

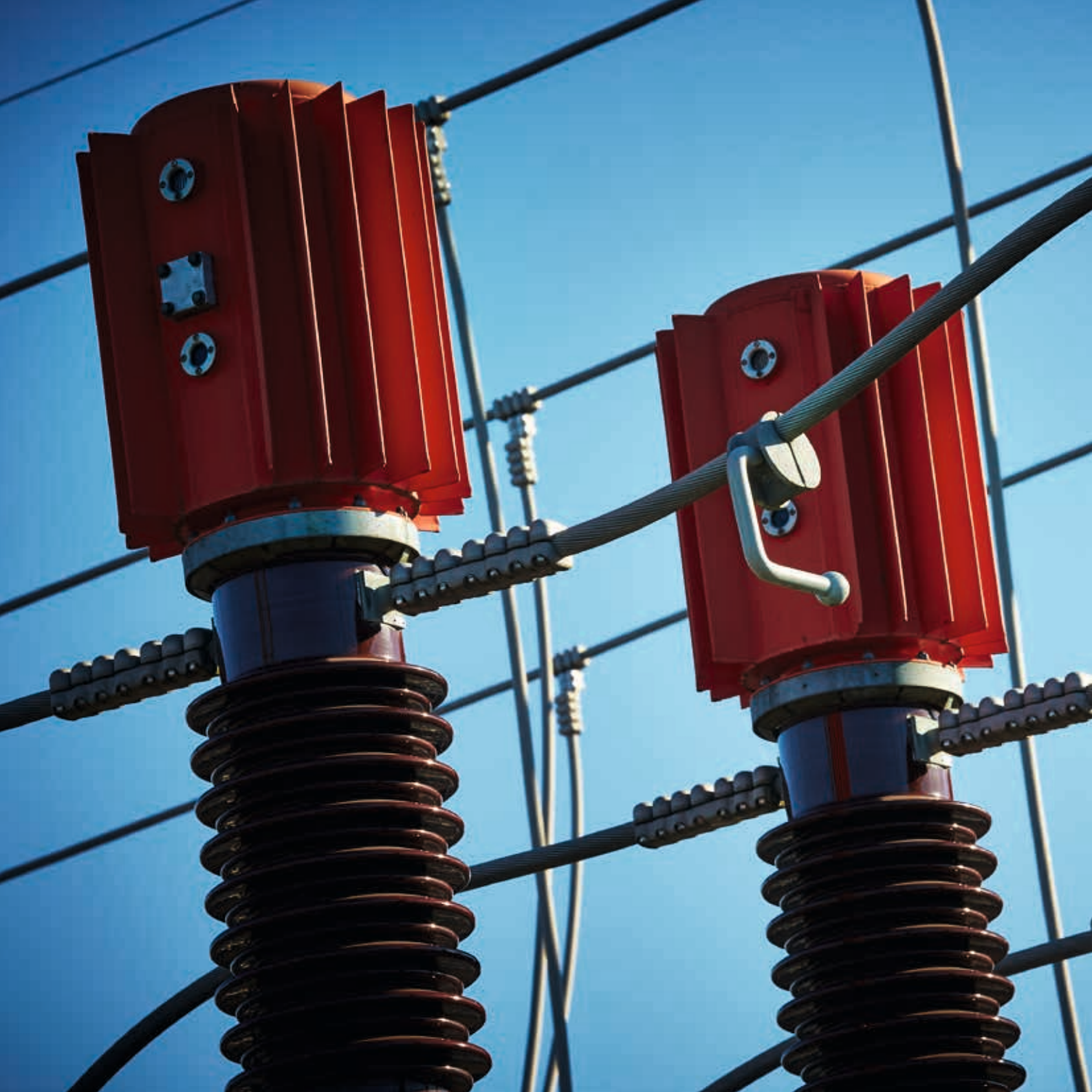


TRAX

Transformer
and Substation
Test System



Megger[®]



Multi-functional like no other

As a leading provider of measuring instruments for electrical power applications, Megger has selected the best from their range of power testing equipment, added unmatched functionality plus intelligent simplicity, and packed it all into an easy-to-transport box ready for your next test assignment. It is called TRAX.

In today's testing environment, there's little that TRAX cannot measure. Thanks to a unique combination of high-performance hardware, modern software and intuitive interface, plus a series of outstanding apps, it easily exceeds the performance and functionality of rival units. As a single-unit, multi-tasking test system, nothing measures up to TRAX.

TRAX – time-saver at your service

One product. One software. One world.

TRAX is not just another multi-functional test instrument, but rather many intelligent instruments built into one box. The software includes a number of apps, making it fast and easy to perform a large range of different tests. The hardware offers unmatched flexibility and the range of cables and accessories adds even more flexibility, making the TRAX an efficient and time saving system for any user in the world.

One product

TRAX is a multi-functional solution for transformer testing. It also adds several common substation testing functionalities, and ultimately replaces numerous individual testing devices. Compared to conventional single-functionality instruments, TRAX saves time and is more cost effective.

TRAX applications range from power transformers, where it offers several unique and outstanding features, to instrument transformers, circuit breakers, relays and many other substation components.

One software

What do we mean by ‘intelligent simplicity’? One instrument with just one software is, of course, easier to learn compared to different instruments with different software. Furthermore, automatic information and downloads via Ethernet make updating your TRAX software easier than anything you have experienced before.

“Simplicity is the ultimate sophistication.”

Leonardo da Vinci (1452–1519)



TRAX Manual Control

The Intuitive TRAX software takes little time to learn. Different apps for each instrument make it quick and easy to perform specific tests and measurements such as winding resistance, turns ratio, impedance measurements, relay testing and circuit breaker analysis without having to know everything about other applications. The user interface also allows full manual control in a specific application, allowing users to define a specific test setup; e.g. generator setting, choice of measurement channels, what to calculate and how to present the results.

One world

Although information and transportation technology appears to make the world smaller, the diversity of demands and expectations among end-users seems to move in the opposite direction. The electric power industry is no exception. New test equipment is expected to deliver more functionality for less money, letting utilities and service companies around the globe decrease learning and transportation time while increasing revenue and valuable data to keep their assets healthy and profitable.

Despite a multitude of languages and different standards from regional and national organizations, TRAX offers almost unlimited possibilities wherever you are in the world. Thanks to its compactness and low weight (less than 32 kg in its transport case), TRAX travels easily with you. For an international service company, this can save weeks of costly shipping time.

One product. For a variety of different tests.

Testing transformers and other substation assets takes time, especially if it involves learning, shipping, and using a lot of different test instruments. Having just one instrument for a variety of different tasks makes a lot of sense. What's more, TRAX doesn't compromise on the performance you normally expect when using individual test sets from one or several manufacturers.

TRAX is a no-compromise transformer and substation test system. It's packed with features that will make the transformer test engineer's task easier and quicker while results will become more reliable and accurate. Take the 100 A true DC test current for winding resistance measurements or the 250 V AC voltage for turns ratio measurements for example. Consider also the adaptive technique for fast and efficient demagnetization of the transformer core and the patented technique for dynamic measurements on load tap-changers. TRAX also features 12 kV tan delta/ power factor testing* as well as patented technique for temperature correction and voltage dependence detection. TRAX is arguably the best transformer tester available today!

*requires optional TDX module



Add DC resistance measurements with dual-ground capability, a three-phase circuit-breaker analyzer, CT and VT testing, basic relay testing capabilities and you also have a multi-function substation test system that will stand-up against any comparable test set.

The features and applications list includes :

- State-of-the-art winding resistance and tap-changer testing
 - 100 A/50 V compliance
 - Adaptive demagnetization
 - Tap-changer control
 - Dynamic resistance measurements
- High-voltage ratio measurement (250 V and 2200 V output)
- Switchbox for 3-phase/6-winding measurements (option)
- 12 kV tan delta (power factor) and capacitance testing (option)
 - Individual temperature correction (ITC)
 - Automatic voltage dependence detection (VDD)
- CT and VT testing
- 3-phase circuit-breaker analyzer
 - Main and resistor contacts
 - Automatic measurement of substation battery voltage and coil current
 - Motion
- LV circuit-breaker timing
- Relay testing
- Timer applications
- Phase-angle meter
- Ground (earth) impedance testing
- 4-channel power multimeter
- Oscilloscope



Both TRAX 220 and TRAX 280 are delivered in rugged, highly mobile transport cases with wheels and recessed retractable handle.



One software. Many different apps!

A dedicated app for each and every instrument plus easy-to-use interface architecture that displays only the necessary functionality and nothing else. TRAX transforms even the most complex measuring task into a simple, standard operation.

Sophisticated simplicity

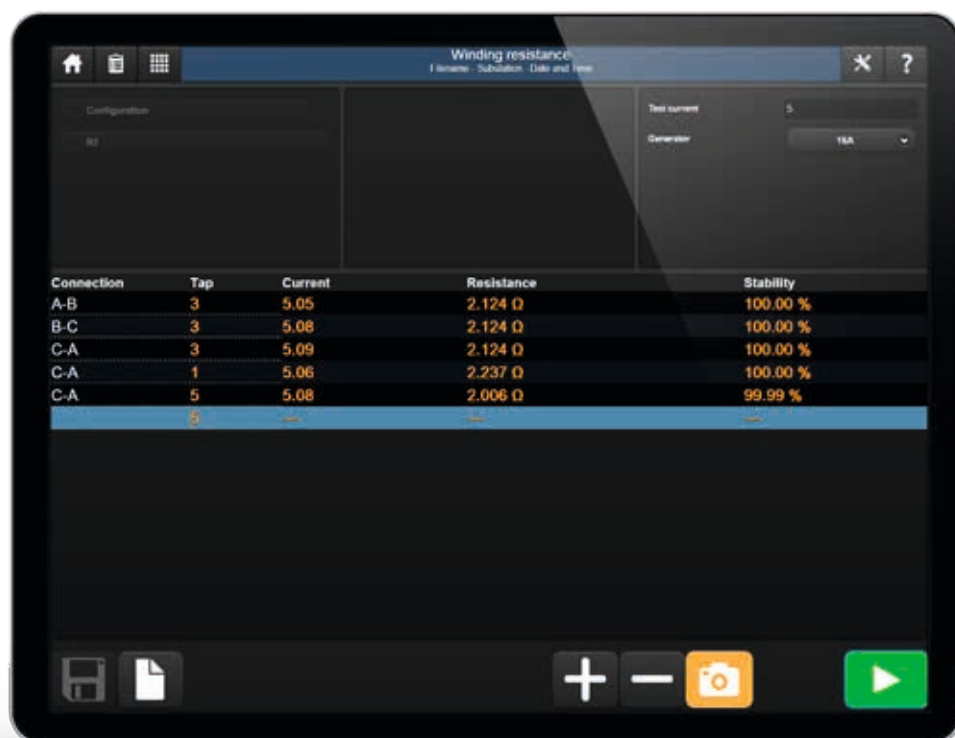
Sophisticated technology requires simple solutions. The simplicity of TRAX translates into time-saving convenience when performing advanced measurements – getting complex things done quickly and efficiently. TRAX apps are the key to this simplicity, ‘transforming’ the unit into dedicated instruments for specific applications.

Easy to learn – easy to use

TRAX user-interface architecture is based on a number of individual instruments/apps where only the necessary functionality is displayed by default. All instruments are ‘ready-to-go’ without making any specific settings.

In the no-configuration mode, just connect to the test object, select the voltage or current of the test signal and press start/play. This suggests a minimum of training, thus saving time and money for the user.

If you prefer guidance from TRAX on how to perform the measurement, simply enter the configuration. TRAX then provides connection diagrams plus a table with the correct order of measurements.



Winding resistance no-configuration example



Minimize learning time
+ Minimize testing time

= Maximize efficiency



One world. Any standard...

TRAX Transformer and Substation Test System is designed for mobility – yet it still performs as well as or better than any dedicated field-test equipment on the market. TRAX supports transformer tests according to most of the applicable standards and guidelines (IEC, ANSI, CIGRE, etc). It's probably the world's most compatible 'transformer and substation' test system.

Any destination...

No part of the system weighs more than 32 kg, making TRAX the first truly mobile transformer and substation multi-functional test system. No need to send it by air cargo when flying to the other side of the globe for a commissioning job.

Any language...

At birth, TRAX already speaks many languages. Wherever your testing takes you, we will make sure you get the reports in the language required.

Any user...

TRAX is a true multi-function tester. It measures a variety of objects and components using state-of-the-art methods for advanced diagnostic testing.

It replaces the need for multiple test sets and is as suitable for the transformer manufacturer as the travelling service engineer.



Portable and compact parts for easy shipping. The TRAX 220 in the light weight transport case weighs less than 32 kg. This light weight transport case is available as an option.



"We need equipment with high performance for testing in the factory. It's ideal if commissioning engineers can use it in the field as well."

Transformer manufacturer test-room manager

"I don't want to part with my test equipment for weeks when flying to work."

Service company test engineer

"How to find value for money when equipping our testing crew with test gear? What about the cost for training the people that will perform the tests?"

Power utility asset manager

"We need a versatile testing toolbox that will fit all testing needs for our primary assets."

Industrial plant electrical engineer



Any application you like:

...power transformer health assessments

Power transformers are among the most expensive parts of the electrical network. Testing a power transformer is important in order to correctly assess the condition of the unit and to detect incipient faults at an early stage. The objective is to ensure safe operation and minimize the risk of outages. With a careful asset management program, it will be possible to extend the life of the power transformer while maintaining reliability. TRAX makes it possible to perform all the basic electrical tests* on a power transformer with one device.

Winding resistance

The TRAX winding resistance instrument is designed specifically to measure the resistance of all types of inductive circuits. With high output current and high compliance voltage (100 A with up to 50 V true DC voltage), it effectively tests high and low-voltage windings on all power transformers. Thanks to dual measurement inputs, two windings can be measured at the same time (simultaneous winding magnetization). TRAX has multiple built-in safety features to protect the end-user, the test object and the unit itself, including auto-discharge in the event of input power loss.

The TSX switchbox accessory provides functionality to automatically test all transformer windings and taps with just one single connection. All windings are connected at one time. This minimizes the time otherwise needed for reconnection and improves safety by reducing the number of trips up and down the ladder.

Demagnetization

Often, when a transformer trips off-line, or after applying DC test signals in, for example, a winding resistance test, the transformer core remains magnetized. As this can cause issues for further tests, international standards and guides recommend demagnetization before doing excitation current and SFRA measurements.

It is also recommended to perform demagnetization before the transformer is taken into service, thus avoiding unnecessary high in-rush currents.

TRAX provides fully-automatic demagnetization of the transformer core. The method, which adapts a demagnetization cycle unique for the specific transformer design and size, minimizes the time needed for demagnetization.

Tap-changer testing

For testing transformers with load tap-changers, TRAX has two binary outputs for operating the tap-changer. TRAX measures the winding resistance per tap and also verifies the continuity (make-before-break) of the tap-changer during the switching operation.

TRAX also makes it possible to measure the dynamic characteristics of a load tap-changer. This unique, patent-pending DRM (dynamic resistance measurement) method can simultaneously measure contact switching times and the resistance value of the diverter resistors.

Turns ratio

The TRAX instrument for turns ratio measurements easily and accurately verifies the vector configuration and measures the turns ratio as well as the phase deviation of various transformers. This ensures that the winding and tap-changer connections are correct and will detect open-circuits and shorted winding sections or turns.

TRAX' turns ratio app determines the transformer turns-ratio as defined by international standards.

* Ref CIGRE TB 445



Turns Ratio app in config mode

The instrument provides an excitation test voltage (from 1.5 to 250 V) to the primary windings of the transformer and simultaneously measures the voltage at the corresponding secondary winding. Voltage ratio is displayed and compared with the expected target ratio. Recalculation of measured values with respect to the transformer configuration is automatically performed for various vector groups.

TRAX measures turns ratio, phase deviation and excitation current at the same time. Testing can be done at power frequency, or preferred and default, at a frequency different from the power frequency (55 Hz) to avoid interference. This makes the measurement fast and accurate. The app can also be used with the optional TSX switchbox accessory for automatic three-phase testing.

Excitation current

For single-phase excitation (magnetising) current measurements, TRAX offers a specific instrument with a test voltage up to 2200V. In addition to the measured current the app also directly calculates and displays winding impedance, reactance, inductance and power factor.

Short-circuit impedance

This TRAX app measures short-circuit impedance (leakage impedance/leakage reactance) in a power transformer at the primary winding while the correspondent secondary winding is shorted. Changes in the leakage flux, and therefore the leakage reactance, are generally caused by winding deformation.

Short-circuit impedance can be measured by phase or as a three-phase equivalent. TRAX measures the short-circuit impedance for each phase and the three phases can be compared referring to international standards and guides. When TRAX is selected to calculate transformer impedance, it uses the three-phase equivalent method to calculate a result that can be compared with the nominal nameplate impedance value for the transformer.

Frequency response of stray losses (FRSL)

FRSL measurement is the same as impedance measurement; it supplies low voltage to one winding of the transformer and short-circuits another. However, instead of measuring at a single frequency, the test is performed over a frequency range, typically from 20 to 500 Hz. Results are presented as a frequency sweep of apparent/stray resistance. The FRSL technique indicates short-circuited parallel strands of transposed conductors, a failure mode undetectable by other diagnostic methods such as excitation current.

Time-saver at your service

The need to implement an efficient maintenance plan and diagnostic methods increases as the overall transformer inventory ages. No single measurement can predict the service life of a transformer. It has been demonstrated, however, that combining test activities, data trending and continuous follow-up of maintenance records increases reliability and reduces the number of breakdowns and disruptions, thereby optimizing the utilization of the transformer inventory.



COM
One Ethernet port to run the instrument from an external PC or connect it to an external network. Three USB ports allow multipurpose use, e.g. for an external mouse, keyboard or USB-memory stick.

ON / OFF SWITCH
Press for one second to start the instrument. Press for three seconds to shut it down.

TRANS
General input for analog transducers and low-level analog signals, e.g. motion transducers, Rogowski output, etc.

CONTROL
Close and open contacts for tap-changer control (up/down) and circuit-breaker control (close-trip).

SAFETY
The emergency switch cuts off all power to the generator if needed. The key switch, (Interlock 1) is a fixed interlock, allowing the operator to manually lock or unlock the generator. Interlock 2 is the input for an additional external interlock switch.

Strobe output offers an opportunity to use an external strobe (optional) to indicate when TRAX is generating, similar to the ACTIVE LED described below. The ground loop indicator (orange LED to the left) flashes if the external ground is not connected. SAFE and ACTIVE LEDs indicate state of the instrument (e.g. safe to connect leads and cables, ready for generation or actually generating).

TRIG IN

External trig input.

TIMING

Three binary inputs are used for timing measurements in the circuit-breaker instrument (where they offer three-phase timing) as well as in the timer and relay instruments.

ANALOG

A four-channel digital multimeter measuring voltage and current offers many user opportunities. R1 and R2 inputs, specifically designed for DC measurements, are mainly used for winding and contact resistance measurements. R1 and R2 are also connected to the discharge circuit for extra safety.

DIAL

Has the same functionality as the dial in the Manual Control app, offering a manual feel when adjusting voltage or current in any app. Also used as pairing device when connecting TRAX for external control via Ethernet or Wifi.

LCD TOUCH-SCREEN

The 10.4-inch touch-screen offers great visibility in all environments thanks to its high contrast ratio and strong backlight. Its size is equal to most standard tablets. All software instruments are big enough for large buttons, making TRAX easy to read and control.



Any application you like:

...maintaining substations in tip-top condition

Conventional solutions for testing substations and their safety systems have been associated with complicated methods and heavy, difficult-to-use equipment. Megger TRAX now changes that viewpoint. Its modern design plus app-based software ensures the reliable supply of electricity and safety of personnel during the entire substation lifecycle.

Primary testing

The TRAX system comes with apps for primary injection testing of protective relay equipment and circuit breakers. Its capability also facilitates testing the turns ratio of current transformers and use in other applications that require high variable currents. TRAX generates up to 800 A output current (TRAX 280), even up to 2000 A with the TCX 200 accessory.

Phase-angle meter

TRAX includes a phase-angle meter for electrical power systems measurements. It displays phase angle, voltage, current, frequency and timing. The phase-angle is calculated from the relationship between two power signals, which can be current, voltage or any combination.

Timer

TRAX includes timer functionality that can be used separately for various applications where accurate time measurements are needed.

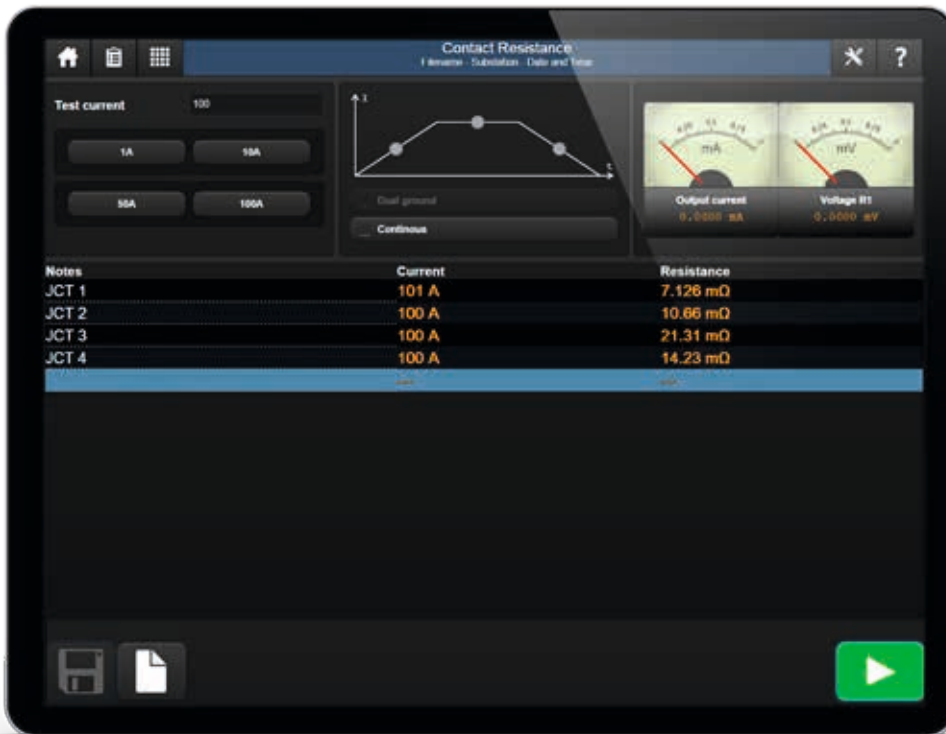
The timing channels operate in voltage or contact sense, detecting high, low or change states. The instrument is designed to withstand severe interference in high voltage substations.

Relay testing

TRAX includes many functions that facilitate verification of substation protection and control systems, especially during commissioning. System functionality can be verified by injecting into the primary side of the CT or VT and measuring the respective values at the secondary. Finally, injecting fault current should result in the tripping of the circuit breaker within a specified time, which allows verification of the complete chain (instrument transformer, wiring, relay, trip circuitry and the circuit breaker itself).

TRAX functions for various relay tests:

- Variable AC and DC voltage and current outputs (see specification on page 22)
- All AC outputs variable frequency 5–505 Hz
- Four analog inputs capable of measuring AC and DC voltages/currents, also derived entities such as Power (P, VA, Q, S, Watts), Impedance (R (DC), Z, Xp, Xs) and phase angle
- Three binary inputs for timing, contact or voltage sense
- TRIG IN to start the measurement from an external trig signal (contact or voltage)
- Capability to manually as well as automatically ramp voltage or current outputs (including frequency ramping at constant voltage)
- Capability to manually as well as automatically generate sequences of voltage or current outputs.



Contact Resistance app

Circuit-breaker testing

TRAX includes a circuit-breaker testing instrument equipped with:

- One 0–100 A DC supply for contact resistance measurements
- CONTROL circuitry for close and trip commands with built-in coil current and supply voltage measurements
- TRIG IN to start the measurement from an external trig signal (contact or voltage)

- Three timing inputs for 3-phase contact timing measurements, 1 break/phase
- TRANS (Transducer) – analog input channel with voltage supply intended for measuring travel (motion) or other analog entity. (Optional transducers not included).

ANALOG – Four high-accuracy voltage/current inputs for monitoring auxiliary contacts, coil currents, battery voltages, pressure transducers, etc.

Any application you like:

...measuring current and voltage transformers' vital signs

The easy-to-use, multi-functionality of TRAX comes into its own when assessing the condition and performance of current and voltage transformers. You can test the assets of both types with ease, as well as the key parts of an individual asset, e.g. core, windings, bushing and insulation. Variable frequency testing is essential for both standard and advanced diagnostic tasks.



Current transformers are vital for both network measurement and safety systems. Testing helps detect installation-related problems such as manufacturing defects, transportation damage and wiring errors, as well as aging of the insulation. The insulation part may be tested periodically to detect deterioration, while electrical circuits are normally tested and verified when commissioning or re-commissioning a substation. TRAX tests all CT and VT circuits and, with the TDX accessory, the tan delta/power factor of the insulation.

Current transformers

TRAX performs most of the electrical tests for current transformers such as excitation (saturation, knee point), ratio, polarity, burden, winding resistance, demagnetization and voltage withstand. It is also possible to test special CTs like Rogowski types and low power CTs.

Excitation (saturation) curves can be measured up to 2200 V. Knee point voltage and current is calculated according to international standards.

Ratio tests are performed with up to 800 A test current (2000 A with the CSX accessory). Ratio can also be measured by voltage comparison, applying the test voltage to the secondary side.

Voltage transformers

TRAX performs most of the tests for voltage transformers such as ratio and polarity and voltage withstand. It is also possible to test electronic (low power) VTs.

One specific dilemma when testing VTs is that the measured secondary voltage may be difficult to measure due to electrical interference in the substation. The TRAX solution to this problem is to measure at a frequency different from the power frequency and use advanced filter techniques to eliminate the contribution from noise.

With a voltage output up to 2200 V AC, TRAX tests VT ratio, polarity and burden with ease.

Injecting voltage into the primary side permits ratio and phase angle measurements between the primary and secondary side. Any polarity error is easily detected and the correct polarity of the VT can be verified. Burden is measured by injecting voltage into the secondary circuit and measuring voltage, current and phase.

Any application you like:

...testing any way you want



Manual Control app

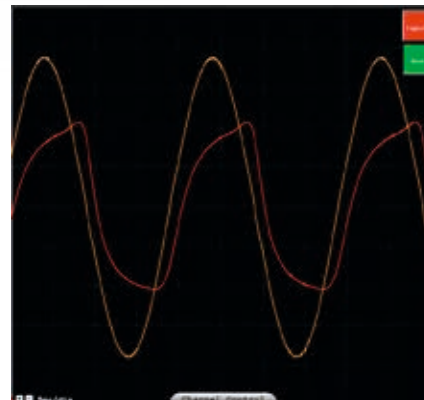
Manual Control

The TRAX Manual Control app is the key to individually specified measurements where users define what signal to generate and what to measure.

Users can select any of the test signal generators, voltage or current outputs, DC or AC, test frequency, and how the generator should operate; manually controlled, ramp or set value. Amplitude can be set by using the on-screen dial, the dial on the top panel or by entering a value using the pop-up keyboard.

Test signals can be measured as RMS (true RMS value), AC RMS, RMV (rectified mean value), single frequency or DC.

Users also decide what parameters to calculate based on the measured data. Examples include; arithmetic calculations, DC resistance, impedance, reactance, inductance, capacitance, phase angle and user-defined formulas.



OSCILLOSCOPE
For monitoring the waveform of any of the internal or external measurement channels.

The output signal is monitored with two meters showing output voltage and current. All channels have floating inputs to avoid issues with grounded or non-grounded test objects. In addition, an oscilloscope is available for monitoring the waveform of any of the internal or external measurement channels.

All in all, the TRAX Manual Control app provides an almost unlimited measurement environment for the test engineer.

Data handling and reporting

One of the key components in asset management is managing and analyzing data from performed tests. For a service company, presenting clear and structured reports is vital to a job well done. TRAX uses a standardized open format, allowing the user to export the data to any asset management system or for designing their own report.

TRAX data architecture is based on the following principles. Individual measurements with a specific instrument are collected in a test that can contain one or several measurements. Tests can be collected in a session containing several tests on, for example, a power transformer. They can be stored in files as separate tests or as a complete session.

A test session starts by entering the necessary data and creating a test plan, or by directly starting a test and entering information as it proceeds. Several tests can be combined into one session/template/report.

This can be made on the unit itself or on a PC and then transferred to TRAX. The report can be reviewed at any time during the test. If necessary, users can directly recall and repeat any individual test measurement.

Measurement reports can be generated at any time after test completion. TRAX generates one report for each session. The report, which contains nameplate data, test conditions and specific data for the object itself, can be exported and printed as a PDF file. Actual test data can be exported as .csv files for standard programs such as Excel.

TRAX - Test report

Test asset		Test conditions	
Substation	PowerPlant	Reason	Maintenance
Position	123	Weather	Sunny
Job #	150317-1	Ambient temp.	25
Asset ID	T3	Humidity	low
		Date	2013-05-17
		Tester	O. P. Rator

PRIMARY	SECONDARY
10.40	400.0
5	1
3	0
None	None

Test results

Primary side to Secondary side nominal turns ratio tests

Winding	Tap	Tap Voltage	U (Fq)	TTR	Measured TTR	error	I exc (Fq) Phase
1U-1V / 2U-2V	1	10920	251 V	27.30	27.28	-0.06 %	3.060 mA-0.01*
1U-1V / 2U-2V	3	10660	251 V	26.65	26.63	-0.08 %	3.191 mA-0.01*
1U-1V / 2U-2V	3	10400	251 V	26.00	25.97	-0.10 %	3.323 mA-0.01*
1U-1V / 2U-2V	4	10140	251 V	25.35	25.32	-0.12 %	3.478 mA-0.01*
1U-1V / 2U-2V	5	9880	251 V	24.70	24.65	-0.21 %	3.630 mA-0.01*
1V-1W / 2V-2W	1	10920	251 V	27.30	27.29	-0.05 %	3.796 mA-0.01*
1V-1W / 2V-2W	2	10660	248 V	26.65	26.63	-0.08 %	3.924 mA-0.01*
1V-1W / 2V-2W	3	10400	251 V	26.00	25.98	-0.10 %	4.153 mA-0.01*
1V-1W / 2V-2W	4	10140	251 V	25.35	25.32	-0.11 %	4.380 mA-0.01*
1V-1W / 2V-2W	5	9880	249 V	24.70	24.67	-0.14 %	4.605 mA-0.00*
1W-1U / 2W-2U	1	10920	251 V	27.30	27.29	-0.05 %	4.945 mA-0.01*
1W-1U / 2W-2U	2	10660	251 V	26.65	26.63	-0.07 %	5.067 mA-0.01*
1W-1U / 2W-2U	3	10400	251 V	26.00	25.98	-0.09 %	
1W-1U / 2W-2U	4	10140	251 V	25.35	25.32	-0.11 %	5.444 mA-0.01*

Example using TRAX to test a power transformer:

- Select the configuration in the TTR app and enter the necessary transformer nameplate data. A number of ratio measurements are then performed.
- Save the data and move on to the next test (nameplate data is already in place). The report now contains both tests. Proceed to the next instrument until the test session is over.
- View the report and add more information about the test object. If further confirmation of test data is needed, go directly to the app and repeat any measurement.
- It is also possible to add specific measurements to the test session, e.g. customized tests done with manual control.
- After the completed session, the report can be transferred to a PC for further editing, printed as a PDF, or exported as a text file to, for example, Excel.

Accessories add extra value

Optional TRAX accessories include dedicated solutions that offer greater time-saving plus even more cost-effective performance compared with conventional methods. By adding extra functions and finesse, they enhance what is already an outstanding Transformer and Substation Test System.

Tan delta/power factor measurements

For tan delta/power factor measurements of power transformers and other high-voltage assets, TRAX uses the optional TDX accessory. TRAX then becomes a fully automatic 12 kV tan delta/power factor test set for condition assessment of electrical insulation in high-voltage apparatus such as transformers, bushings, circuit breakers, cables, lightning arresters and rotating machinery.

In addition to performing insulation tests, TRAX/TDX can also measure the excitation current of transformer windings and perform automatic tip-up tests and HV turns-ratio testing with an optional test capacitor. (Also, by adding an external generator and a reference capacitor, TRAX can measure tan delta/power factor at even higher voltages, >12 kV.)

The high power variable frequency design generates its own test signal independent of line frequency quality, while the hardware uses the latest digital technology to filter response signals. As a result, TRAX produces reliable results and stable readings in the shortest time and with the highest accuracy, even in high-interference substations. High noise suppression plus advanced signal-acquisition circuitry can handle up to 15 mA interference current or a signal-to-noise ratio of up to 1:20, for example. This results in extremely accurate and clean measurements, even in the most severe conditions.

A wide frequency range of 1–500 Hz gives TRAX the capability to perform a more informative tan delta test that provides important information about the condition of the insulation, temperature dependence, etc. It also expands the range of capacitance measurements. As an example, TRAX can test specimen with a capacitance up to 1600 nF at 2 kV and 15 Hz.

Individual Temperature Correction (ITC) is a patented technique for estimating the actual temperature dependence of the test object by measuring tan delta over a frequency range. Mathematically calculating individual temperature correction (instead of using standard tables) results in a more accurate assessment of the insulating material's condition.

Automatic voltage dependence detection (VDD), another patented technique, lets TRAX alert users when tan delta results indicate that the test object may have a voltage dependence, and that additional tests should thus be performed at different voltage levels.



TDX 120 accessory tan delta /power factor measurements at 12 kV



High-current box TCX 200

TRAX Transformer and Substation Test System is designed for primary injection testing of protective relay equipment and circuit breakers. It is also used to test the turns ratio of current transformers and for other applications that require high variable currents. When the high-current output of TRAX 220 (max 200 A) or TRAX 280 (max 800 A) is not sufficient, the optional accessory TCX offers currents up to 2000 A.

Thanks to its dimensions and design, the TCX unit can be placed close to the test object, thus reducing the need for long heavy current cables. Shorter cables save time, weight and money, and allow higher test currents.

Three-phase switchbox TSX 300

The optional TSX switchbox accessory provides functionality to automatically test all windings and taps of a transformer with only one single connection. All windings are connected at one time, minimizing the time needed for reconnections and improving safety by reducing the number of trips up and down the ladder.

TSX 300 is controlled from TRAX and can handle up to 250 V AC and 16 A DC. It comes with necessary cables and connectors.



TRAX Current Box TXC 200



Three-phase switchbox TSX 300



Other accessories

TRAX TDB 200

It is not always convenient, or even possible, to get hold of a transformer in the network for training purposes. By covering most of TRAX' many functions, TDB 200 makes it easy to perform in-house training. A built-in transformer, a 100 A shunt and a 32 A Miniature Circuit Breaker allow all of the following to be tested in an office environment.

- Winding resistance up to 10 A
- Turns ratio up to 250 V (10:1 or 20:1)
- Excitation current and short circuit impedance up to 250 V
- Contact resistance up to 100 A DC
- Miniature Circuit Breaker up to 300 A AC
- Over-current relay functionality

TDB 200 is delivered in a light transport case with all necessary cables and connectors.



TRAX training box TDB 200

Cables and accessories

In addition to reducing testing time, one of the advantages of a multi-functional system is that it cuts down the number of accessories needed. Of the TRAX cables, cases and other accessories that are required, we ensure that each one makes the life of the user much easier.

Cables come in many sizes and lengths, but generally our standard generator and measuring cables (including Kelvin cable sets) range from 6 meters (20 ft) up to 20 meters (66 ft). High-current generator cables range from 1 meter up to 20 meters, depending on current and area. See Ordering Information for what is included in each standard package.

Two different transport cases are available: a flight case (delivered as standard accessory) and an optional light-weight transport case. In the light-weight transport case, TRAX 220 weighs less than 32 kg, making it possible to check-in on the same flight as you, thus saving days or even weeks of transportation time. Our trolley is also a useful accessory when moving your TRAX system in a substation.

Safety is always a top priority and among our accessories we offer an external interlock with up to 18 meters of cable plus an indicator box (TIB 225) that shows whether TRAX is active (generating or discharging) or in Safe mode. This allows connecting and disconnecting to be performed safely.

TRAX 219/220/280

Specifications

Scan the QR code for Product data sheet.



GENERAL

Mains input	100–240 V, 50/60 Hz ($\pm 10\%$)
Current input	≤ 16 A continuous Short-term up to 30 A < 60 s
Display	
Size	10.4 inch
Resolution	1024 x 768
Type	TFT touch
Contrast ratio	1000:1
Brightness	1000 nits
Dimensions (main unit)	475 x 315 x 330 mm (excl. handles)
Weight	TRAX 219 25 kg TRAX 220 26 kg TRAX 280 30 kg

ENVIRONMENT

Application field	For use in high-voltage substations and industrial environments
Temperature	
Operating	-10°C to +55°C (14°F to +131°F)
Storage	-20°C to +70°C (-4°F to +158°F)
Humidity	< 90%RH, non-condensing

CE-MARKING

EMC	IEC 61326-1
LVD	IEC 61010-1:2010

Calculated / displayed parameters

Items	Specification
Arithmetic	+, -, *, /
Power	P, VA, Q, S
Resistance	R (DC)
Impedance	Z, Xp, Xs, Rs, Rp, Ls, Lp, Cs, Cp
Phase	Degrees or minutes
Time	Binary start-stop-change, generator start-stop, trig to event
User-defined formulas	Mathematical operations using measured data

Inputs

Items	Specification	Comment
General AC/DC current	4 x 0–10 A	
General AC/DC voltage	4 x 0–250 V	
DC voltage	2 x 0–50 V	For resistance measurements
Transducer	0–50 V DC 0–5 V AC	
Binary input/timing	3 x 0–10000 s	Contact or voltage sense
Trig input		Contact or voltage sense

Outputs

Items	Specification	Comment
Frequency range, all AC outputs	5–505 Hz	1–505 Hz with TDX accessory Derating at frequencies below 50 Hz, linear voltage drop
10 A AC output	0–2 A/250 V, continuous 0–10 A, 1 min 0–20 A, 10 s	
200 A AC output	0–40 A/6 V, continuous 0–200 A, 30 s	TRAX 219/220
800 A AC output	0–150 A/6 V, continuous 0–800 A, 30 s	TRAX 280
2000 A AC output	0–2000 A/2.4 V, 30 s 0–1000 A/4.8 V, 30 s	With TRAX TCX accessory
250 V AC output	0–250 V/2 A, continuous 0–200 V/10 A, 1 min	
2200 V AC output	0–2200 V/0.2 A, continuous 0–2000 V/1 A, 1 min	
12 kV AC output	0–12 kV/300 mA, 4 min 0–12 kV/100 mA, continuous	With TDX accessory
100 A DC output	0–100 A, 1 min 0–70 A, continuous	
16 A DC output	0–16 A continuous	
1 A DC output	0–1 A continuous	
DC output power	Max 1000 VA, 1 min Max 700 VA, continuous Max 50 V compliance voltage	
300 V DC output	0–300 V/2 A, continuous 0–240 V/4 A, 1 min	Rectified AC
Binary outputs	2 x 0–10000 s	Output contacts for LTC and CB operation with internal voltage and current measurements
Measurements		Internal voltage and current measurements on generator outputs

Specifications are valid at 230 V input voltage and an ambient temperature of +25°C $\pm 5^\circ$, (77°F). Specifications are subject to change without notice. Please visit www.megger.com for latest product data sheet.



ORDERING INFORMATION

Item	Art. No.	Item	Art. No.
TRAX 280 with accessories, 800 A AC output	AJ-19090	TCX 200 – TRAX CURRENT BOX Including the following: Aux Power cable, 10 m (30 ft) Ground cable, 10 m (30 ft) Serial current cable, 95 mm ² , 0.5 m (2 ft) 4 x current cables, 95 mm ² , 1.5 m (3 ft)	AJ-69290 GC-31210 GC-30075 GC-32150 GC-32151
TRAX 220 with accessories, 200 A AC output	AJ-19290		
TRAX 219 with accessories, 200 A AC output, PC control only	AJ-19390		
Accessories included in the above		TDX 120 – TRAX TAN DELTA BOX Including the following: Aux Power cable, 1 m (3 ft) Ground cable, 1 m (3 ft) Ethernet cable, 1 m (3 ft) High voltage cable, 20 m (60 ft) Measuring cable, 20 m (60 ft), red Measuring cable, 20 m (60 ft), blue Transport case TDX software package User Manual TDX 120	AJ-69090 GC-31201 GC-30070 GA-00985 GC-32520 GC-32532 GC-32535 GD-30100 AJ-8060X ZM-AJ02E
Mains cable 16 A (EU)	04-00080		
Ground cable, 6 m (18 ft)	GC-30080		
Ethernet cable, 3 m, shielded	GA-00985		
Interlock 2, safety hand switch, 2 m (6 ft)	GC-31103		
Test cable, 10 m, black	04-35060		
Test cable, 10 m, red	04-35062		
2 x Timing clamp	KD-03040		
5 kV cable 5 m, black	04-35300		
5 kV cable 5 m, red	04-35302		
Dolphin clip black	40-08320		
Dolphin clip red	40-08322		
Kelvin cable, 10 m (30 ft), black	GC-32310		
Kelvin cable, 10 m (30 ft), red	GC-32312		
Current cable, 16 mm ² , 10 m (20 ft), black	GC-32010		
Current cable, 16 mm ² , 10 m (20 ft), red	GC-32012		
Jumper cable, 10 mm ² , 5 m (15 ft)	GC-32091		
2 x Current cable, 50 mm ² , 6 m (20 ft) (TRAX 280 only)	GC-32106		
TRAX transport case with wheels	GD-30100		
Transformer SW package	AJ-8010X		
User Manual	ZM-AJ01E		
Optional accessories		TSX 300 – TRAX SWITCH BOX Including the following: Aux Power cable, 10 m (30 ft) Ground cable, 10 m (30 ft) Ethernet cable, 10 m (30 ft) TSX measuring cable, 10 m (30 ft) Three-phase lead set, 9 m (30 ft) User Manual TSX 300	AJ-69390 GC-31210 GC-30075 GA-00987 GC-32440 GC-32430 ZM-AJ03E
Test lead set: 4 x 0.5 m, 6 x 2 m, 4 x 5 m, red/black/yellow/blue	GC-32600	SOFTWARE PACKAGES	
4 x Dolphin clamps (black/red)		Transformer SW package	AJ-8010X
Timing test lead set: 6 x 10 m (30 ft), 6 x Timing clamps	GC-32610	including the following apps: Demagnetization, Turns ratio, Excitation current, Short circuit impedance, Manual Control	
Light-weight transport case for TRAX 220 / TRAX 219	GD-31050	Advanced transformer SW package	AJ-8020X
TRAX Indicator Box, TIB 225, green/red light, 10 m (30 ft)	AJ-90030	including: Dynamic OLTC (DRM), Magnetic balance, FRSL (frequency response of stray losses)	
TIB extension cable, 10 m (30 ft)	GC-32410	CT & VT SW package	AJ-8030X
Interlock 2, footswitch, 2 m (6 ft)	GC-31150	including: CT ratio, burden, excitation curve, polarity, ratio with voltage, winding resistance, voltage withstand test, ratio Rogowski, ratio low power, VT ratio, burden, polarity, electronic, sec voltage withstand	
Interlock 2, fixed, 2 m (6 ft)	AJ-90020	Substation SW package	AJ-8040X
Interlock 2, extension cable, 15 m	GC-32415	including: Circuit breaker analyzer, LV CB timing, Single phase relay testing, Timer, Phase angle meter, Ground/earth impedance, Line impedance/K-factor, Wattmeter	
Trolley for TRAX 280/220/219 plus TDX 120	AJ-90040		
Accessory kit for bushings	AG-90100		
TDB 200 – TRAX DEMO BOX	AJ-90010	Longer or shorter cables can be supplied on request. Please contact your local Megger dealer for more information. Subject to change without notice.	
Including transport case, ground cable, high current test leads, standard test leads, user guide			

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