead>
<tr>
<th>TRAX 219 and 279 has no display</th>
</tr>
</thead>
</table>

1) TRAX 219 and 279 has no display
### Outputs

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2200 VAC</td>
<td>1 A, 1 min</td>
<td>The output is disconnected with a relay and the output is “live” only when this generator is selected</td>
</tr>
<tr>
<td></td>
<td>0.2 A, &gt;2 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2500 VA (max)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency range: 5–70 Hz</td>
<td></td>
</tr>
<tr>
<td>0-250 VAC / 0-10 AAC</td>
<td>10 A, 1 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 A, max 10 s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5 A, &gt;2 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency range: 5–505 Hz</td>
<td></td>
</tr>
<tr>
<td>0-200 AAC</td>
<td>200 A/6 V, 1 min</td>
<td>TRAX 219/220</td>
</tr>
<tr>
<td></td>
<td>80 A, &gt;2 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency range: 45–70 Hz</td>
<td></td>
</tr>
<tr>
<td>0-800 AAC</td>
<td>0–800 A/6 V, 1 min</td>
<td>TRAX 279/280</td>
</tr>
<tr>
<td></td>
<td>0–200 A/10 V, &gt;2 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency range: 45–70 Hz</td>
<td></td>
</tr>
<tr>
<td>0-16 ADC</td>
<td>16 A, continuous</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 A continuous</td>
<td></td>
</tr>
<tr>
<td>0-300 VDC</td>
<td>10 A, 1 minute</td>
<td>Rectified DC. Intended to be used as e.g. auxiliary DC supply</td>
</tr>
<tr>
<td></td>
<td>2.5 A, &gt;2 h</td>
<td></td>
</tr>
<tr>
<td>0-100 ADC</td>
<td>100 A, 2 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70 A, continuous</td>
<td></td>
</tr>
<tr>
<td>DC output power</td>
<td>Max 1000 VA, continuous</td>
<td></td>
</tr>
<tr>
<td>Binary output</td>
<td>250 V/35 A (max)</td>
<td>Output contacts for OLTC and circuit breaker operation with internal voltage and current measurements</td>
</tr>
<tr>
<td>AUX</td>
<td>CONTROL</td>
<td>54 V DC</td>
</tr>
<tr>
<td></td>
<td>Directly from power amplifier for powering accessories (TDX/TCX)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POWER</td>
<td>0-235 V AC</td>
</tr>
<tr>
<td>With TRAX TDX</td>
<td>12 kV AC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–12 kV, 1 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–12 kV/300 mA, continuous</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–12 kV/100 mA, continuous</td>
<td></td>
</tr>
<tr>
<td>With TRAX TCX</td>
<td>2000 A AC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–2000 A/2.4 V, 1 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–1000 A/4.8 V, 1 min</td>
<td></td>
</tr>
</tbody>
</table>

### Inputs

<table>
<thead>
<tr>
<th>ANALOG</th>
<th>T 2 3 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>4 x 0-10 A AC/DC</td>
</tr>
<tr>
<td>Voltage</td>
<td>4 x 250/350 V AC/DC</td>
</tr>
<tr>
<td>R1 R2</td>
<td>2 x 0-50 V DC</td>
</tr>
</tbody>
</table>

Intended for resistance measurements but can be used for AC voltage measurement up to 40 Vrms.

<table>
<thead>
<tr>
<th>TRANS</th>
<th>Input for analog transducers and low level analog signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIG IN</td>
<td>Contact or voltage sense</td>
</tr>
<tr>
<td>TIMING</td>
<td>3 x 0-10000 s Binary inputs for timing measurements in timer and relay testing applications. A and B inputs dedicated for Start and Stop.</td>
</tr>
</tbody>
</table>

### Calculated / displayed parameters

- **Arithmetic**: +, –, *, /
- **Power**: P, VA, Q, S
- **Impedance**: R (DC), Z, Xp, Rs, Rp, Ls, Lp, Cs, Cp, phase

### Derating

- **at lower mains voltage**: TRAX specification is valid at 230–240 V mains voltage. Output power is decreased at lower mains voltages.
- **at high ambient temperature**: TRAX specification is valid at 23 ±5°C. Max output current times will be reduced when using TRAX in high ambient temperature.
- **at lower frequencies**: TRAX voltage output specification is at 50 Hz. Maximum voltage output at lower frequencies is limited by the transformer. Derating is linear with frequency and max voltage output at 5 Hz is 10% of rated output.

### Measurement accuracy

- **External AC/DC voltage and current**: 0.05% of reading + 0.05% FS
- **Internal DC current**: 0.1% of reading + 0.1% FS
- **Internal AC current**: 0.2% of reading + 0.2% FS
- **Internal AC voltage**: 0.2% of reading + 0.2% FS

### COM

- **Ethernet port**: For running the instrument from an external PC or connect it to an external network.
- **Connector for Wifi antenna**: For running the instrument wireless from a PC or tablet. (Option)
- **USB**: 3 USB ports for multipurpose use
OPTIONAL ACCESSORIES

Instruments

- TDX 120 – High voltage unit (12 kV) for tan delta and capacitance measurements, AJ-69090

- TCX 200 – High current accessory, AJ-69290

- TSX 300 – 3-phase/6-winding switchbox, AJ-69390 / AJ-69395

Miscellaneous

- Strobe box, AJ-90030

- Interlock foot switch, GC-31150

- Soft light case, GD-31050

- Trolley, AJ-90040
## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Item</th>
<th>Art. No.</th>
</tr>
</thead>
</table>
| **TRAX 280**  
800 A AC current output  
With internal touch screen  
Included software: Manual control and Standard transformer package (AJ-8010X) | AJ-19090 |
| **TRAX 279**  
800 A AC current output  
No internal screen, remote control only  
Included software: Manual control and Standard transformer package (AJ-8010X) | AJ-19190 |
| **TRAX 220**  
200 A AC current output  
With internal touch screen  
Included software: Manual control and Standard transformer package (AJ-8010X) | AJ-19290 |
| **TRAX 219**  
200 A AC current output  
No internal screen, remote control only  
Included software: Manual control and Standard transformer package (AJ-8010X) | AJ-19390 |

**Standard transformer package**  
Software included for all models above  
- Winding resistance with OLTC continuity  
- Demagnetization  
- Turns ratio  
- Excitation current  
- Short-circuit impedance (leakage reactance)  

**Included Accessories**  
(for all models above)  
- Mains cable  
- Ground cable 10 m (33 ft)  
- Test cable set  
- Sense cables 2 x 10 meter (33 ft)  
- Kelvin cables, 2 x 10 meter (33 ft)  
- Current cables, 16 mm², 2 x 10 m (33 ft)  
  - (TRAX219/220)  
- Current cables, 50 mm², 2 x 6 m (20 ft)  
  - (TRAX279/280)  
- HV cables, 2 x 5 m (16 ft)  
- Interlock Fixed, 2 m (6.5 ft)  
- Jumper cable 5 meter (16 ft)  
- Ethernet cable  
- Flight case with wheels  
- User Manual

<table>
<thead>
<tr>
<th>Item</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optional Accessories</strong></td>
<td></td>
</tr>
<tr>
<td>Trolley</td>
<td>AJ-90040</td>
</tr>
<tr>
<td>Soft light case</td>
<td>GD-31050</td>
</tr>
<tr>
<td>Interlock foot switch</td>
<td>GC-31150</td>
</tr>
<tr>
<td>Green/red strobe box (flash light)</td>
<td>AJ-90030</td>
</tr>
</tbody>
</table>

### Additional software packages

**Advanced transformer**  
- Dynamic OLTC measurements (DRM)  
- FRSL (frequency response of stray losses)  
- Magnetic balance  

**Instrument transformer**  
- CT ratio  
- CT burden  
- CT excitation curve (knee point)  
- CT polarity  
- CT winding resistance  
- VT ratio  
- VT burden  
- VT polarity  

**Substation**  
- Circuit-breaker analyzer  
- Relay over current timing  
- Timer  
- Phase angle meter (manual)  
- Ground/earth/impedance (manual)  
- Line impedance/K-factor (manual)  

**Instruments**

- **TDX 120** – High voltage unit for tan delta, capacitance and excitation current measurements. With hardware connected to TRAX main unit the SW app is activated.  

<table>
<thead>
<tr>
<th>Item</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TCX 200</strong> – High current accessory (cable + booster) that can be placed close to the measurement object for minimizing high current cable length/weight when performing high current primary testing up to 2000 A</td>
<td>AJ-69090</td>
</tr>
<tr>
<td><strong>TSX 300</strong> – 3-phase/6-winding switchbox for simplified measurements of turns ratio (250V), winding resistance (16A), excitation current, leakage reactance and FRSL</td>
<td>AJ-69290</td>
</tr>
<tr>
<td><strong>Line impedance kit</strong></td>
<td>AJ-69690</td>
</tr>
</tbody>
</table>

1) See separate datasheets for more information.  
2) To be released in 2017.  
Other options e.g. SFRA/FRAX, DFR/IDAX, DC insulation/MIT offered as separate products if requested.