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 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.

Test capability:
- Winding resistance measurements
- Adaptive algorithm for optimized transformer demagnetization
- True dynamic resistance measurements on load tap-changers
- 250 V transformer turns ratio measurements
- 12 kV dissipation factor and capacitance testing features

The user interface allows fully manual control where the user defines a specific test setup. Alternatively, a variety of individual instruments/apps are available to perform automated testing procedures such as winding resistance, turns ratio, impedance measurements, relay testing, circuit breaker analysis and more. The tests can be organized and reported as separate tests or as a combined full set of test results for the same asset.

The compact, light-weight design, only 26 kg (TRAX 220), allows shipment in its transportation case within the limits of check-in luggage (32 kg)
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
  - 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.

Start screen

My TRAX

Manual Control
Winding resistance

Turns ratio

Excitation current

Contact resistance
**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)
- **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**
  - Single phase testing of primary and secondary relays (> I, < I, > V, < V, > f, < f)
- **AC insulation testing**
  - Tan delta/Power factor
  - Capacitance
  - Tip-up testing
  - 1-505 Hz frequency range

**Specifications**

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

**Environment**

**Application field** For use in high-voltage substations and industrial environments

**Temperature**

- Operating: -20°C to +55°C (-4°F to +131°F)
- Storage: -20°C to +70°C (-4°F to +158°F)

**Humidity** < 90%RH, non-condensing

**CE- marking**

- **EMC**: 2004/108/EC
- **LVD**: 2006/95/EC

**General**

Mains input

- **TRAX 219**: 100-240 V, 50/60 Hz (± 10%)
  - Input current ≤ 16 A continuous
    - Short-term up to 30 A < 60 s
  - Main fuses F1 and F2, 25 A

- **TRAX 220**: 25 kg (55 lbs)
  - TEST GROUND
    - To be connected to the test object ground before connecting any other cables to the unit.

- **TRAX 280**: 26 kg (57 lbs)
  - GROUND
    - For connecting an additional ground between the main unit and accessories or to ground external objects e.g. optional trolley

**Dimensions**

- **TRAX 219**: 475 x 315 x 330 mm (excl. handles)
  - (18.7” x 12.4” x 13”)

**Weight**

- **TRAX 219**: 25 kg (55 lbs)
- **TRAX 220**: 26 kg (57 lbs)
- **TRAX 280**: 30 kg (66 lbs)

**Display**

- **Size**: 10.4”
- **Resolution**: 1024x768 XGA
- **Type**: TFT touch
- **Contrast ratio**: 1000:1
- **Nits**: 1000

**Outputs**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0-2200 VAC</strong></td>
<td>1 A, 1 min 2500 VA (max)  Frequency range: 5-70 Hz</td>
<td>The output is additionally disconnected with a relay and the output is “live” only when this generator is selected</td>
</tr>
<tr>
<td><strong>0-250 VAC / 0-10 AAC</strong></td>
<td>10 A, 1 min 20 A (short-term, typically a few seconds) Frequency range: 5-505 Hz</td>
<td>TRAX 220</td>
</tr>
<tr>
<td><strong>0-200 AAC</strong></td>
<td>0-200 A/6 V, 1 min 0-20 A/6 V, continuous Frequency range: 45-70 Hz</td>
<td>TRAX 220</td>
</tr>
<tr>
<td><strong>0-800 AAC</strong></td>
<td>0-800 A/6 V, 30 s 0-250 A/10 V, 1 min Frequency range: 45-70 Hz</td>
<td>TRAX 280</td>
</tr>
<tr>
<td><strong>0-16 AAC</strong></td>
<td>0-16 A, continuous 0-1 A continuous</td>
<td>TRAX 280</td>
</tr>
</tbody>
</table>
### Transformer and Substation Test System

**TRAX**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-300 Vdc</td>
<td>0-10 A, 1 minute Rectified DC. Intended to be used as e.g. auxiliary DC supply</td>
</tr>
<tr>
<td>0-100 Adc</td>
<td>100 A, 1 minute 70 A, continuous</td>
</tr>
<tr>
<td>DC output power</td>
<td>Max 1000 VA, continuous Max 50 V compliance voltage</td>
</tr>
<tr>
<td>Binary output</td>
<td>250 V/35 A (max) 2 x 0-10000 s Output contacts for LTC and CB operation with internal voltage and current measurements</td>
</tr>
<tr>
<td><strong>AUX</strong></td>
<td><strong>CONTROL</strong> 54 V DC Ethernet communication and power to accessories.</td>
</tr>
<tr>
<td><strong>POWER</strong></td>
<td>0-235 V AC Directly from power amplifier for powering accessories (TDX/TCX)</td>
</tr>
<tr>
<td>With TRAX TDX</td>
<td>12 kV AC 0-12 kV, 1 min 0-12 kV/300 mA, 4 min 0-12 kV/100 mA, continuous</td>
</tr>
<tr>
<td>With TRAX TCX</td>
<td>2000 A AC 0-2000 A/2.5 V, 1 min 0-1000 A/5 V, 1 min</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td><strong>ANALOG</strong> 4 x 0-10 A AC/DC 4 x 250/350 V AC/DC</td>
</tr>
<tr>
<td>1 2 3 4</td>
<td><strong>R1 R2</strong> 2 x 0-50 V DC Intended for resistance measurements but can be used for AC voltage measurement up to 60 Vrms</td>
</tr>
<tr>
<td><strong>TRANS</strong></td>
<td><strong>Input for analog transducers and low level analog signals</strong></td>
</tr>
<tr>
<td><strong>TRIG IN</strong></td>
<td><strong>Contact or voltage sense</strong></td>
</tr>
<tr>
<td><strong>TIMING</strong></td>
<td><strong>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.</strong></td>
</tr>
</tbody>
</table>

### Calculated / displayed parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetic</td>
<td>+, -, *, /</td>
</tr>
<tr>
<td>Power</td>
<td>P, VA, Q, S</td>
</tr>
<tr>
<td>Impedance</td>
<td>Z, Xp, Xs, Rs, Rp, Ls, Lp, Cs, Cp, phase</td>
</tr>
<tr>
<td>Time</td>
<td>Binary start-stop-change, generator start-stop, trig to event</td>
</tr>
<tr>
<td>User defined formulas</td>
<td></td>
</tr>
</tbody>
</table>

### Derating at lower mains voltage

TRAX specification is valid at 230-240 V mains voltage. Output power is decreased at lower mains voltages.

### Derating 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.

### Measurement accuracy

<table>
<thead>
<tr>
<th>Type</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>External AC/DC voltage and current</td>
<td>0.05% of reading + 0.05% FS</td>
</tr>
<tr>
<td>Internal DC current</td>
<td>0.1% of reading + 0.1% FS</td>
</tr>
<tr>
<td>Internal AC current</td>
<td>0.2% of reading + 0.2% FS</td>
</tr>
<tr>
<td>Internal AC voltage</td>
<td>0.2% of reading + 0.2% FS</td>
</tr>
</tbody>
</table>

### COM

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet port</td>
<td>For running the instrument from an external PC or connect it to an external network.</td>
</tr>
<tr>
<td>Connector for Wifi antenna</td>
<td>For running the instrument wireless from a PC or tablet. (Option)</td>
</tr>
<tr>
<td>USB</td>
<td>3 USB ports for multipurpose use</td>
</tr>
</tbody>
</table>
## TRAX Transformer and Substation Test System

### Ordering information

<table>
<thead>
<tr>
<th>Item</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRAX 280</strong></td>
<td></td>
</tr>
<tr>
<td>800 A AC current output</td>
<td></td>
</tr>
<tr>
<td>With internal touch screen</td>
<td></td>
</tr>
<tr>
<td>SW: Manual Control and Standard Transformer package with the following apps:</td>
<td></td>
</tr>
<tr>
<td>▪ Winding resistance with OLTC continuity</td>
<td></td>
</tr>
<tr>
<td>▪ Demagnetization</td>
<td></td>
</tr>
<tr>
<td>▪ Turns ratio</td>
<td></td>
</tr>
<tr>
<td>▪ Excitation current</td>
<td></td>
</tr>
<tr>
<td>▪ Short-circuit impedance (leakage reactance)</td>
<td>AI-19090</td>
</tr>
<tr>
<td><strong>TRAX 220</strong></td>
<td></td>
</tr>
<tr>
<td>200 A AC current output</td>
<td></td>
</tr>
<tr>
<td>With internal touch screen</td>
<td></td>
</tr>
<tr>
<td>SW: Manual Control and Standard Transformer package with the following apps:</td>
<td></td>
</tr>
<tr>
<td>▪ Winding resistance with OLTC continuity</td>
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<tr>
<td>▪ Demagnetization</td>
<td></td>
</tr>
<tr>
<td>▪ Turns ratio</td>
<td></td>
</tr>
<tr>
<td>▪ Excitation current</td>
<td></td>
</tr>
<tr>
<td>▪ Short-circuit impedance (leakage reactance)</td>
<td>AI-19291</td>
</tr>
<tr>
<td><strong>TRAX 219</strong></td>
<td></td>
</tr>
<tr>
<td>200 A AC current output</td>
<td></td>
</tr>
<tr>
<td>SW: Manual Control</td>
<td></td>
</tr>
<tr>
<td>No internal screen, remote control only</td>
<td>Ai-19390</td>
</tr>
</tbody>
</table>

**Included Accessories (for all models above)**

- Mains cable
- Ground cable 5 m (16 ft)
- Test cable set
- Current cables, 2 x 10 m (33 ft)
- HV cables, 2 x 5 m (16 ft)
- Interlock Fixed, 2 m (6.5 ft)
- Jumper cable
- Ethernet cable
- SW Basic package
- Transport case

### Optional Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<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>

### SW packages for extended instruments/apps

**Advanced transformer**

SW package with the following apps:

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

**CT/VT**

SW package with the following apps:

- CT ratio (with burden)
- CT burden
- CT excitation curve (knee point)
- Polarity
- CT ratio with voltage
- CT winding resistance
- CT voltage withstand test
- CT ratio Rogowski
- CT ratio low power
- VT ratio
- VT burden
- VT secondary voltage withstand test
- Polarity
- VT electronic

### Substation

SW package with the following apps:

- Circuit-breaker analyzer
- LV CB timing
- Single-phase relay testing
- Timer
- Phase angle meter
- Ground/earth/impedance
- Line impedance/K-factor
- Wattmeter

**TRAX TDX 120** – High voltage unit for tan delta, capacitance and excitation current measurements.

**TRAX TCX 200** – 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

**TRAX TSX 300** – Automated 3-phase/6-winding switchbox for automated turns ratio (250V), winding resistance (16A), excitation current, leakage reactance, FRSL and magnetic balance measurements

Other options e.g. SFRA/FRAX, DFR/IDAX, DC insulation/MIT offered as separate products if requested.

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TDX120, high voltage unit (12 kV) for tan delta and capacitance measurements (optional accessory, AJ-69090).