

## DELTA4000 12 kV Insulation Diagnostic System



DELTA4310A test set shown above with onboard computer

- Immediate power frequency (50 / 60 Hz) insulation condition assessment with 1 Hz power factor / tan delta
- Precise temperature correction based on insulation deterioration with patented Individual Temperature Correction (ITC)
- Guided test forms streamline testing and condition assessment of critical high voltage assets
- Simplified connection to bushing taps using quick disconnect clamps and 4mm banana plug sockets
- Portable, lightweight, and rugged two-piece design
- Accurate measurements under high noise conditions (765 kV substations)
- Industrial 300 mm (12 in.) touch-screen controller option

### DESCRIPTION

The DELTA4000 is an automatic 12 kV insulation power factor/dissipation factor ( $\tan\delta$ ) test set designed for immediate condition assessment of electrical insulation. In addition to traditional power frequency (50/60 Hz) testing, the DELTA4000 utilizes 1 Hz power factor/dissipation factor to enhance power frequency assessment of high voltage transformers, bushings, circuit breakers, cables, lightning arresters, and rotating machines. Using the same connection and software as power frequency tests, 1 Hz improves maintenance planning by reducing the need for historical trending and proprietary databases.

By varying frequency from 1 to 505 Hz, the DELTA4000 provides individual temperature correction (ITC) from 0 to 50 °C for power frequency and 1 Hz measurements. When using ITC, the insulation condition of the asset under test determines temperature correction, eliminating the need for inaccurate temperature correction tables.

In addition to innovative insulation assessment, the DELTA4000 can be used to measure the excitation current of transformer windings and perform automatic tip-up tests. With optional accessories, oil, TTR and CCVT ratio and phase, and rotating machine testing is possible.

Utilizing PowerDB forms, the DELTA4000 guides users through connections and tests. Individual files preserve asset data for trending, while Microsoft Excel® export enables import into asset management software. In addition, PowerDB can import historical data from asset management software or comparable insulation diagnostic test sets, guaranteeing access to historical data. For expert users, Delta Manual Control provides powerful diagnostic capabilities.

### APPLICATION

- Power transformers
- Distribution transformer
- Instrument transformers
  - CT
  - PT
  - CCVT
- Rotating machines
- Oil insulation
- Bushings
- Cables
- Capacitors
- Circuit breakers
- Surge arresters

### TEST CAPABILITIES

- Power factor
- Dissipation factor ( $\tan\delta$ )
- Excitation current
- Automatic Tip-up
- Watts Loss
- Inductance
- Capacitance
- Voltage
- Current
- HV TTR
- CCVT ratio and phase

## DELTA4000 12 kV Insulation Diagnostic System

### TEST LEAD CONNECTIONS

HV Lead 21 m (70 ft)  
PN 30012H-11

Hinged Connection  
allows both rotation  
and angular twisting

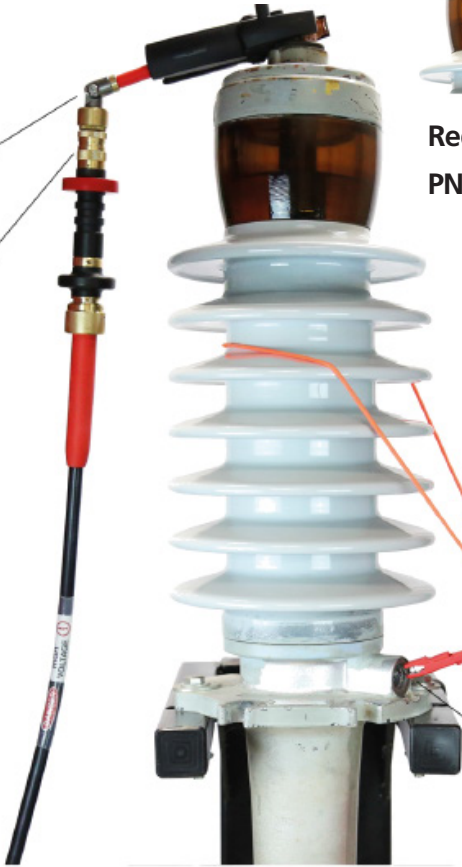
Quick Connect



Red Lead 21 m (70 ft)  
PN 25572H-1



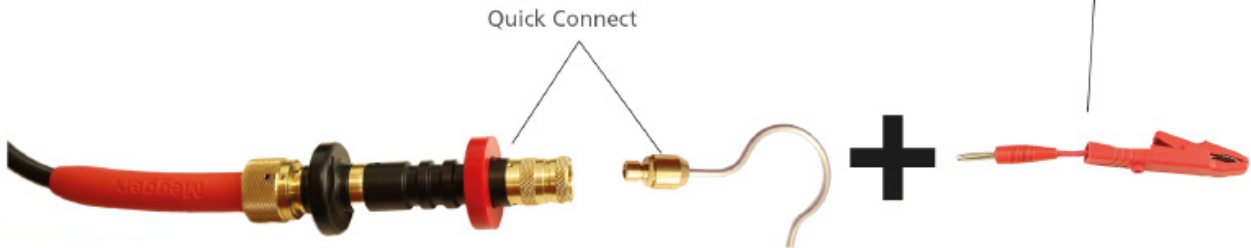
Blue Lead 21 m (70 ft)  
PN 25572H-2



Tether Strap  
supporting  
HV cable

Tether clips attach to slots in  
the outboard bumper when  
needed to support the  
weight of the cable

Small clip  
for connecting  
to bushing tap



Quick Connect

The DELTA4000 high voltage and measurement leads come equipped with unique quick connects and 4mm banana plug sockets, providing superior connectivity to assets. Connecting to bushing taps with a small clip provides confidence that the connection to the bushing tap spring is secure. Large bumpers and tether straps ensure that leads do not contact with the transformer tank, eliminating interference with measurements.

# DELTA4000

## 12 kV Insulation Diagnostic System

### 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  $\mu$ 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:** 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)

Current  $\pm$ (1% of reading)

Capacitance  $\pm$ (0.5% of reading + 0.1 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  $\mu$ 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 61326-1:2013

##### Shock and Vibration

IEC 68-2-31 Drop, Topple, Freefall

#### 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)	8 kg (18 lbs)	10 kg (23 lbs)

# DELTA4000

## 12 kV Insulation Diagnostic System

### ORDERING INFORMATION

Item [Qty]	Cat. No.	Item [Qty]	Cat. No.
DELTA4110 Insulation Diagnostic System (DELTA4100 control unit and DELTA4010B HV unit)	DELTA4110		
DELTA4310A Insulation Diagnostic System with onboard computer (DELTA4300A control unit and DELTA4010B HV unit)	DELTA4310A		
<b>Included Accessories</b>		<b>Optional Accessories</b>	
High voltage lead: 21 m (70 ft), double shielded	30012H-11	For more details on DELTA4000 Accessories, please refer to the DELTA accessories brochure.	
Measurement lead, color-coded red, 21 m (70 ft)	25572H-1	Standard accessory kit, includes:	670501
Measurement lead, color-coded blue, 21 m (70 ft)	25572H-2	<ul style="list-style-type: none"> <li>▪ Hot collar straps [set of 3] P/N 670505</li> <li>▪ Thermometer - hygrometer - clock [1] P/N 670504</li> <li>▪ Temperature and humidity probe, complete with 7 m (20 ft) lead, P/N 2002-138</li> <li>▪ 0.75" bushing tap adapter [1] P/N 30918-000</li> <li>▪ 1" bushing tap adapter [1] P/N 30918-100</li> <li>▪ "J" probe bushing tap adapter [1], P/N 30917</li> <li>▪ Bushing tap adapter - ABB (older style bushings) P/N 2006-375</li> <li>▪ Bushing tap adapter, female-to-female P/N 90014-353</li> <li>▪ Bushing adapter, male to female P/N 90021-216</li> <li>▪ 3m (10ft) non-insulating shorting lead P/N 2014-136-10</li> <li>▪ 6m (20ft) non-insulating shorting lead P/N 2014-136-20</li> </ul>	
Ground lead: 9 m (30 ft)	2002-131	Safety hand switch, Interlock #2, 2.4 m (8 ft)	1001-851
Input power cable 16A EU	17032-29	1m (3ft) non-insulating shorting lead P/N 2014-136-3	
Input power cable 16A US	17032-28	2m (6ft) non-insulating shorting lead P/N 2014-136-6	
Input power cable 16A UK	17032-30	Mini bushing tap connectors [set of 2] P/N 670506	
Safety hand switch, Interlock #1, 21 m (70 ft)	1001-850	External HV strobe P/N 90009-210, complete with 18 m (60 ft) detachable lead P/N 1004-532	1004-639
Safety foot interlock, 3m (10 ft)	1001-852	Soft padded carrying case for control or HV unit [2 required]	2001-766
HV unit power cable, 1 m (3 ft)	2002-132	Transport case [2 required]	2005-115
HV unit control cable, 1 m (3 ft)	2002-133	Transport cart / trolley	2009-071
Ground lead interconnect cable, 1 m (3 ft)	2002-134	10 kV PF/DF & Capacitance Reference	PFDF-10
USB cable, 2 m (7 ft)	CA-USB	Calibration kit (CAL4000)	2002-137
Ethernet cable, CAT 5, 2 m (7 ft)	36798	High-voltage reference standard	670500-1
Backpack lead bag	2012-180	Transit case for 670500-1	670635
Software DELTA manual control	1001-981	HV TTR transducer for measuring transformer turns ratio	1013-060
PowerDB Lite software		HV CVT/VT ratio transducer for measuring CVT/VT ratio & phase	1013-061
<b>Optional Software</b>		HV TTR capacitor, single phase (10 nF, 10 kV)	36610
PowerDB Pro software, on USB dongle	DB1001S-A	HV reference capacitor (100 pF, 10 kV)	36610-1
Advanced PowerDB software, on USB dongle	DB1011	HV reference capacitor (1000 pF, 10 kV)	36610-2
<b>Optional Extended Warranty and Annual Support</b>		Transit case for capacitor set of 3 above	36610-CC
Priority Access annual support plan	81897	Capacitor kit (TTR cap, 2 ref caps, transit case)	36610-KIT2
Additional 6-month product warranty	Y6-WARRANTY	Resonating inductor	670600-1
Additional 12-month product warranty	Y12-WARRANTY	Adapter kit for DELTA4000 and competitor's resonating inductor	1002-455
Additional 24-month product warranty	Y24-WARRANTY	Oil test cell, field model, complete with transit case	670511
Additional 36-month product warranty	Y36-WARRANTY	Oil test cell, high-temperature lab model, complete with transit case	1004-716
		Factory upgrade: DELTA4110 to DELTA4310A <i>Note: only available for DELTA4110 units built after August 1, 2017</i>	1010-297
		Factory upgrade: DELTA4010 to DELTA4010B. <i>Note: DELTA4010B required for HV TTR &amp; HV CVT/VT ratio accuracy of ±0.1%</i>	DELTA4010B-UPGRADE

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