

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 14 kg and 22 kg**
- **New built-in intelligent temperature correction eliminates the need for temperature correction tables (patent pending)**
- **New automatic voltage dependence detection (patent pending)**

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 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 | ■ Bushings |
| ■ Distribution transformers | ■ Cables |
| ■ Instrument transformers | ■ Capacitors |
| ■ Rotating machines | ■ Circuit breakers |
| ■ Oil insulation | ■ Surge arrestors |

TEST CAPABILITIES

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



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** (1-500Hz) 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.

Industry's Lightest and Most Rugged

- **Industry's lightest** 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 Advanced

- **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 adjust the output voltage and measure output current and output voltage continuously.
- **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.

- **Simple, intuitive, easy-to-use interface** between operator and instrument.
- **Suspect data points are flagged** visually with a red highlight.
- **Capability to trend** a specific asset over time.
- **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

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 are 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 Megger facilities.

SPECIFICATIONS**Input Power**

90 - 264 V
45 - 66 Hz
16 A max

No loss in performance when used with portable generator. Also possible to use 12 V dc with optional inverter kit (P/N 35271-16)

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**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)
Frequency \pm 0.005% of reading

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 μ T, at 50/60 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

Environment**Temperature**

Operating: -20 to +55° C (-4 to +131° F)
Storage: -50 to +70° C (-58 to +158° F)

Relative humidity

Operating: 0 to 95% non-condensing
Storage: 0 to 95% non-condensing

Standards**Safety**

IEC/EN 61010-1:2001

Shock and vibration

IEC 68-2-31, first edition, drop and topple (push over)
IEC 68-2-31, second edition, free fall
ISTA 2A

EMC

FCC 47 CFR Part 15 Class A Emissions requirements (USA) (FCC Subpart B of Part 15 Class A)
EN 55011:1998/A1:1999/A2:2002 Group 1 Class A ISM Emissions requirements (EUROPE)
AS/NZS CISPR 11:2004 Class A ISM Emissions requirements (Australia)
EN 61326:1997/A1:1998/A2:2001/A3:2003
IEC/EN 61000-4-2/3/4/5/6/8/11
IEC/EN 61000-6-2
Test Equipment Specifications Met: IEC/EN 61000-6-4;
IEC 801-2(1984) Electrostatic Discharge; ANSI/IEEE C37.90.1 Surge Withstand Capability

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	DELTA4300	DELTA4010	Cables
14 kg (31 lbs)	15 kg (33 lbs)	23kg (48 lbs)	15 kg (33 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	
DELTA4310 Insulation Diagnostic System with onboard computer (DELTA4300 control unit and DELTA4010 HV unit)	DELTA4310	Standard accessory kit: mini bushing tap connectors [2] P/N 670506, hot collar straps [3] P/N 670505, digital temperature and humidity meter [1] P/N 670504, .75" bushing tap connector [1] P/N 30918-000, 1" bushing tap connector [1] P/N 30918-100, "J" probe bushing tap connector [1], P/N 30917	
Included Accessories		1 m (3 ft) non-insulating shorting lead [3], P/N 34726-1	
High voltage lead: 21 m (70 ft), double shielded	30012-11	2 m (6 ft) non-insulating shorting lead [3], P/N 34726-2 670501	
Measurement lead, color-coded red	25572-1	Digital temperature and humidity meter 670504	
Measurement lead, color-coded blue	25572-2	External temperature and humidity probes 2002-138	
Ground lead: 9 m (30 ft)	2002-131	Safety foot switch 1001-852	
Input power cable 25A EU	17032-23	External strobe, 3 m (9 ft) Y37181	
Input power cable 16A US	17032-20	External strobe extension cable, 18 m (60 ft) 1001-853	
Input power cable 16A UK	17032-21	Transport case, 2-piece design kit, consists of: 1001-932	
Input power cable 16A no plug	17032-22	case for control unit and accessories (2001-746), case for HV unit and accessories (2001-746)	
Safety hand switch, Interlock #1: 18 m (60 ft)	1001-850	Transport case, 3-piece design kit, consists of: 1001-933	
Safety hand switch, Interlock #2: 2.5 m (8 ft)	1001-851	case for control unit (2001-791), case for HV unit (2001-791), case for accessories (2001-792)	
HV unit power cable, 1 m (3 ft)	2002-132	Transport cart / trolley 1001-530	
HV unit control cable, 1 m (3 ft)	2002-133	Calibration box set for CAL4000 2002-137	
Ground lead cable, 1 m (3 ft)	2002-134	Calibration standard 670500-1	
USB cable, 2 m (7 ft)	CA-USB	Transit cases for calibration standard 670635	
Ethernet cable, CAT 5, 2 m (7 ft)	36798	HV TTR capacitor, single phase (10 nF, 10 kV) 36610	
Soft padded carrying case for control unit [1]	2001-766	HV reference capacitor (100 pF, 10 kV) 36610-1	
Soft padded carrying case for HV unit [1]	2001-766	HV reference capacitor (1000 pF, 10 kV) 36610-2	
Soft case for HV cable	2001-507	Carry case for capacitors 36610-CC	
Soft case for other cables/accessories	2001-506	Capacitor kit (TTR cap, 2 ref caps, carry case) 36610-KIT2	
User manual	81331	Inverter kit 35271-16	
Warranty [1 year]		Resonating inductor 670600-1	
PowerDB software		Thermal Pentax® printer, 120 V 36493-1	
Optional Software		Thermal Pentax® printer, 240 V 36494-1-KIT	
PowerDB Pro software, on USB dongle	DB1001S-A	Thermal paper (8.5" x 11") for printer 36809-1	
PowerDB Pro software, via soft key	DB1001-A	Thermal paper (A4) for printer 36809-2	
Extended Warranty and Annual Support		Oil test cell 670511	
Priority Access annual support plan	D4K-P-ACCESS	Hot collar belts [3] 670505	
Product warranty	Y12-WARRANTY	Bushings tap connectors [2] 670506	
Training	D4K-TRAINING	USB bar code wand and software 36528	
PowerDB software maintenance and upgrades	D4K-SOFTWARE	Special length cables available upon request Consult factory	
24/7 technical support	D4K-TECHSUPPORT	Additional Transformer Test Products	
Engineering consulting and results analysis	D4K-ENGCONSULT	Leakage Reactance MLR	
Loaner unit and accessories	D4K-LOANER	Turns Ratio, 3-phase TTR	
		Winding Resistance MTO	
		Sweep Frequency Response Analysis (SFRA) FRAX	
		Dielectric Frequency Response (DFR) and moisture assessment IDAX	
		DC Insulation MIT/S1	
		Current Transformer Measurements MCT	

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