

DELTA4000 Series 12 kV Insulation Diagnostic System



DELTA4310A test set shown above with onboard computer

- Wide frequency test voltage (1-500 Hz), includes DFR diagnostic capability
- Accurate measurement results under high noise conditions as tested to 765 kV substations
- Lightweight, rugged two-piece design
- Patented built-in individual temperature correction eliminates the need for temperature correction tables
- Industrial 300 mm (12 in.) touch-screen controller

DESCRIPTION

The DELTA4000 Series is a fully automatic 12 kV insulation power factor/dissipation factor ($\tan\delta$) test set designed 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 power factor tests, the DELTA4000 Series can be used to measure the excitation current of transformer windings as well as to perform automatic tip-up tests and HV turns-ratio testing (an optional TTR capacitor is available).

The test set is designed to provide a comprehensive AC insulation diagnostic test. The high power variable frequency design generates its own test signal independent of line frequency quality and the hardware design uses the latest technology available for digital filtering of the response signal. As a result, the DELTA4000 Series produces reliable results and stable readings in the shortest time with the highest accuracy, even in high interference substations.

The DELTA4000 Series operates with PowerDB software for automatic testing and reporting or with Delta Control software for real-time manual testing.

Measurements include voltage, current, power (loss), tan delta, inductance, power factor and capacitance. The test results are automatically stored in the computer and can also be downloaded directly to USB storage or a printer.

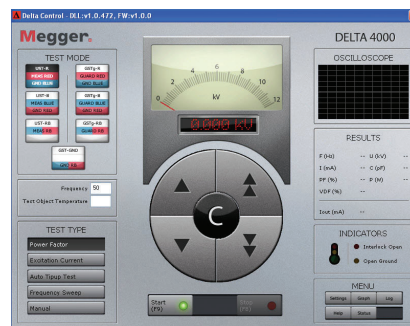
DELTA4110 test set is to be used with an external computer (not included) while the DELTA4310A test set comes with an onboard computer.

APPLICATIONS

- | | |
|-----------------------------|--------------------|
| ■ Power transformers | ■ Bushings |
| ■ Distribution transformers | ■ Cables |
| ■ Instrument transformers | ■ Capacitors |
| ■ Rotating machines | ■ Circuit breakers |
| ■ Oil insulation | ■ Surge arresters |

TEST CAPABILITIES

- | | |
|---------------------------------------|---------------------------|
| ■ Power factor | ■ Capacitance |
| ■ Dissipation factor ($\tan\delta$) | ■ Voltage |
| ■ Excitation current | ■ Current |
| ■ Power factor tip-up | ■ Turns ratio* |
| ■ Watts loss | * with optional accessory |
| ■ Inductance | |



DELTA manual control

FEATURES AND BENEFITS

Performance and Accuracy

- Generates its own test signal resulting in accurate and clean measurements even in the most severe conditions and in the event power is required from a portable generator.
- High noise suppression and advanced signal acquisition circuitry can handle up to 15 mA interference current or a signal to noise ratio of up to 1:20 resulting in extremely accurate and clean measurements even in the most severe conditions.
- Patented Individual Temperature Correction (ITC) allows the user to estimate the actual temperature dependence of the test object by measuring tan delta over a frequency range. Mathematically calculating accurate individual temperature correction results in a more accurate measurement of the insulating material’s condition.
- Patented automatic voltage dependence detection: various high voltage components may have a voltage dependence where tip-up testing is recommended.
- Dynamic noise suppression minimizes actual test time.

Wide frequency range test output (1-500Hz)

- Ability to perform wide range DFR for diagnostic (1-500Hz) testing of transformer, bushings, etc.
- Allows testing of large capacitive specimens as well as ITC.
- Easier to test and lighter weight solution for large capacitive specimen testing.
- The following table is a sample specimen size vs. frequency output:

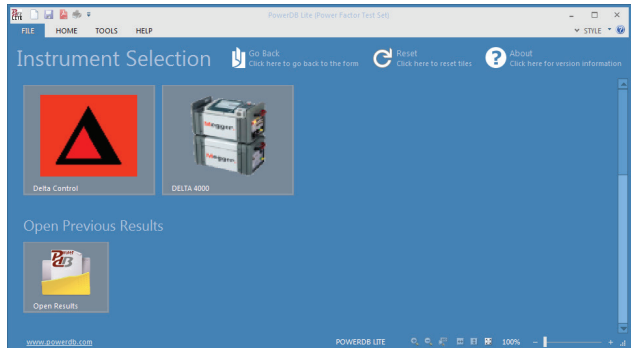
| I Max Continuous (mA) | Max Volt (kV) | Frequency (Hz) | Cap (nF) |
|-----------------------|---------------|----------------|----------|
| 300 | 12 | 60 | 67 |
| 300 | 8 | 60 | 100 |
| 300 | 6 | 60 | 133 |
| 300 | 4 | 60 | 200 |
| 300 | 2 | 60 | 400 |
| 300 | 12 | 45 | 89 |
| 300 | 8 | 45 | 133 |
| 300 | 6 | 45 | 178 |
| 300 | 4 | 45 | 267 |
| 300 | 8 | 30 | 200 |
| 300 | 6 | 30 | 267 |
| 300 | 4 | 30 | 400 |
| 300 | 4 | 15 | 800 |
| 300 | 2 | 15 | 1600 |

Designed for the Field

- Two-piece design, weighing 14 kg + 22 kg, saves on effort, space, and shipping costs.
- Designed for various work environments: in the field; in a test van; in a manufacturing facility; or in a repair facility.
- Units have performed successful testing in the world’s most extreme conditions including: high temperatures, low temperatures, high elevations, high noise, and high humidity.

Software Package — PowerDB LITE

- Automatic and manual operation – provides fully automatic operation for tan delta as well as excitation current and tip-up testing. The user simply selects the test object and the unit will automatically run the complete test and report the results back to the test form.
- Easy to save and retrieve data – information will be saved in an XML file with all historical data. This allows the user to view previous year’s test sheet or trend specific test points.
- Capability to trend a specific asset over time (with optional Advanced or Pro version).
- Easily recall transformer setups from the settings menu.



DELTA4310A OnBoard computer screen

PREMIUM SUPPORT

Region dependent; please contact your Megger Sales Representative for details. Available in 1-yr, 2-yr, and 3-yr agreements.

- Extended product warranty protects your unit beyond the standard manufacturer’s warranty.
- Loaner units and loaner accessories provide guaranteed reliability. Loaners are delivered within 1-2 business days.
- Field application support provided by former utility engineers who have vast substation and transformer experience to guide you through your testing procedures and answer your questions.
- Software support and guidance through installation, importing older data, customizing forms, comparing results, and data trending.
- Onsite training on the equipment software, theory, field testing, data analysis, and PowerDB. Training can be provided on-site or at any of the Megger facilities.

SPECIFICATIONS

Input Power

90 - 264 V 45 - 66 Hz

16 A max

No loss in performance when used with portable generator.

Output Voltage

0 to 12 kV, continuously adjustable

Test Frequency Range

45-70 Hz (12 kV)

15-400 Hz (4 kV)

1-505 Hz (250V)

0.0001 Hz maximum resolution

Output Power

3.6 kVA

Output Current

300 mA (4 minutes)

200 mA (30 minutes)

100 mA (continuous)

The power supply capacity can be expanded to 4 A at 12 kV using the optional Resonating Inductor, (Cat. No. 670600-1).

Measuring Ranges

Voltage

25 V to 12 kV, 1 V resolution

Current

0 to 5 Amps, 0.1 μ A maximum resolution. The measurement can be corrected to either 2.5 kV or 10 kV equivalents.

Capacitance: 0 to 100 μ F, 0.01 pF maximum resolution

Inductance: 6 H to 10 MH, 0.1 mH maximum resolution

Power factor: 0-100% (0-1), 0.001% maximum resolution

Dissipation factor: 0-100 (0-10,000%), 0.001% maximum resolution

Watt Loss

0 to 2 kW, actual power, 0 to 100 kW when corrected to 10 kV equivalent.

0.1 mW maximum resolution. The measurement can be corrected to either 2.5 kV or 10 kV equivalents.

Temperature Correction

Individual temperature correction

from 5°C to 50°C insulation test temperature to 20°C reference

Standard tables

As by international standards and manufacturers' data

Accuracy

Voltage \pm (1% of reading + 1 digit)

Current \pm (1% of reading + 1 digit)

Capacitance \pm (0.5% of reading + 1 pF)

Inductance \pm (0.5% of reading + 1 mH)

Power Factor and Dissipation Factor \pm (0.5% of reading + 0.02%)

Watt Loss \pm (1% of reading + 1mW)

Frequency \pm 0.005% of reading

Noise Immunity

Electrostatic

15mA induced noise into any test lead with no loss of measurement accuracy at maximum interference to specimen current of 20:1

Electromagnetic

500 μ T, at 50/60 Hz in any direction

Measurement

UST: Ungrounded Specimen Testing

GST: Grounded Specimen Testing

PC Requirements

DELTA4110

Operating system: Windows 7, Windows 8 and Windows 10

Processor: Min Pentium 1 GHz

Memory: Min 1024 Mb RAM

Hard drive: Min 2 Gb available

Interface: USB and Ethernet

DELTA4310A

Internal PC (provided)

DELTA4310A Provided Hardware

Touchscreen Display (ruggedized for field use)

Size: 300 mm (12 in.)

Resolution: 1024 x 768 (XGA)

Luminance: 1600 nits

Coating: anti-glare

Backlight: LED

Technology: 4-wire resistive touchscreen

Memory: 32 Gigabits (SSD)

Controls & Communication

Built-in touchscreen, 2 only USB 2.0 ports and 1 only Ethernet interface

(10/100 Mbps) provided for data export, built-in printer as well as OnBoard

computer remote control of the Megger TTR3XX, MTO3XX, MLR10, MWA3XX

and S1/MIT series insulation testers.

Environment

Temperature

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

Storage: -50 to +70° C (-58 to +158° F)

Relative humidity

Operating and Storage: 0 to 95% non-condensing

Standards

Safety

IEC/EN 61010-1:2001

EMC

EN 61326:1997/A1:1998/A2:2001/A3:2003

Dimensions

Control Unit: 290 x 290 x 460 mm (11 x 11 x 18 in.)

High Voltage Unit: 290 x 290 x 460 mm (11 x 11 x 18 in.)

*Does not include handles

Weight

| | | | | |
|----------------|----------------|---------------|----------------|----------------|
| DELTA4100 | DELTA4300A | DELTA4010 | HV Cable | Other Cables |
| 14 kg (31 lbs) | 17 kg (35 lbs) | 23kg (48 lbs) | 11 kg (25 lbs) | 10 kg (23 lbs) |

ORDERING INFORMATION

| Item [Qty] | Cat. No. | Item [Qty] | Cat. No. |
|---|--------------|---|------------|
| DELTA4110 Insulation Diagnostic System (DELTA4100 control unit and DELTA4010 HV unit) | DELTA4110 | Optional Accessories <i>For more details on DELTA4000 Accessories, please refer to the DELTA accessories brochure.</i> | |
| DELTA4310A Insulation Diagnostic System with onboard computer (DELTA4300A control unit and DELTA4010 HV unit) | DELTA4310A | Standard accessory kit, includes: | 670501 |
| Included Accessories | | <ul style="list-style-type: none"> ▪ Mini bushing tap connectors [set of 2] P/N 670506 ▪ Hot collar straps [set of 3] P/N 670505 ▪ Thermometer - hygrometer - clock [1] P/N 670504 ▪ Temperature and humidity probe, complete with 7 m (20 ft) lead, P/N 2002-138 ▪ 0.75" bushing tap adapter [1] P/N 30918-000 ▪ 1" bushing tap adapter [1] P/N 30918-100 ▪ "J" probe bushing tap adapter [1], P/N 30917 ▪ 1 m (3 ft) non-insulating shorting lead, 3 each of P/N 34726-1 ▪ 2 m (6 ft) non-insulating shorting lead, 3 each of P/N 34726-2 ▪ Bushing tap adapter - ABB (older style bushings) P/N 2006-375 ▪ Bushing tap adapter, female-to-female P/N 90014-353 ▪ Bushing adapter, male to female P/N 90021-216 | |
| High voltage lead: 21 m (70 ft), double shielded | 30012-11 | Safety hand switch, Interlock #2, 2.4 m (8 ft) | 1001-851 |
| Measurement lead, color-coded red, 21 m (70 ft) | 25572-1 | External HV strobe P/N 90009-210, complete with 18 m (60 ft) detachable lead P/N 1004-532 | 1004-639 |
| Measurement lead, color-coded blue, 21 m (70 ft) | 25572-2 | Soft padded carrying case for control or HV unit [2 required] | 2001-766 |
| Ground lead: 9 m (30 ft) | 2002-131 | Transport case [2 required] | 2005-115 |
| Input power cable 16A EU | 17032-29 | Transport cart / trolley | 2009-071 |
| Input power cable 16A US | 17032-28 | Calibration kit (CAL4000) | 2002-137 |
| Input power cable 16A UK | 17032-30 | High-voltage reference standard | 670500-1 |
| Safety hand switch, Interlock #1, 21 m (70 ft) | 1001-850 | Transit case for 670500-1 | 670635 |
| Safety foot interlock, 3m (10 ft) | 1001-852 | HV TTR capacitor, single phase (10 nF, 10 kV) | 36610 |
| HV unit power cable, 1 m (3 ft) | 2002-132 | HV reference capacitor (100 pF, 10 kV) | 36610-1 |
| HV unit control cable, 1 m (3 ft) | 2002-133 | HV reference capacitor (1000 pF, 10 kV) | 36610-2 |
| Ground lead interconnect cable, 1 m (3 ft) | 2002-134 | Transit case for capacitor set of 3 above | 36610-CC |
| USB cable, 2 m (7 ft) | CA-USB | Capacitor kit (TTR cap, 2 ref caps, transit case) | 36610-KIT2 |
| Ethernet cable, CAT 5, 2 m (7 ft) | 36798 | Resonating inductor | 670600-1 |
| Lead Bag for HV cable | 2001-507 | Adapter kit for DELTA4000 and competitor's resonating inductor | 1002-455 |
| Lead Bag for other cables/accessories | 2005-265 | Oil test cell, field model, complete with transit case | 670511 |
| Software DELTA manual control | 1001-981 | Oil test cell, high-temperature lab model, complete with transit case | 1004-716 |
| PowerDB Lite software | | Factory upgrade: DELTA4110 to DELTA4310A <i>Note: only available for DELTA4110 units built after August 1, 2017</i> | 1010-297 |
| Optional Software | | | |
| PowerDB Pro software, on USB dongle | DB1001S-A | | |
| Advanced PowerDB software, on USB dongle | DB1011 | | |
| Optional Extended Warranty and Annual Support | | | |
| Priority Access annual support plan | D4K-P-ACCESS | | |
| Additional 6-month product warranty | Y6-WARRANTY | | |
| Additional 12-month product warranty | Y12-WARRANTY | | |
| Additional 24-month product warranty | Y24-WARRANTY | | |
| Additional 36-month product warranty | Y36-WARRANTY | | |

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The word 'Megger' is a registered trademark

