

# DELTA4000 Series

## 12 kV Insulation Diagnostic System



- Easy to use with automatic and manual operation
- Accurate and repeatable measurement results with high noise suppression for the most extreme conditions
- Lightweight, rugged two-piece design, with unit weights of 31 lb and 48 lb
- New built-in intelligent temperature correction, eliminates the need for temperature correction tables (patent pending)
- New automatic voltage dependence detection (patent pending)
- Performs Doble test (insulation power factor); also imports or exports data from DTA software to PowerDB
- Dedicated engineering support team, available 24/7
- Premium+ support includes extended warranty, annual training, and loaner unit

### DESCRIPTION

The new 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 765kV 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, 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 DELTA4310 test set comes with an onboard computer.

### APPLICATIONS

- Power transformers
- Distribution transformers
- Instrument transformers
- Rotating machines
- Oil insulation
- Bushings
- Cables
- Capacitors
- Circuit breakers
- Surge arrestors

### TEST CAPABILITIES

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



DELTA4110 test set  
to be used with external  
computer



DELTA4310 test set with  
onboard computer

**FEATURES AND BENEFITS****Industry-Leading 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.
- **Industry leading frequency range** (1-500 Hz) reveals details in the insulation characteristics that are not possible to detect with other test sets.
- **Intelligent temperature correction** (patent pending) 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.
- **Automatic voltage dependence detection** (patent pending) Various high voltage components may have a voltage dependence where tip-up testing is recommended (i.e. the dissipation factor is pending test voltage). The DELTA4000 Series has a patented method for detecting voltage dependence and gives the user an alarm, suggesting additional tests should be performed at different voltage levels.
- **Fast test time** - Dynamic noise suppression minimizes actual test time.
- **Performs Doble testing**. When a Doble test is required or specified, be assured the Megger DELTA4000 Series performs all your Doble testing needs.

**Industry's Lightest and Most Rugged**

- **Industry's lightest** two-piece design, weighing 31 lb + 48 lb 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.

**DELTA4000 Software Packages**

- **PowerDB Advanced** provides fully automatic operation and capability to trend a specific asset over time.
- **Delta Control** provides a manual testing mode.

**Easy-to-Use Software**

- **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. The DELTA4000 Series can also be used with Delta Control software in a manual testing mode, where the operator has full control to set the test parameters including the possibility to manually increase the test voltage during testing.

- **Easy to save and retrieve data** - Data 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.
- **Simple, intuitive, easy-to-use interface** between operator and instrument.
- **Suspect data points are flagged** visually with a red highlight.
- **Easily recall transformer setups** from the settings menu.
- **Ability to interface with other transformer test units** such as MLR10 (leakage reactance, capacitance banks), TTR-series (transformer turns ratio), MTO210 (winding resistance), MIT/S1-series (DC insulation), MCT-series (CT measurements).

**Optional Database Software**

- **PowerDB Pro** is a comprehensive Acceptance and Maintenance Test Data Management Software and Database that allows you synchronize information from all of your different types of instruments into a single database, trend test results to similar equipment and the ability to design or modify test forms.
- **Easily import your historical data points** even from other manufacturers' databases.
- **Analysis and trending** - As an immediate on-site assessment the user can compare the latest measurements with stored data and see how the insulation values may have changed over time (trending). Comparison of measurements captured at different voltages and different frequencies can also be observed. Pass/Fail criteria can be set to immediately identify a possible problem in your insulation.

**PREMIUM SUPPORT**

Region dependent; please contact your nearest Megger Sales Representative for details. Available in 1-yr, 3-yr, and 5-yr agreements.

- **Extended product warranty** protects your unit beyond the standard manufacturer's warranty.
- **Loaner units and loaner accessories** provide guaranteed reliability. Loaners delivered within 1-2 business days.
- **Field application support provided by** former utility engineers and PhD's 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.
- **Annual onsite training** on the equipment, software, theory, field testing, data analysis, and PowerDB. Training can be provided on-site or at any of the AVO Training facilities.

**SPECIFICATIONS****Input Power**

100-240 V  $\pm$  10 %, 50/60 Hz, 16 A max

**Output Voltage**

0 to 12 kV, continuously adjustable

**Test Frequency Range**

45-70 Hz (12 kV)

15-400 Hz (4 kV)

1-500 Hz (250 V)

**Output Power**

3.6 kVA

**Output Current**

300 mA (4 minutes)

100 mA (continuous)

The power supply capacity can be expanded to 4 A at 12 kV using the optional Resonating Inductor, catalog number 670600.

**Measuring Ranges****Voltage**

25 V to 12 kV, 1 V resolution

**Current**

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

**Capacitance**

0 to 100  $\mu$ F, 0.01 pF maximum resolution

**Inductance**

6 H to 10 MH, 0.1 mH maximum resolution

**Power Factor**

PF 0-100% (0-1)

**Dissipation Factor**

DF 0-100 (0-10,000%)

**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****Intelligent 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  $\pm$ (0.5% of reading + 0.02%)

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

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

**Measurement**

The following test modes are available:

**UST: Ungrounded Specimen Testing**

UST-R: UST: Measure Red, Ground Blue

UST-B: UST: Measure Blue, Ground Red

UST-RB: UST: Measure Red and Blue

**GST: Grounded Specimen Testing**

GST-GND: GST: Ground Red and Blue

GSTg-R: GST: Guard Red, Ground Blue

GSTg-B: GST: Guard Blue, Ground Red

GSTg-RB GST: Guard Red and Blue

**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  $\mu$ T, at 50 Hz in any direction

**Computer Interface**

Ethernet and USB

**PC Requirements**

DELTA4110

Operating system: Windows XP/Vista/7

Processor: Min Pentium 1 GHz

Memory: Min 1024 Mb RAM

Hard drive: Min 1 Gb available

Interface: USB and Ethernet

DELTA4310

Internal PC with 8.4" full-color VGA, full QWERTY keypad, navigational pushbuttons, and joystick (external mouse can be connected) on-screen view of test forms, USB printer interface.

**Communication/Control/Data Management Software**

PowerDB and DELTA Control

**Safety Qualifications**

IEC / ANSI 61010-1

**Environment****Temperature**

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

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

**Relative Humidity**

Operating: 0 to 95% non-condensing

Storage: 0 to 95% non-condensing

**Shock and Vibration**

ASTM D999.75

**EMC**

EN 61326

**Dimensions**

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

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

\*Does not include handles.

**Weight**

DELTA4100 Control Unit: 31 lbs (14 kg)

DELTA4300 Control Unit: 33 lbs (15 kg)

DELTA4010 High Voltage Unit: 48 lbs (22kg)

Cables: 33 lbs (15 kg)

**ORDERING INFORMATION**

Item [Qty]	Cat. No.	Item [Qty]	Cat. No.
DELTA4110 Insulation Diagnostic System (DELTA4100 control unit and DELTA4010 HV unit)	DELTA4110	<b>Optional Accessories</b>	
DELTA4310 Insulation Diagnostic System with onboard computer (DELTA4300 control unit and DELTA4010 HV unit)	DELTA4310	Safety foot switch	1001-852
<b>Included Accessories</b>		External strobe	Y37181
High voltage lead: 60 ft (18 m), double shielded	2002-120	External strobe extension cable, 60 ft (18 m)	1001-853
Measurement lead, color-coded red	25572-1	Transport case, 2-piece design	
Measurement lead, color-coded blue	25572-2	Case for control unit and accessories [1]	2001-746
Ground lead: 30 ft (9 m)	2002-131	Case for HV unit and accessories [1]	2001-746
Mains cable 16A EU	17032-19	Transport case, 3-piece design	
Mains cable 16A US	17032-20	Case for control unit [1]	2001-791
Mains cable 16A UK	17032-21	Case for HV unit [1]	2001-791
Mains cable 16A no plug	17032-22	Case for accessories [1]	2001-792
Safety hand switch, Interlock #1: 60 ft (18 m)	1001-850	Transport cart / trolley	1001-530
Safety hand switch, Interlock #2: 8 ft (2.5 m)	1001-851	Calibration box set for CAL4000	2002-137
HV unit power cable 3 ft (1m)	2002-132	Calibration standard	670500-1
HV unit control cable 3 ft (1m)	2002-133	Transit cases for calibration standard	670635
Ground lead cable 3 ft (1m)	2002-134	HV TTR capacitor, single phase (10 nF, 10 kV)	36610
USB cable 10 ft (3 m)	2002-135	HV reference capacitor (100 pF, 10 kV)	36610-1
Ethernet cable, CAT 5, 10 ft (3 m)	2002-136	HV reference capacitor (1000 pF, 10 kV)	36610-2
Soft padded carrying case for control unit [1]	2001-766	Carry case for capacitors	36610-CC
Soft padded carrying case for HV unit [1]	2001-766	Capacitor kit (TTR cap, 2 ref caps, carry case)	36610-KIT2
Soft case for HV cable	2001-507	Resonating inductor	670600-1
Soft case for other cables/accessories	2001-506	Thermal Pentax® printer, 120 V	36493-1
User manual	81331	Thermal Pentax® printer, 240 V	36494-1-KIT
Application guide	81332	Thermal paper (8.5" x 11") for printer	36809-1
Warranty [1 year]		Thermal paper (A4) for printer	36809-2
PowerDB Advanced software with Delta Control		Oil test cell	670511
<b>Optional Software</b>		Hot collar belts [3]	670505
PowerDB Pro software, on USB dongle	DB1001S-A	Bushing tap connectors [2]	670506
PowerDB Pro software, via soft key	DB1001-A	External temperature and humidity probes	2002-138
<b>Extended Product Warranty</b>		USB bar code wand and software	36528
1-year extended warranty	Y12-WARRANTY	Accessory kit: hot collar straps [3], external temperature and humidity meters, .75" bushing tap connector [1], 1" bushing tap connector [1], mini bushing tap connectors [2], "J" probe bushing tap connector [1], 3 ft (1 m) non-insulating shorting lead [3], 6 ft (2 m) non-insulating shorting lead [3]	670501
2-year extended warranty	Y24-WARRANTY	Special length cables available upon request	Consult factory
3-year extended warranty	Y36-WARRANTY	<b>Additional Transformer Test Products</b>	
PowerDB Advanced support and upgrades	Consult factory	Leakage Reactance	MLR
PowerDB Pro software support and upgrades	Consult factory	Turns Ratio, 3-phase	TTR
Premium support plan [where available] 1-yr, 3-yr, or 5-yr agreement	Consult factory	Winding Resistance	MTO
Premium Plus support plan [where available] 1-yr, 3-yr, or 5-yr agreement	Consult factory	Sweep Frequency Response Analysis (SFRA)	FRAX
		Dielectric Frequency Response (DFR) and moisture assessment	IDAX
		DC Insulation	MIT/S1
		Current Transformer Measurements	MCT

MULTI-TEK INTERNATIONAL  
 140-144 Freston Road,  
 London W10 6TR, England  
 Tel: +44 20-73133190  
 Fax: +44 20-73133191  
 E-Mail: [mti@multitekintl.com](mailto:mti@multitekintl.com)

**ISO STATEMENT**

Registered to ISO 9001:2000 Cert. no. 10006.01

**DELTA4000\_DS\_US\_V01**

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