



# Transformer Testing Equipment

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**About Megger:**

You know Megger. Since 1903, the Megger family has provided tools, training and products under such familiar monikers as Biddle, AVO, Programma, Multi-Amp, STATES, PowerDB, SebaKMT, HDW Electronics and Pax Diagnostics. With a vision encompassing excellence, precision, innovation and service, Megger and its subsidiaries and divisions will partner with any customer, working with each on an interactive path to the right solution. Megger equipment supports electrical systems worldwide across a range of industries from power generation, transmission and distribution to control wiring and telecommunications.

Megger has offices across the U.S. and around the world, with major international hubs in Sweden and the U.K.

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<b>PICK YOUR TEST &amp; FULFILL YOUR EQUIPMENT NEEDS</b>	
<b>TESTING FOR:</b>	<b>USE THIS INSTRUMENT:</b>
<b>WINDINGS: RESISTANCE</b>	MTO (PG. 2)
<b>WINDINGS: RATIO/POLARITY</b>	TTR (PG. 4)
<b>WINDINGS: EXCITATION CURRENT</b>	DELTA (PG. 5) TTR (PG. 4)
<b>WINDINGS: SHORT-CIRCUIT IMPEDANCE</b>	FRAX (PG. 6) MLR (PG. 6)
<b>WINDINGS: FREQUENCY RESPONSE ANALYSIS</b>	FRAX (PG. 6)
<b>WINDINGS: INSULATION RESISTANCE</b>	S1 (PG. 8)
<b>WINDINGS: CAPACITANCE</b>	DELTA (PG. 5) IDAX (PG. 9) CDAX605 (PG. 9)
<b>WINDINGS: POWER FACTOR/TAN DELTA</b>	DELTA (PG. 5) IDAX (PG. 9) CDAX605 (PG. 9)
<b>WINDINGS: DIELECTRIC FREQUENCY RESPONSE</b>	IDAX (PG. 9)
<b>BUSHINGS: CAPACITANCE</b>	DELTA (PG. 5) IDAX (PG. 9)
<b>BUSHINGS: POWER FACTOR/TAN DELTA</b>	DELTA (PG. 5) IDAX (PG. 9)
<b>BUSHINGS: DIELECTRIC FREQUENCY RESPONSE</b>	IDAX (PG. 9) CDAX605 (PG. 9)
<b>INSULATING OIL: DIELECTRIC STRENGTH</b>	OTS (PG. 9)
<b>INSULATING OIL: POWER FACTOR/TAN DELTA</b>	DELTA (PG. 5) IDAX (PG. 9)
<b>CELLULOSE INSULATION: MOISTURE CONTENT</b>	IDAX (PG. 9)
<b>TAP CHANGERS (LOAD): CONTACT/WINDING RESISTANCE</b>	MTO (PG. 2)
<b>TAP CHANGERS (LOAD): RATIO</b>	TTR (PG. 4)
<b>TAP CHANGERS (DE-ENERGIZED): TIMING</b>	MTO (PG. 2)
<b>TAP CHANGERS (DE-ENERGIZED): CONTACT PRESSURE</b>	MTO (PG. 2)
<b>TAP CHANGERS (DE-ENERGIZED): RATIO</b>	TTR (PG. 4)
<b>CORE/TANK: INSULATION RESISTANCE</b>	MCT (PG. 6) S1 (PG. 8)
<b>CORE/TANK: FREQUENCY RESPONSE ANALYSIS</b>	FRAX (PG. 6) IDAX (PG. 9)
<b>CORE/TANK: GROUND TEST</b>	MOM (PG. 7) DLRO (PG. 7)

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## MTO Transformer Ohmmeters

### MTO210 TRANSFORMER OHMMETER

- Measures the DC resistance
- Tests transformers and rotating machine windings
- Serves as winding resistance & tap changer test set
- Possesses direct two-channel digital reading
- Uses DC test current up to a maximum of 10 A
- for testing and demagnetization



### MTO Automated Six-Winding Transformer Ohmmeter Series (MTO300 & MTO330)

- Uses simultaneous winding magnetization for fast, accurate DC winding resistance of high-inductive loads
- Saves time by allowing operator to test all six windings without disconnect
- Offers fast set-up & lower safety risk with one-time connection
- Possesses automated eight-terminal/six-winding measurement capability
- Differs in control features: 300 controlled by outside equipment; 330 has onboard computer



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## Test instruments can help with blackout prevention

The U.S. has had a series of major blackouts in the last few years. India recently had a huge one that is currently considered one of the worst since global electrification.

India's blackout, or any of the U.S. blackouts in recent history, stemmed from problems with protection and control issues gone awry and cascading down an infrastructure not properly islanded or with control systems not properly in place to trip and prevent those cascades.

To prevent blackouts in the short-term, the U.S. needs to think about these four currently available game changers:

- 1. Smart grid technology.** Yes, making meters, circuit breakers, bus bars, transformers, synchrophasors and other equipment readily able to talk to each other in fractions of a second will make a difference. Cascades are tripped because technology didn't react fast enough. So, make it faster.
- 2. Cloud technology.** It holds all that info from that smart technology without the utility itself having to invest in better IT systems themselves, a cost that could be passed on to upset consumers. So, avoid the upset (and the delay inevitably caused by the upset) and find a company with a decent cloud offering for your smart grid data.
- 3. Substation and line hardware.** It's time to replace 50-year-old infrastructure—not just meters. Yes, meters are sexy right now. But, blackouts are usually caused by tiny little widgets of things inside substations. So, think past meters: poles, lines, circuit breakers, synchrophasors. Bury some of it. Replace some of it. Check all of it, and chuck the old stuff that has reached its manufacturer's limit.
- 4. Testing & measurement equipment.** Maintain the old stuff and keep an eye on the newer stuff with testers that can tell a substation operator if that circuit breaker is ready to go when needed or that relay is acting properly. As the industry moves smarter technology into the mix, there will be a volatile period of evolution that involves a blending of old and new equipment. During those years, keeping up with testing and measurement schedules in the substation and the field is your final line of defense against this sort of blackout.

## TTR TURNS RATIO TEST SETS

### TTR TURNS RATIO TEST SET , SINGLE-PHASE, HAND-CRANK

- Tests single-phase power & distribution transformers
- Measures turns ratio up to approx. 330:1
- Offers rugged, reliable use



### TTR300/330 THREE-PHASE TURNS RATIO TEST SETS

- Measure ratio, phase deviation & excitation current
- Offer remote-control option using external PC (TTR300), or analysis with **PowerDB ONBOARD** (TTR330)
- Possess transformer vector recognition



### TTR25 BASIC HAND-HELD TURNS RATIO TEST SET

- Measures ratio from 0.8 to 20,000:1 & excitation current up to 100 mA
- Offers simple, push-to-test operation
- Allows printing/uploading of data in real time



### TTR100 ADVANCED HAND-HELD TURNS RATIO TEST SET

- Measures ratio, single- & three-phase (one phase at a time)
- Is the ideal lightweight tester for field & substation environments (3.3 lbs.)
- Allows printing/uploading of data in real time

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## DELTA POWER FACTOR TEST SET

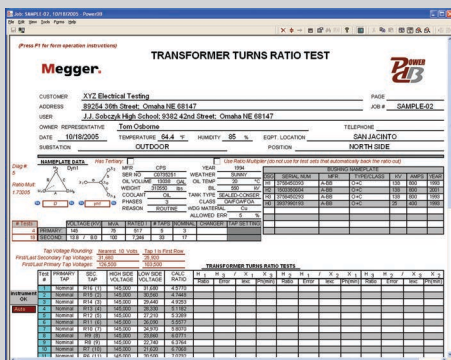
### DELTA4000 AUTOMATED INSULATION TEST KIT (12 kV) (DELTA4110 & DELTA4310)

- Offers individual temperature correction, power factor voltage detection, and automated measurement & manual control
- Possesses industry-leading frequency range (1-505 Hz)
- Offers lightweight multi-piece design (approx. 66 lbs. for both pieces)
- Control options: DELTA4110 test set requires an external computer (not included); DELTA4310 has onboard computer



### POWERDB SOFTWARE

- Synchronizes test records into a single database
- Allows for tracking & management of NERC PRC-005 data & scheduling
- Allows for historical data trending & evaluation



### PRIORITY ACCESS TECHNICAL SUPPORT

- Maximizes investment in **DELTA4000** with expert technical assistance
- Offers engineering consultation & results analysis
- Expedites repair services

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## FRAX, MCT & MLR10 TRANSFORMER TESTERS



### **FRAX101/150 SWEEP FREQUENCY RESPONSE ANALYZERS**

- Detect potential mechanical & electrical problems
- Fulfill all international standards for sweep frequency response analysis
- Offer highest possible repeatability with reliable cable practice & high-performance instrumentation
- Possess built-in PC with backlit screen (FRAX150 only)



### **MCT1605 TRANSFORMER TEST SET**

- Tests saturation, ratio, polarity, insulation tests on current transformers
- Provides microprocessor-controlled variable voltage output
- Displays multiple instantaneous saturation curves with knee point

### **MLR10 LEAKAGE REACTANCE TESTER (10 A)**

- Measures the short-circuit impedance of transformers
- Helps detect/diagnose winding deformation
- Performs measurements with both single- & three-phase



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## DLRO & MOM OHMMETERS & MICRO-OHMMETERS

### DLRO10/10X/10HD DIGITAL LOW RESISTANCE OHMMETERS

- Measure resistance from 0.1  $\mu\Omega$  to 2,000  $\Omega$
- Select most suitable test current up to 10 A
- Produce accurate results in less than three seconds



### DLRO200 DIGITAL LOW RESISTANCE OHMMETER

- Measures contact resistance in high voltage circuit breakers, disconnecting switches (isolators) & bus-bar joints
- Tests currents from 10 to 200 A
- Eliminates magnetic transients with filtered DC output



### DLRO600 MICRO-OHMMETER

- Measures resistance from 0.1  $\mu\Omega$  to 999.9  $\Omega$
- Provides current from 10 A to 600 A
- Uses on-board memory to store up to 300 test results/notes



### DLRO-H200 MICRO-OHMMETER

- Measures resistance in the field
- Incorporates current to 240 A
- Uses Bluetooth headset for audible pass/fail testing



### MOM200 MICRO-OHMMETER

- Measures contact resistance
- Is an ideal choice under 200 A
- Possesses rugged design for field use



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## S1 INSULATION RESISTANCE TESTERS



### S1-552/2 & S1-554/2 INSULATION RESISTANCE TESTERS (5 kV)

- Possess 5 mA high-charging current for testing large generators & cables
- Possess 15 T $\Omega$  measurement range & CAT IV 600 V rating
- Offer extended operating temperatures (-20° C to +50° C)

### S1-1052/2 & S1-1054/2 INSULATION RESISTANCE TESTERS (10 kV)

- Possess 5 mA high-charging current for testing large generators & cables
- Possess 35 T $\Omega$  measurement range & CAT IV 600 V rating
- Offer extended operating temperatures (-20° C to +50° C)

## S1 series stops the noise, brings in the data

The latest version of Megger's S1 series of insulation testers offers the standard requirements for a solid piece of insulation testing equipment: insulation resistance (IR), polarization index (PI), dielectric absorption ratio (DAR), step voltage (SV) and dielectric discharge (DD) testing. Additionally, the S1 series increases safety, allows for precise testing and accounts for the highest noise an operator may encounter in the field, setting it a step above the standard.

### Testing and Safety

The S1 series offers testing safety, even in demanding applications, in both the 5 kilovolt (kV) and 10 kV models; every product in this series now meets the requirements for use in CAT IV 600 V applications (in line with IEC 61010-1).

With 8 kV transient immunity, the S1 series is both suitable for measurements at low-voltage installations and offers high-voltage immunity (up to 8 kV). That's double the rating of previous insulation tester options.

Megger also supplies the S1 series with a fully specified guard terminal, a unique feature in this industry. Acting as a shunt circuit for parallel leakage points, the guard terminal (labeled with a "G" on the unit) allows the operator to sectionalize testing. As a result, users can achieve fast, accurate results even with equipment possessing high levels of surface leakage, providing more reliable information to assist in fault diagnostics.

### Noise

Along with meeting requirements and possessing a guard terminal for enhanced testing, the S1 series also offers industry-leading 4 milliampere (mA) noise rejection. Supported by sophisticated hardware and software, the series delivers accurate and reliable results even in noisy electrical environments (substation switchyards, for example) where other insulation testers are rendered useless.

Default settings suit the vast majority of applications, but the experienced operator may use the optional software filtering of the S1 series to fine-tune testing optimization, especially with demanding applications.

Additionally, the S1 series delivers a higher charging current than the standard insulation tester in the industry, which saves time and minimizes the risk of measuring before the set test voltage is reached, and it offers a variable test voltage up to 10 kV (depending on unit) to allow for the early detection of insulation deterioration.

The software of the S1 series has been upgraded to PowerDB LITE, which comes standard in the latest S1 series package. PowerDB LITE allows test results from the S1 series to be kept, trended and reported.

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## OTS OIL TESTERS & INDAX INSULATION DIAGNOSTIC ANALYZERS



### OTS60PB & OTS80PB PORTABLE OIL TEST SETS (60 kV, 80 kV)

### OTSAF SERIES AUTOMATIC LABORATORY OIL TEST SETS (60 kV, 80 kV, 100 kV)

- Test mineral, ester & silicon oils
- Offer precision oil vessel with lockable adjustment & 3.5" color display
- Offer lightest portability for measuring insulation oil breakdown voltage
- Possess transparent, shielded lid & large test chamber



### IDAX300/350 INSULATION DIAGNOSTIC ANALYZERS

- Provide fast, accurate moisture assessment in power transformers
- Allow for testing insulation in bushings, generators & cables, too
- Offer automated analysis of moisture content & oil conductivity
- Possess built-in PC (IDAX350 only)



### CDAX605 High-precision capacitance and dissipation factor measurement instrument

- High accuracy and wide measurement range
- Automatic measurement process
- Works with any standard capacitor or resistor value without any recalculations

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