

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)

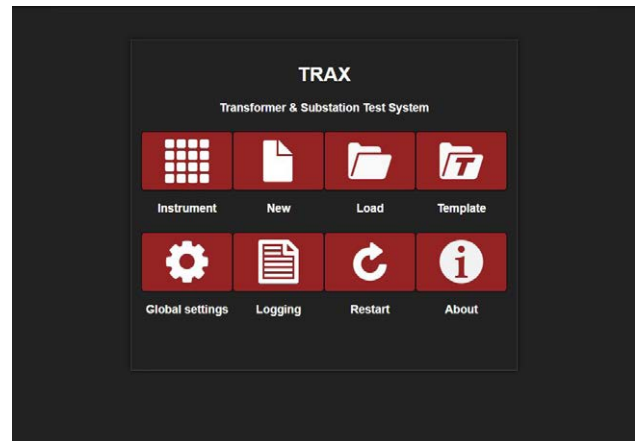
FEATURES AND BENEFITS

- One unit multi function system for transformer/substation testing
 - ▶ Replaces need for multiple test sets
 - ▶ Saves time by eliminating need for multiple instruments 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

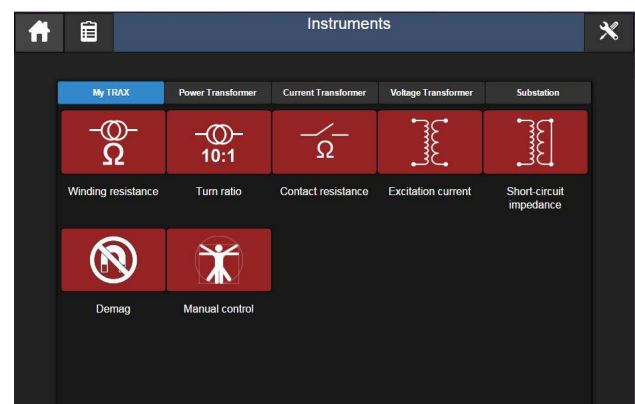
USER INTERFACE

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.

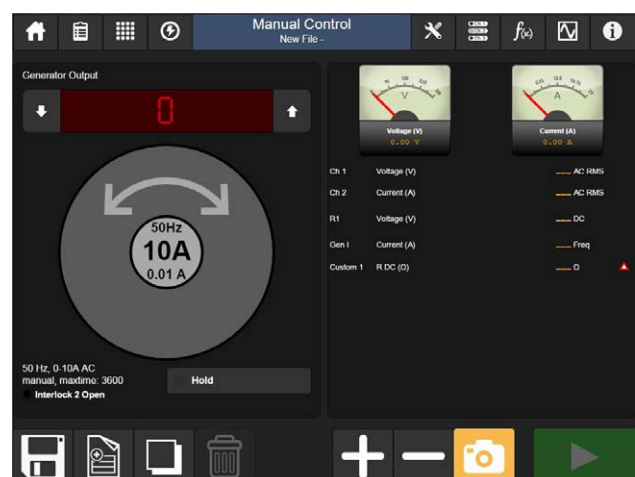
For testing complete components (e.g. power transformers), measurement results from multiple instruments can be collected and presented in one report.



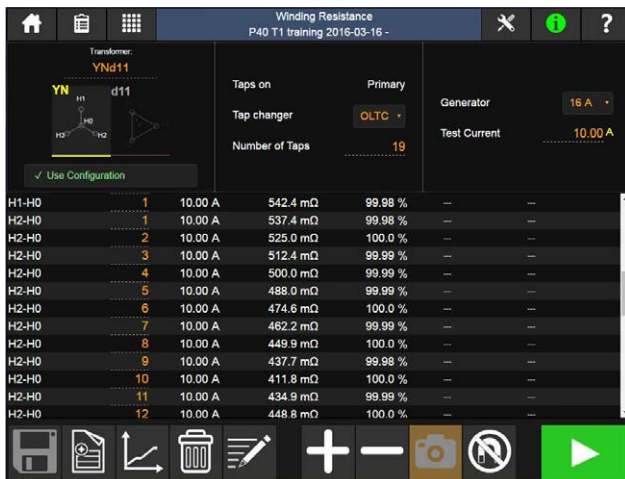
Start screen



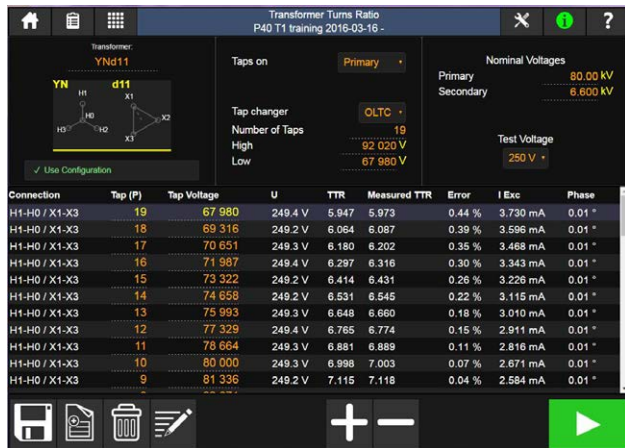
My TRAX



Manual Control



Winding resistance



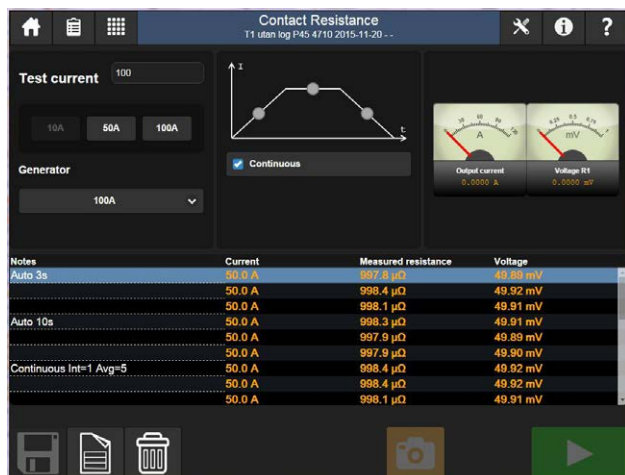
Turns ratio



Excitation current



Oscilloscope



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)
 - ▶ 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

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

| | |
|--------------------------|---|
| <i>Application field</i> | For use in high-voltage substations and industrial environments |
| <i>Temperature</i> | |
| <i>Operating</i> | -20°C to +55°C (-4°F to +131°F) |
| <i>Storage</i> | -20°C to +70°C (-4°F to +158°F) |
| <i>Humidity</i> | < 90%RH, non-condensing |

CE- marking

| | |
|------------|-------------|
| <i>EMC</i> | 2004/108/EC |
| <i>LVD</i> | 2006/95/EC |

General

| | |
|--|---|
| <i>Mains input</i> | 100-240 V, 50/60 Hz (± 10%) |
| <i>Input current</i> | ≤ 16 A continuous Short-term up to 30 A < 60 s |
| <i>Main fuses</i> | F1 and F2, 25 A |
|  | TEST GROUND To be connected to the test object ground before connecting any other cables to the unit. |
|  | GROUND For connecting an additional ground between the main unit and accessories or to ground external objects e.g. optional trolley |
| <i>Dimensions</i> | 475 x 315 x 330 mm (excl. handles) (18.7" x 12.4" x 13") |
| <i>Weight</i> | |
| <i>TRAX 219</i> | 25 kg (55 lbs) |
| <i>TRAX 220</i> | 26 kg (57 lbs) |
| <i>TRAX 280</i> | 30 kg (66 lbs) |
| <i>Display</i> | |
| <i>Size</i> | 10.4" |
| <i>Resolution</i> | 1024x768 XGA |
| <i>Type</i> | TFT touch |
| <i>Contrast ratio</i> | 1000:1 |
| <i>Brightness</i> | 1000 cd/m ² |

| Outputs | | |
|---|---|---|
| Item | Specification | Comment |
| 0-2200 V_{AC} | 1 A, 1 min 0.2 A, >2 h 2500 VA (max) Frequency range: 5-70 Hz | The output is disconnected with a relay and the output is "live" only when this generator is selected |
| 0-250 V_{AC} / 0-10 A_{AC} | 10 A, 1 min 20 A, max 10 s 2.5 A, >2 h Frequency range: 5-505 Hz | |
| 0-200 A_{AC} | 200 A/6 V, 1 min 80 A, >2 h Frequency range: 45-70 Hz | TRAX220 |
| 0-800 A_{AC} | 0-800 A/6 V, 1 min 0-200 A/10 V, >2 h Frequency range: 45-70 Hz | TRAX280 |
| 0-16 A_{DC} | 16 A, continuous | |
| | 1 A continuous | |
| 0-300 V_{DC} | 10 A, 1 minute 2.5 A, >2 h | Rectified DC. Intended to be used as e.g. auxiliary DC supply |
| 0-100 A_{DC} | 100 A, 2 minutes 70 A, continuous | |
| <i>DC output power</i> | Max 1000 VA, continuous Max 50 V compliance voltage | |
| <i>Binary output</i> | 250 V/35 A (max) 2 x 0-10000 s | Output contacts for OLTC and circuit breaker operation with internal voltage and current measurements |
| AUX | | |
| CONTROL | 54 V DC | Ethernet communication and power to accessories. |
| POWER | 0-235 V AC | Directly from power amplifier for powering accessories (TDX/TCX) |
| <i>With TRAX TDX</i> | 12 kV AC 0-12 kV, 1 min 0-12 kV/300 mA, 4 min 0-12 kV/100 mA, continuous | |
| <i>With TRAX TCX</i> | 2000 A AC 0-2000 A/2.4 V, 1 min 0-1000 A/4.8 V, 1 min | |

| Inputs | | |
|----------------|---------------------|---|
| ANALOG | | |
| 1 2 3 4 | | |
| <i>Current</i> | 4 x 0-10 A AC/DC | |
| <i>Voltage</i> | 4 x 250/350 V AC/DC | |
| R1 R2 | 2 x 0-50 V DC | Intended for resistance measurements but can be used for AC voltage measurement up to 40 V _{RMS} |
| TRANS | | Input for analog transducers and low level analog signals |
| TRIG IN | | Contact or voltage sense |
| TIMING | 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. |

Calculated / displayed parameters

| | |
|-------------------|--|
| <i>Arithmetic</i> | +, -, *, / |
| <i>Power</i> | P, VA, Q, S |
| <i>Impedance</i> | R (DC), Z, X _p , X _s , R _s , R _p , L _s , L _p , C _s , C _p , phase |

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.

Derating 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

| | |
|---|-----------------------------|
| <i>External AC/DC voltage and current</i> | 0.05% of reading + 0.05% FS |
| <i>Internal DC current</i> | 0.1% of reading + 0.1% FS |
| <i>Internal AC current</i> | 0.2% of reading + 0.2% FS |
| <i>Internal AC voltage</i> | 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 |

ORDERING INFORMATION

| Item | Art. No. |
|---|----------|
| TRAX 280 800 A AC current output With internal touch screen SW: Manual Control and Standard Transformer package with the following apps: <ul style="list-style-type: none"> Winding resistance with OLTC continuity Demagnetization Turns ratio Excitation current Short-circuit impedance (leakage reactance) | AJ-19090 |
| TRAX 220 200 A AC current output With internal touch screen SW: Manual Control and Standard Transformer package with the following apps: <ul style="list-style-type: none"> Winding resistance with OLTC continuity Demagnetization Turns ratio Excitation current Short-circuit impedance (leakage reactance) | AJ-19290 |
| TRAX 219 200 A AC current output SW: Manual Control No internal screen, remote control only | AJ-19390 |
| Included Accessories (for all models above) <ul style="list-style-type: none"> 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) (TRAX 280) HV cables, 2 x 5 m (16 ft) Interlock Fixed, 2 m (6.5 ft) Jumper cable 5 meter (16 ft) Ethernet cable SW Standard package Transport case User Manual | |



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

| Item | Art. No. |
|---|----------|
| Optional Accessories | |
| Trolley | AJ-90040 |
| Soft light case | GD-31050 |
| Interlock foot switch | GC-31150 |
| Green/red strobe box (flash light) | AJ-90030 |
| SW packages for extended instruments/apps | |
| Advanced transformer SW package with the following apps: <ul style="list-style-type: none"> Dynamic OLTC measurements (DRM) FRSL (frequency response of stray losses) Magnetic balance | AJ-8020X |
| CT/VT SW package with the following apps: <ul style="list-style-type: none"> 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 | AJ-8030X |
| Substation SW package with the following apps: <ul style="list-style-type: none"> Circuit-breaker analyzer LV CB timing Single-phase relay testing Timer Phase angle meter Ground/earth/impedance Line impedance/K-factor Wattmeter | AJ-8040X |
| Instruments | |
| 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 requested. | |

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TRAX_DS_en_V07a
Art. No. ZI-AJ01E ■ Doc.AJ0204GE ■ 2016
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