DELTA4000 Series DELTA4000 4110 4310
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)**

-MEGGER DELTA4000 4110 4310 DESCRIPTION

The new DELTA4000 Series is a fully automatic 12 kV insulation power factor/dissipation factor (tan∂) 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.

-MEGGER DELTA4000 4110 4310 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∂)
- ■ 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** (1-500Hz) 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 increase the test voltage during testing.

- **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
100-240 V ± 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 (250V)

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

Capacitance
0 to 100 µF, 0.01 pF maximum resolution

Inductance
6 H to 10 MH, 0.1 mH maximum resolution

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

Dissipation factor
DF   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 ±(1% of reading + 1 digit)
Current ±(1% of reading + 1 digit)
Capacitance ±(0.5% of reading + 1 pF)
Inductance ±(0.5% of reading + 1 mH)
Power Factor ±(0.5% of reading + 0.02%)
Dissipation Factor ±(0.5% of reading + 0.02%)
Watt Loss ±(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 µT, 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: -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

Shock and vibration
ASTM D999.75

EMC
EN 61326

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 Control Unit: 14 kg (31 lbs)
DELTA4300 Control Unit: 15 kg (33 lbs)
DELTA4010 High Voltage Unit: 22kg (48 lbs)
Cables: 15 kg (33 lbs)

ORDERING INFORMATION

Item [Qty]	Cat. No.
DELTA4110 Insulation Diagnostic System (DELTA4100 control unit and DELTA4010 HV unit)	DELTA4110
DELTA4310 Insulation Diagnostic System with onboard computer (DELTA4300 control unit and DELTA4010 HV unit)	DELTA4310
Included Accessories	
High voltage lead: 21 m (70 ft), double shielded	30012-11
Measurement lead, color-coded red	25572-1
Measurement lead, color-coded blue	25572-2
Ground lead: 9 m (30 ft)	2002-131
Input power cable 25A EU	17032-23
Input power cable 16A US	17032-20
Input power cable 16A UK	17032-21
Input power cable 16A no plug	17032-22
Safety hand switch, Interlock #1: 18 m (60 ft)	1001-850
Safety hand switch, Interlock #2: 2.5 m (8 ft)	1001-851
HV unit power cable, 1 m (3 ft)	2002-132
HV unit control cable, 1 m (3 ft)	2002-133
Ground lead cable, 1 m (3 ft)	2002-134
USB cable, 2 m (7 ft)	CA-USB
Ethernet cable, CAT 5, 2 m (7 ft)	36798
Soft padded carrying case for control unit [1]	2001-766
Soft padded carrying case for HV unit [1]	2001-766
Soft case for HV cable	2001-507
Soft case for other cables/accessories	2001-506
User manual	81331
Application guide	81332
Warranty [1 year]	
PowerDB Advanced software	
Optional Software	
PowerDB Pro software, on USB dongle	DB1001S-A
PowerDB Pro software, via soft key	DB1001-A
Extended Warranty and Annual Support	
Priority Access annual support plan	D4K-P-ACCESS
Product warranty	Y12-WARRANTY
Training	D4K-TRAINING
PowerDB software maintenance and upgrades	D4K-SOFTWARE
24/7 technical support	D4K-TECHSUPPORT
Engineering consulting and results analysis	D4K-ENGCONSULT
Loaner unit and accessories	D4K-LOANER

Item [Qty]	Cat. No.
Optional Accessories	
Safety foot switch	1001-852
External strobe	Y37181
External strobe extension cable, 18 m (60 ft)	1001-853
Transport case, 2-piece design kit, consists of: case for control unit and accessories (2001-746), case for HV unit and accessories (2001-746)	1001-932
Transport case, 3-piece design kit, consists of: case for control unit (2001-791), case for HV unit (2001-791), case for accessories (2001-792)	1001-933
Transport cart / trolley	1001-530
Calibration box set for CAL4000	2002-137
Calibration standard	670500-1
Transit cases for calibration standard	670635
HV TTR capacitor, single phase (10 nF, 10 kV)	36610
HV reference capacitor (100 pF, 10 kV)	36610-1
HV reference capacitor (1000 pF, 10 kV)	36610-2
Carry case for capacitors	36610-CC
Capacitor kit (TTR cap, 2 ref caps, carry case)	36610-KIT2
Resonating inductor	670600-1
Thermal Pentax® printer, 120 V	36493-1
Thermal Pentax® printer, 240 V	36494-1-KIT
Thermal paper (8.5" x 11") for printer	36809-1
Thermal paper (A4) for printer	36809-2
Oil test cell	670511
Hot collar belts [3]	670505
Bushing tap connectors [2]	670506
External temperature and humidity probes	2002-138
USB bar code wand and software	36528
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], 1 m (3 ft) non-insulating shorting lead [3], 2 m (6 ft) non-insulating shorting lead [3]	670501
Special length cables available upon request	Consult factory
Additional Transformer Test Products	
Leakage Reactance	MLR
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