TRAX
Transformer and Substation Test System

Description

TRAX is a multi-functional test set solution 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.

These 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

The TRAX multifunction instrument is designed to be a complete solution in transformer testing. With its 100 A at up to 50 V compliance voltage it is a high efficiency, high accuracy and excellent performance transformer test set.

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 learning
  - User-friendly interface reduces training and testing time
  - Portable and compact parts 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 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 (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.
Megger. TRAX 219/220/280
Transformer and Substation Test System

Excitation current

Winding resistance

Oscilloscope

Turns ratio
Application

A variety of voltage and current levels can be generated and measured with high precision which allows the test system 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**
  - 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
Specification TRAX 219/220/280

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 (68°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
100-240 V, 50/60 Hz (± 10%)

Input current
≤ 16 A continuous Short-term up to 30 A < 60 s

Display

Size 10.4”

Resolution 1024x768 XGA

Type TFT touch

Contrast ratio 1000:1

Nits 1000

Outputs

Item | Specification | Comment
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Frequency range, all AC outputs | 5-505 Hz | 1-505 Hz with TDX accessory Derating at frequencies below 50 Hz, linear voltage drop

AC output power | Max 5 kVA, 10 s Max 2.5 kVA, 1 min Max 1 kVA, 30 min

800 A AC output | 0-800 A/6 V, 10 s 0-250 A/10 V, 1 min

10 A AC output | 0-10 A/250 V, 1 min 0-20 A, 10s

2000 A AC output | 0-2000 A/2.5 V, 1 min 0-1000 A/5 V, 1 min

DC output power | Max 1000 VA, 1 min Max 700 VA, cont Max 50 V compliance voltage

100 A DC output | 100 A, max 1 min 0-70 A, continuous

16 A DC output | 0-16 A continuous

250 V AC output | Max 2500 VA 0-250 V/10 A, 1 min

2200 V AC output | Max 2500 VA 0-2200 V/1 A, 1 min

12 kV AC output | 0-12 kV/450 mA, 1 min 0-12 kV/300 mA, 4 min 0-12 kV/100 mA, continuous

300 V DC output | 0-300 V/10 A Rectified DC. Intended to be used as e.g. auxiliary DC supply

Binary output | 2 x 0-10000 s Output contacts for LTC and CB operation with internal voltage and current measurements

Measurements | Internal U and I measurements on generator outputs

Inputs

General AC/DC current | 4 x 0-10 A Auto ranging

General AC/DC voltage | 4 x 0-250 V Auto ranging

DC voltage | 2 x 0-50 V For resistance measurements

Binary input/timing | 3 x 0-10000 s Contact or voltage sense

Trigger input | Contact or voltage sense

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

Calculated / displayed parameters

Arithmetic | +, -, *, /

Power | P, VA, Q, S, Watts

Impedance | R (DC), Z, Zp, Xs, Rs, Rp, Ls, Lp, Cs, Cp, phase

Time | Binary start-stop-change, generator start-stop, trig to event

User defined formulas

Derating at low mains voltage
Max rating at 230-240 mains voltage is 4800 VA. When mains voltage is 100-120 V, the max output is limited to 3200 VA, suggesting 33% lower output power at 100 V.

Derating at high ambient temperature
Max output time will be shorter when using the TRAX in ambient temperature >25°C. See the user manual for details.
## Ordering information

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

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<tr>
<td><strong>Optional Accessories</strong>&lt;br&gt;Trolley</td>
<td>AJ-90040</td>
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<tr>
<td>Soft light case</td>
<td>GD-31050</td>
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<tr>
<td>Interlock foot switch</td>
<td>GC-31150</td>
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<tr>
<td>Green/red strobe box (flash light)</td>
<td>AJ-90030</td>
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**SW packages for extended instruments/ apps**

**Advanced transformer**
- SW package with the following apps:<br>▪ Dynamic OLTC measurements (DRM)<br>▪ FRSL (frequency response of stray losses)<br>▪ Magnetic balance | AJ-8020X |

**CT/VT**
- SW package with the following apps:<br>▪ C T ratio (with burden)<br>▪ CT burden<br>▪ CT excitation curve (knee point)<br>▪ Polarity<br>▪ CT ratio with voltage<br>▪ CT winding resistance<br>▪ CT voltage withstand test<br>▪ CT ratio Rogowski<br>▪ CT ratio low power<br>▪ VT ratio<br>▪ VT burden<br>▪ VT secondary voltage withstand test<br>▪ Polarity<br>▪ VT electronic | AJ-8030X |

**Substation**
- SW package with the following apps:<br>▪ Circuit-breaker analyzer<br>▪ LV CB timing<br>▪ Single-phase relay testing<br>▪ Timer<br>▪ Phase angle meter<br>▪ Ground/earth/impedance<br>▪ Line impedance/K-factor<br>▪ Wattmeter | AJ-8040X |

**TRAX TDX 120** – High voltage unit for tan delta, capacitance and excitation current measurements. | AJ-69090 |

**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 | AJ-69290 |

**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 | AJ-69390 |

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

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