

Delta 4110/4310A

12kV Insulation Diagnostic System

Training Guide

Megger[®]
Power on

Delta 4110/4310A Topics

■ PowerDB Lite – New Test

- Startup
- Selecting a form
- Entering Nameplate
- Saving
- Testing
 - Test Type
 - Connection Diagram
 - Test Configuration
 - Running a Test
 - Viewing Results
- Individual Temperature Correction (ITC)
- Export to DTA5/6

■ PowerDB Lite – Open Previous Test

- Open (Continue) Test Result
- New Test Result
- Delete Test Result

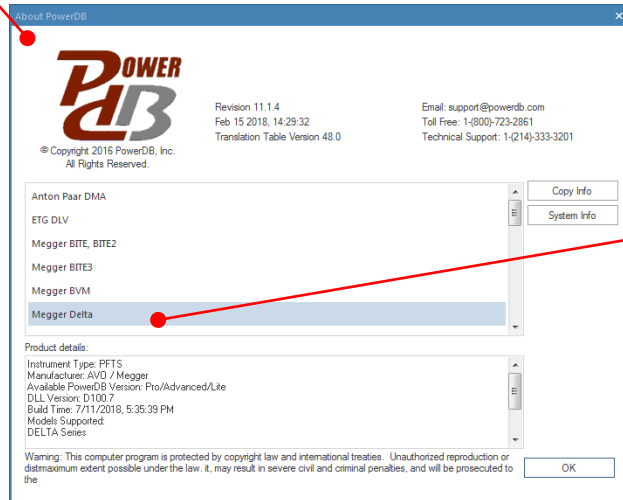
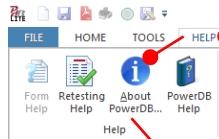
■ PowerDB Pro

- Adding New Result
- Trending
- Import from DTA6

■ Delta Manual Control

- Object ID
- Temperatures
- Test Tag
- Test Type
- Interference Mode
- Test Mode
- Voltage/Frequency
- Testing
 - Interlocks
 - Results
- Settings
- Graph
- Results
- Help
- Status

Delta 4110/4310A – PowerDB Startup



■ Check for PowerDB Updates

In PowerDB Lite, go to Help

About PowerDB...

Select Megger Delta

Delta 4110/4310A – PowerDB Startup

About PowerDB

POWER DB

Revision 11.1.4
Feb 15 2018, 14:29:32
Translation Table Version 48.0

Email: support@powerdb.com
Toll Free: 1-(800)-723-2861
Technical Support: 1-(214)-333-3201

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Anton Paar DMA
ETG DLV
Megger BITE, BITE2
Megger BITE3
Megger EVM
Megger Delta

Product details:
Instrument Type: PFTS
Manufacturer: AVO / Megger
Available PowerDB Versions: Pro/Advanced/Lite
DLL Version: D100.7
Build Time: 7/17/2018, 5:35:39 PM
Models Supported:
DELTA Series

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OK

ment Software

Downloads Forms Search...

ould affect multi-user access to your data. In order to synchronize data or have all machines at a company must be running the same major release of a different major release (e.g., version 9, 10 or 11), then you will need to update to a new version.

PowerDB supervisor before upgrading to Version 11.1. Update the database schema and will no longer be compatible.

program prior to installing on your PC.

Up

Order Files by:
Default | Name | Author | Date | Hits

Files:

Name	Created	Size
PowerDB Pro, Advanced, and Lite	2018-09-10 17:37:37	702 MB

Download

Release Notes / Change Log

See note above about updating to

* 11.1.4 Driver Update *

* - August 21, 2018 *

* - PowerDB 11.1.4 *

* - AVO_DELTA2000.D100.7 (NO CHANGE) *

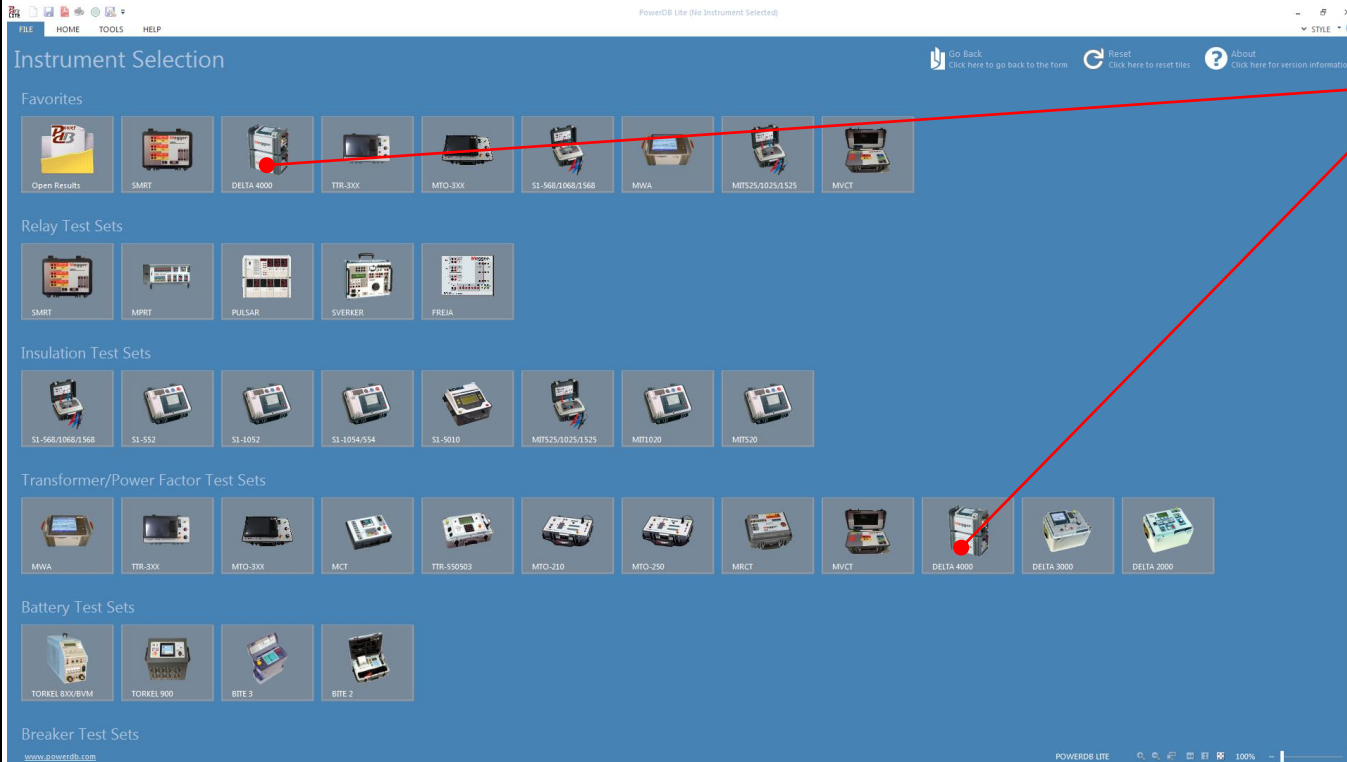
* - AVO_MTO.D100.11 (DRIVER/FORM CHANGE) *

* - AVO_TTR.D100.6 (DRIVER/FORM CHANGE) *

Go to www.powerdb.com
Downloads page
Open change log and see if the Delta driver has been updated



Delta 4110/4310A – PowerDB Startup



Click on the
DELTA 4000

*DELTA 4000 will appear in
your favorites after the first
time you select it from
Transformer/Power Factor
Test Sets*

Delta 4110/4310A – Select Form

Select A Form

RECOMMENDED

- PF TWO-WINDING TRANSFORMERS - 93500
- PF THREE-WINDING TRANSFORMERS - 94500
- PF AUTO TRANSFORMER WITH TERTIARY - 95500
- PF AUTO TRANSFORMER WITHOUT TERTIARY - 95501
- Shunt Reactor - 95502

CABLES

- PF CABLES - 96005

CIRCUIT BREAKER

- PF AIR-MAG CIRCUIT BREAKER - 92500
- PF OIL CIRCUIT BREAKER - 92510
- PF SF6 DEAD TANK CIRCUIT BREAKER - 92520
- PF SF6 LIVE TANK CIRCUIT BREAKER - 92529
- PF VACUUM CIRCUIT BREAKER - 92530
- PF VACUUM CIRCUIT RECLOSER - 92550

GENERATORS

- PF GENERATOR TIP UP - 98000

INSTRUMENT TRANSFORMERS

- PF PT/VT TRANSFORMER - 27600

OK Cancel

Select a form and click OK

Choose a form that is appropriate for the asset you are testing.

For the purpose of this training material, we will focus on Two-Winding Transformers

Delta 4110/4310A – Nameplate

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT REASON _____
 YEAR TANK TYPE WEIGHT
 WINDING MATERIAL
 OIL VOLUME
 OIL TEMP °C
 IMPEDANCE _____ %
 WEATHER _____
 BIL _____ kV

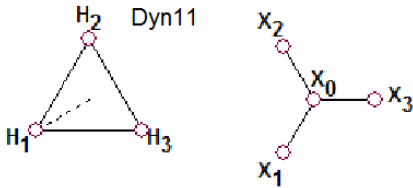


Diagram # 15 (ANSI)

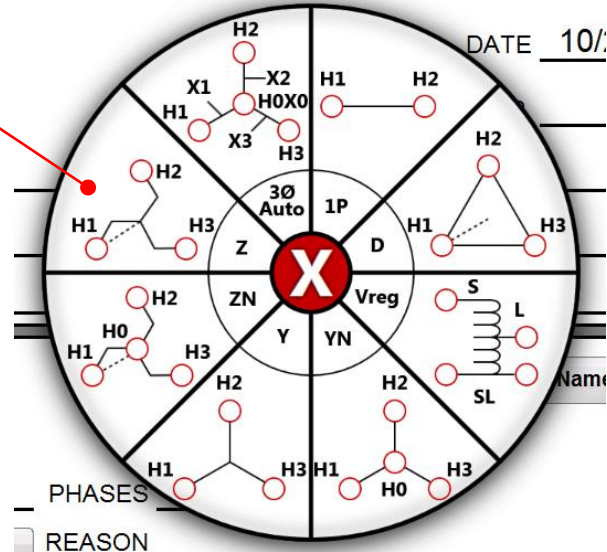
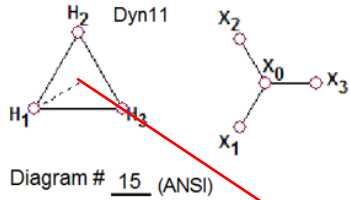
	VOLTAGE (kV)		kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>		5	3	DETC	
SECOND:	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>		1		OLTC	

COMMENTS:

■ Fill out Nameplate

After saving, fields required for temperature correction will highlight red if unpopulated

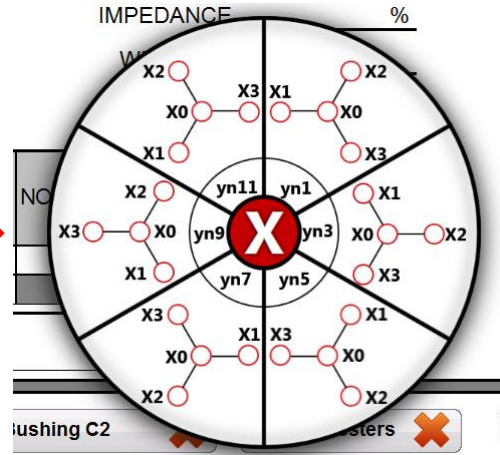
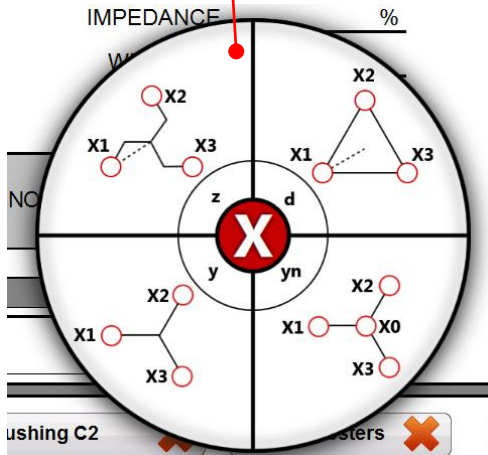
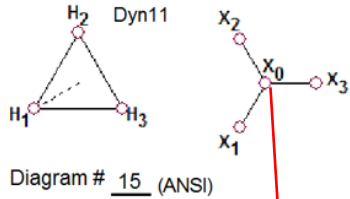
Delta 4110/4310A – Primary Vector



■ Select Primary Vector

Match to nameplate

Delta 4110/4310A – Secondary Vector



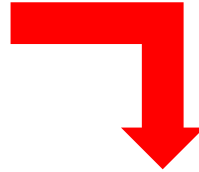
- Select Secondary Vector

Select Secondary Vector Group, then Secondary Vector Phasing

Secondary Vector Groups and Phasing limited by Primary Vector selected

Delta 4110/4310A – Bushing Nameplate

BUSHING NAMEPLATE						
Dsg	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
N/A						
X1						
X2						
X3						
X0						



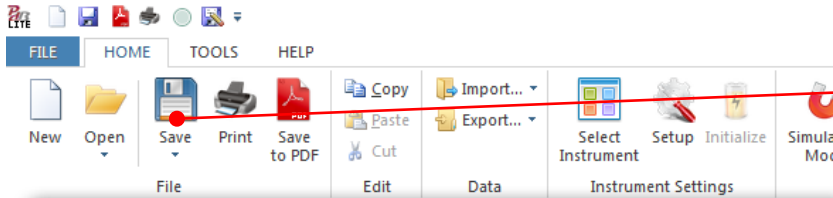
■ Fill out Bushing Nameplate

Designations based on Vector

BUSHING NAMEPLATE						
Dsg	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1		COB	L	5	5000	1999
H2		COB	L	5	5000	1999
H3		COB	L	5	5000	1999
N/A						
X1		BRUSH	ONA	7	2000	1929
X2		BRUSH	ONA	7	2000	1929
X3		BRUSH	ONA	7	2000	1929
X0		BRUSH	ONA	7	2000	1929

MFR, Type/Class, kV, AMPS, Year copies if unpopulated
 H1 copies to H2/H3/H0
 X1 copies to X2/X3/X0

Delta 4110/4310A – Save Form

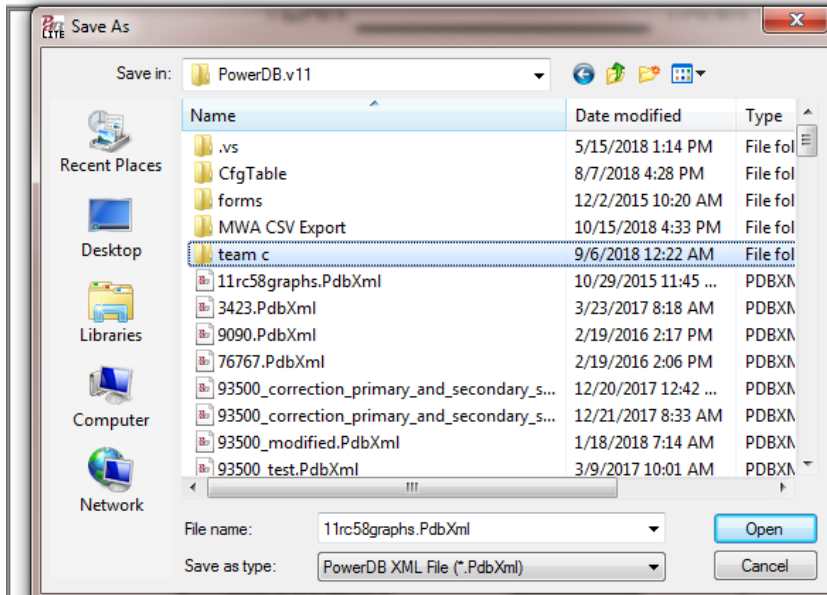


■ Select Save in the ribbon bar

It is recommended to save before running tests.


If you do not save before running a test, PowerDB will ask you to save after every test completes until the result is saved.


PowerDB automatically saves after every test if the form was previously saved




Delta 4110/4310A – Test Sections

Select Tests:

Overall Test 

Bushing C1 

Bushing C2 


Surge Arresters 


Settings

Recalculate Test Voltages


Hot Collar Test 

TTR 

Exciting Current 

Manual Tests 

Communications Log

 Select which tests to display on the form

Delta 4110/4310A – Settings

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings Recalculate Test Voltages

Hot Collar Test TTR Exciting Current Manual Tests Communications Log

Form Settings

Standard: ANSI
Equivalent Reading: Direct
Use PF or DF: POWER FACTOR
%PF/%DF G Limit: 1.000
%PF/%DF I Limit: 2.000
Greater than I Limit = Bad
Disable Color Ratings:
Show Diag Number:

Load Settings

Current Form
Global Settings
Factory Settings

Delta 4000 Settings

Test Frequency: 60
Hide VDF%: %VDF Limit: 0.50
Hide DFR:
DFR Test Voltage (kV): 0.25
DFR Plot: Log X - Log Y
DFR Frequencies (i.e. 320 160 80 32 16):
470 220 110 70 40 20 10 4.6416 2.1544 1
Delta Calibration Date:

Delta 2000/3000 Settings

Suppression On: Manual Mode:

Save Settings

Current Form
All Forms - Global

Cancel

Select settings

Set Test Frequency (50/60)

Show/Hide VDF% and set limit

Show/Hide DFR selection

Set DFR Test Voltage
0.25kV Recommended

DFR Graph settings

DFR Test Frequencies

Enter Delta Calibration Date

Legacy Delta settings

Save settings for this form

Save settings for all Delta forms

Delta 4110/4310A – Settings

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings Recalculate Test Voltages

Hot Collar Test TTR Exciting Current Manual Tests Communications Log

Form Settings

Standard: ANSI

Equivalent Reading: Direct

Use PF or DF: POWER FACTOR

%PF/%DF G Limit: 1.000

%PF/%DF I Limit: 2.000

Greater than I Limit = Bad

Disable Color Ratings:

Show Diag Number:

Delta 4000 Settings

Test Frequency: 60

Hide VDF%: %VDF Limit: 0.50

Hide DFR:

DER Test Voltage (kV): 0.25

DER Plot: Log X - Log Y

DFR Frequencies (i.e. 320 160 80 32 16): 470 220 110 70 40 20 10 4.64 16 2.1544 1

Delta Calibration Date: []

Delta 2000/3000 Settings

Suppression On: Manual Mode:

Save Settings

Current Form

Global Settings

Factory Settings

All Forms - Global

Cancel

- Select settings
- ANSI/IEC/Australian
- View mA/Watts as Direct/2.5kV/10kV
- Display PF or DF
- PF Good limit
- PF Investigate limit
- Enable Color coded PF limits
- Enable Vector Diagram number
- Load Current Form settings (*discard changes*)
- Load Global Settings
- Load Factory Settings

Delta 4110/4310A – Overall Test

	VOLTAGE (kV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests Communications Log

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _H L	GST-GND	H	L		G	10.00				0.900					
2	C _H G	GSTg-RB	H	L		G	10.00				0.900					
3	C _H L	UST-R	H	L		G	10.00				0.900					
4	C _H L'		Test 1 Minus Test 2													
5	C _{LG} + C _H L	GST-GND	L	H		G	2.00				0.900					
6	C _L G	GSTg-RB	L	H		G	2.00				0.900					
7	C _H L	UST-R	L	H		G	2.00				0.900					
8	C _H L'		Test 5 Minus Test 6													
9	C _H G'		C _H G Minus H Bushings													
10	C _L G'		C _L G Minus L Bushings													
Oil Test 1	Overall Oil Test	UST-R	L	H		G					0.795					
Oil Test 2	TTR Chamber Oil Test	UST-R	L	H		G					0.795					

Corr Factor based on Transformer Year, Oil Temp, kV, kVA

Temperature Correction table can be changed, or manual correction factors can be entered with this button

Delta 4110/4310A – Overall Test

	VOLTAGE (kV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test ITR Exciting Current Manual Tests

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mVA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00				0.900					
2	C _{HG}	GSTg-RB	H	L		G	10.00				0.900					
3	C _{HL}	UST-R	H	L		G	10.00				0.900					
4	C _{HL} '	Test 1 Minus Test 2														
5	C _{LG} + C _{HL}	GST-GND	L	H		G	2.00				0.900					
6	C _{LG}	GSTg-RB	L	H		G	2.00				0.900					
7	C _{HL}	UST-R	L	H		G	2.00				0.900					
8	C _{HL} '	Test 5 Minus Test 6														
9	C _{HG} '	C _{HG} Minus H Bushings														
10	C _{LG} '	C _{LG} Minus L Bushings														
Oil Test 1	Overall Oil Test	UST-R	L	H		G					0.795					
Oil Test 2	ITR Chamber Oil Test	UST-R	L	H		G					0.795					

■ Test kV based on nameplate

Use Recalculate Test Voltages if nameplate voltage entered was incorrect

Can be manually entered

Delta 4110/4310A – Overall Test

	VOLTAGE (kV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00				0.900					
2	C _{HG}	GSTg-RB	H	L		G	10.00	<input checked="" type="checkbox"/>			0.900					
3	C _{HL}	UST-R	H	L		G	10.00	<input checked="" type="checkbox"/>			0.900					
4	C _{HL} '	Test 1 Minus Test 2														
5	C _{LG} + C _{HL}	GST-GND	L	H		G	2.00				0.900					
6	C _{LG}	GSTg-RB	L	H		G	2.00	<input checked="" type="checkbox"/>			0.900					
7	C _{HL}	UST-R	L	H		G	2.00				0.900					
8	C _{HL} '	Test 5 Minus Test 6														
9	C _{HG} '	C _{HG} Minus H Bushings														
10	C _{LG} '	C _{LG} Minus L Bushings														
Oil Test 1	Overall Oil Test	UST-R	L	H		G					0.795					
Oil Test 2	TTR Chamber Oil Test	UST-R	L	H		G					0.795					

■ Enable/Disable DFR Sweep

A single test will be run at the Test kV, followed by 250V DFR sweep (default setting)

Delta 4110/4310A – Overall Test

	VOLTAGE (KV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00				0.900					
2	C _{HG}	GSTg-RB	H	L		G	10.00				0.900					
3	C _{HL}	UST-R	H	L		G	10.00				0.900					
4	C _{HL} '		Test 1 Minus Test 2													
5	C _{LG} + C _{HL}	GST-GND	L	H		G	2.00				0.900					
6	C _{LG}	GSTg-RB	L	H		G	2.00				0.900					
7	C _{HL}	UST-R	L	H		G	2.00				0.900					
8	C _{HL} '		Test 5 Minus Test 6													
9	C _{HG} '		C _{HG} Minus H Bushings													
10	C _{LG} '		C _{LG} Minus L Bushings													
Oil Test 1	Overall Oil Test	UST-R	L	H		G					0.795					
Oil Test 2	TTR Chamber Oil Test	UST-R	L	H		G					0.795					

■ Enable/Disable Multiple Test

When multiple test is enabled, all high side tests or all low side tests will be run together

Delta 4110/4310A – Overall Test

	VOLTAGE (KV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests Communications Log

Multiple Test TRANSFORMER OVERALL TEST SET UP Temp Corr. Table TRANSFORMER OVERALL TEST RESULTS

Review Hookup Diagrams

Settings

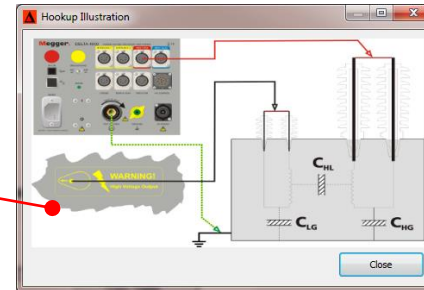
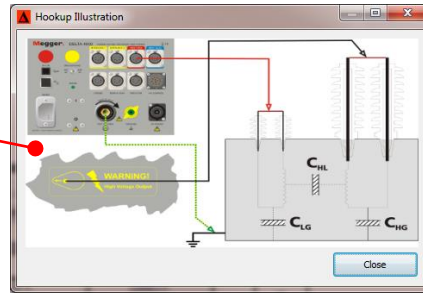
High Side Tests

CHG + CHL
CHG
CHL

Low Side Tests

CLG + CHL
CLG
CHL

Oil Tests



Delta 4110/4310A – Overall Test

	VOLTAGE (KV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00				0.900					
2	C _{HG}	GSTg-RB	H	L		G	10.00				0.900					
3	C _{HL}	UST-R	H	L		G	10.00				0.900					
4	C _{HL}	Test 1 Minus Test 2														
5	C _{LG} + C _{HL}	GST-GND	L	H		G	2.00				0.900					
6	C _{LG}	GSTg-RB	L	H		G	2.00				0.900					
7	C _{HL}	UST-R	L	H		G	2.00				0.900					
8	C _{HL}	Test 5 Minus Test 6														
9	C _{HG}	C _{HG} Minus H Bushings														
10	C _{LG}	C _{LG} Minus L Bushings														
Oil Test 1	Overall Oil Test	UST-R	L	H		G					0.795					
Oil Test 2	TTR Chamber Oil Test	UST-R	L	H		G					0.795					

■ Run a test

Select any of the blue Test No. buttons to run a test

Turn on Delta 4110/4310A

Ensure the INT/EXT switch is set appropriately:

INT for control from 12" top

EXT for control from PC

If EXT, connect USB or Ethernet to PC

Delta 4110/4310A – Overall Test

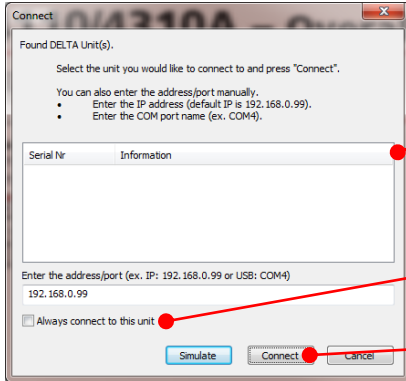
	VOLTAGE (KV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	
COMMENTS:								

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings Recalculate Test Voltages

Hot Collar Test TTR Exciting Current Manual Tests Communications Log

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
			CHG + C _H L	GST-GND	H	L				G	10.00			0.900		
1																



■ PC - Connect to the Delta

Serial Nr & information should automatically populate. If not, IP address listed can be used for Ethernet. For USB, consult Microsoft Device Manager for USB port

Select "Always connect to this unit" to skip connection step next time tests are run

Click Connect

Delta 4110/4310A – Overall Test

	VOLTAGE (kV)		KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G						
PRIMARY:	10		253	14.61	5	3	DETC	
SECOND:	5	2.887	253	29.21	1		OLTC	

COMMENTS:

Select Tests:

Overall Test Bushing C1 Bushing C2 Surge Arresters Settings

Hot Collar Test TTR Exciting Current Manual Tests

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00				0.900					

DELTA 4000

Measurement Overview

- Verify that the list below is correct. Press CANCEL to go back.
- Click on the START button to start the test(s).

For help about how to hookup, select one of the tests below and press the 'Hookup Illustration' button.

Test Mode	Suppression	Frequency	Voltage	Power Factor	Current	Capacitance	Watts
Single Frequency							
GST-GND	Frequency Variation	60 Hz	10.000 kV	--	--	--	--
GStg-RB	Frequency Variation	60 Hz	10.000 kV	--	--	--	--
UST-R	Frequency Variation	60 Hz	10.000 kV	--	--	--	--

Automatically close the dialog when measurement(s) completed successfully

START (F2) Hookup Illustration Resonance Inductor Balancing Measurement Information CLOSE (ESC)

Measurement Screen

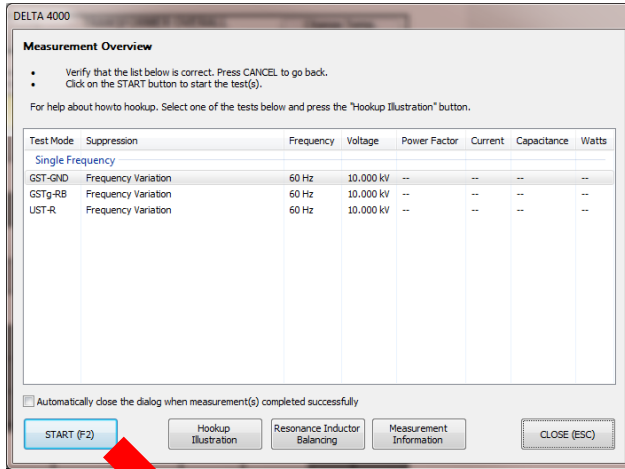
Verify Test Mode, Suppression, Frequency, and Voltage

Select Automatically close to immediately import results to PowerDB

Click Start to begin test

Measurement Information - view details during test

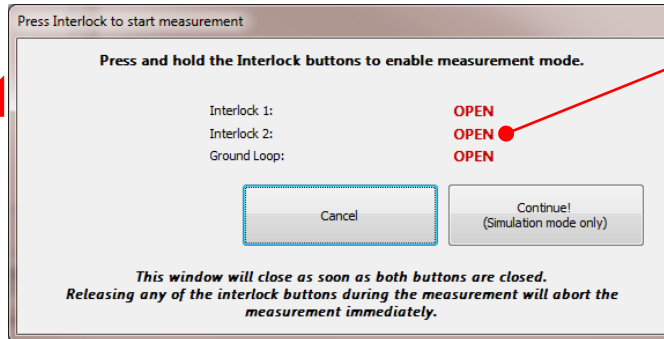
Delta 4110/4310A – Overall Test



■ Interlocks & Ground

Ground must be connected and Interlocks continuously engaged to begin and run test

OPEN will change to **CLOSED** after ground and interlocks engaged



Delta 4110/4310A – Overall Test

DELTA 4000

Measurement Overview

- Verify that the list below is correct. Press CANCEL to go back.
- Click on the START button to start the test(s).

For help about howto hookup. Select one of the tests below and press the "Hookup Illustration" button.

Test Mode	Suppression	Frequency	Voltage	Power Factor	Current	Capactance	Watts
<i>Single Frequency</i>							
GST-GND	Frequency Variation	60 Hz	10.000 kV	0.328%	36.11 mA	9.578 nF	0.5922 W
GSTg-RB	Frequency Variation	60 Hz	10.000 kV	0.5%	11.31 mA	3 nF	0.2827 W
UST-R	Frequency Variation	60 Hz	10.000 kV	0.333%	25.42 mA	6.743 nF	0.4233 W

Automatically close the dialog when measurement(s) completed successfully

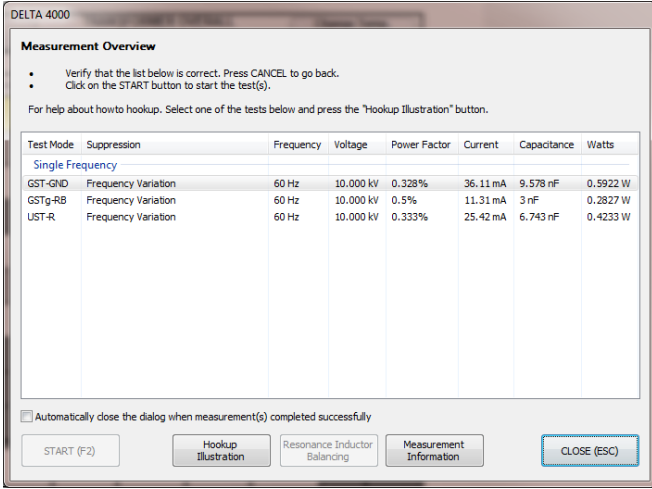
START (F2) Hookup Illustration Resonance Inductor Balancing Measurement Information CLOSE (ESC)

■ Measurement Complete

Review measurement information

Click Close to return to PowerDB form

Delta 4110/4310A – Overall Test



■ Data Imports into PowerDB

Review measurement information

IR based on settings

Multiple Test <input checked="" type="checkbox"/>		TRANSFORMER OVERALL TEST SET UP				Hookup Diagram		Temp Corr. Table		TRANSFORMER OVERALL TEST RESULTS				Change Temp. Corr. Table		
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00		9,578.00	0.33	0.30	0.900	36.1084	0.5922	1.00	G
2	C _{HG}	GSTg-RB	H	L		G	10.00	✘	3,000.00	0.50	0.45	0.900	11.3099	0.2827	1.00	G
3	C _{HL}	UST-R	H	L		G	10.00	✘	6,743.00	0.33	0.30	0.900	25.4207	0.4233	1.00	G

Delta 4110/4310A – Overall Test

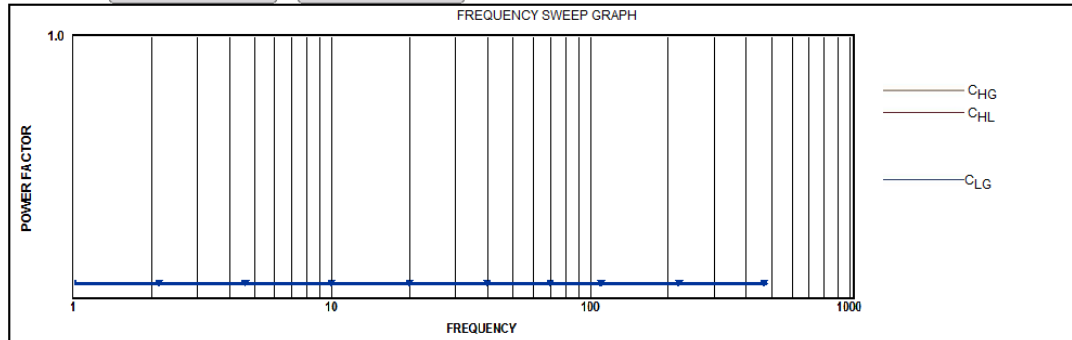
5	C _{LG} + C _{HL}	GST-GND	L	H		G	2.50								
6	C _{LG}	GSTg-RB	L	H		G	2.50	✓	3,000.00	0.50			2.3562	0.0147	1.00
7	C _{HL}	UST-R	L	H		G	2.50								
8	C _{HL} '		Test 5 Minus Test 6												
9	C _{HG} '		C _{HG} Minus H Bushings												
10	C _{LG} '		C _{LG} Minus L Bushings												
Oil Test 1	Overall Oil Test	UST-R	L	H		G							0.910		
Oil Test 2	ITC Chamber Oil Test	UST-R	L	H		G							0.910		

■ Show/Hide DFR Graph

Format Y-Axis to see more/less of the graph

Show DFR Results ✓

Format Y-Axis



Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests								Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings ✖				
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00	✖				1.140				
12	H2					UST-R	10.00	✔				0.900				
13	H3					UST-R	10.00	✖				0.900				
14	N/A					UST-R	10.00	✖								
15	X1					UST-R	2.00	✖								
16	X2					UST-R	2.00	✖								
17	X3					UST-R	2.00	✖								
18	X0					UST-R	2.00	✖								
19						UST-R		✖								

- Serial # based on Bushing Nameplate
- Cat # can be entered here

Show DFR Results ✖ Format Y-Axis

Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests					Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings							
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00	✗				1.140				
12	H2					UST-R	10.00	✓				0.900				
13	H3					UST-R	10.00	✗				0.900				
14	N/A					UST-R	10.00	✗								
15	X1					UST-R	2.00	✗								
16	X2					UST-R	2.00	✗								
17	X3					UST-R	2.00	✗								
18	X0					UST-R	2.00	✗								
19						UST-R		✗								

Show DFR Results ✗

Format Y-Axis

■ Corr. Factor based on Ambient Temp, Oil Temp, Type/Class of bushing

Manual temp correction can be entered in the first row

Correction factor for first bushing can be copied to all bushings

Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests					Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings							
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00	✗				1.140				
12	H2					UST-R	10.00	✓				0.900				
13	H3					UST-R	10.00	✗				0.900				
14	N/A					UST-R	10.00	✗								
15	X1					UST-R	2.00	✗								
16	X2					UST-R	2.00	✗								
17	X3					UST-R	2.00	✗								
18	X0					UST-R	2.00	✗								
19						UST-R		✗								

■ Select Test Mode

UST-R
UST-B

Show DFR Results ✗

Format Y-Axis

Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests						Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings ✖						
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00	✖				1.140				
12	H2					UST-R	10.00	✔				0.900				
13	H3					UST-R	10.00	✖				0.900				
14	N/A					UST-R	10.00	✖								
15	X1					UST-R	2.00	✖								
16	X2					UST-R	2.00	✖								
17	X3					UST-R	2.00	✖								
18	X0					UST-R	2.00	✖								
19						UST-R		✖								

■ Test kV based on Nameplate
Can be manually entered

Show DFR Results ✖

Format Y-Axis

Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests						Temp Corr. Table	Apply C1 Correction Factor from First Bushing to All Bushings							
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00	✗				1.140				
12	H2					UST-R	10.00	✓				0.900				
13	H3					UST-R	10.00	✗				0.900				
14	N/A					UST-R	10.00	✗								
15	X1					UST-R	2.00	✗								
16	X2					UST-R	2.00	✗								
17	X3					UST-R	2.00	✗								
18	X0					UST-R	2.00	✗								
19						UST-R		✗								

Enable/Disable DFR Sweep

A single test will be run at the Test kV, followed by 250V DFR sweep (default setting)

Show DFR Results ✗

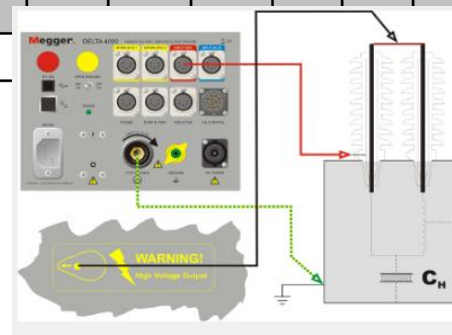
Format Y-Axis

Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests					Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings							
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT			
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts	%VDF	IR
11	H1					UST-R	10.00	✗				1.140				
12	H2					UST-R	10.00	✓				0.900				
13	H3					UST-R	10.00	✗				0.900				
14	N/A					UST-R	10.00	✗								
15	X1					UST-R	2.00	✗								
16	X2					UST-R	2.00	✗								
17	X3					UST-R	2.00	✗								
18	X0					UST-R	2.00	✗								
19						UST-R										

Review Hookup Diagrams

Show DFR Results ✗ Format Y-Axis

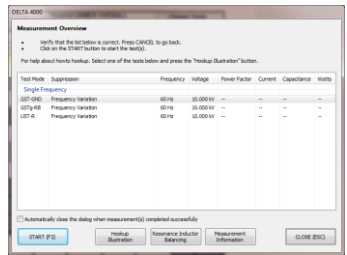
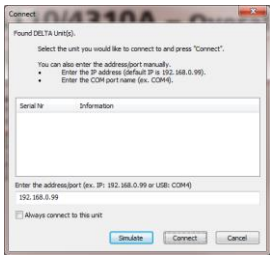


Delta 4110/4310A – Bushing C1 Test

Hookup Diagram		Transformer - Bushing C1 Tests					Temp Corr. Table		Apply C1 Correction Factor from First Bushing to All Bushings							
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	CorrFactor	mA	Watts		
11	H1					UST-R	10.00					1.140				
12	H2					UST-R	10.00					0.900				
13	H3					UST-R	10.00					0.900				
14	N/A					UST-R	10.00									
15	X1					UST-R	2.00									
16	X2					UST-R	2.00									
17	X3					UST-R	2.00									
18	X0					UST-R	2.00									
19						UST-R										

- Run a test
- Connection and Measurement Screen same as Overall Test
- Show DFR results same as Overall Test
- Review measurement information

Show DFR Results Format Y-Axis



Delta 4110/4310A – Bushing C2 Test

Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)				Measured	@ 20°C	CorrFactor	mA	Watts		
20	H1					GSTg-RB	0.50				1.140				
21	H2					GSTg-RB	0.50				0.900				
22	H3					GSTg-RB	0.50				0.900				
23	N/A					GSTg-RB	0.50								
24	X1					GSTg-RB	0.50								
25	X2					GSTg-RB	0.50								
26	X3					GSTg-RB	0.50								
27	X0					GSTg-RB	0.50								

Serial # based on Bushing Nameplate

Cat # based on C1 test

Delta 4110/4310A – Bushing C2 Test

Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)				Measured	@ 20°C	CorrFactor	mA	Watts		
20	H1					GSTg-RB	0.50				1.140				
21	H2					GSTg-RB	0.50				0.900				
22	H3					GSTg-RB	0.50				0.900				
23	N/A					GSTg-RB	0.50								
24	X1					GSTg-RB	0.50								
25	X2					GSTg-RB	0.50								
26	X3					GSTg-RB	0.50								
27	X0					GSTg-RB	0.50								

■ Corr. Factor based on Ambient Temp, Oil Temp, Type/Class of bushing

Manual temp correction can be entered in the first row

Delta 4110/4310A – Bushing C2 Test

Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)				Measured	@ 20°C	CorrFactor	mA	Watts		
20	H1					GSTg-RB	0.50				1.140				
21	H2					GSTg-RB	0.50				0.900				
22	H3					GSTg-RB	0.50				0.900				
23	N/A					GSTg-RB	0.50								
24	X1					GSTg-RB	0.50								
25	X2					GSTg-RB	0.50								
26	X3					GSTg-RB	0.50								
27	X0					GSTg-RB	0.50								

■ Select Test Mode

UST-R
UST-B
UST-RB
GST-GND
GSTg-R
GSTg-B
GSTg-RB

Delta 4110/4310A – Bushing C2 Test

Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)				Measured	@ 20°C	CorrFactor	mA	Watts		
20	H1					GSTg-RB	0.50				1.140				
21	H2					GSTg-RB	0.50				0.900				
22	H3					GSTg-RB	0.50				0.900				
23	N/A					GSTg-RB	0.50								
24	X1					GSTg-RB	0.50								
25	X2					GSTg-RB	0.50								
26	X3					GSTg-RB	0.50								
27	X0					GSTg-RB	0.50								

■ Test kV based on Nameplate

Can be manually entered

Delta 4110/4310A – Bushing C2 Test

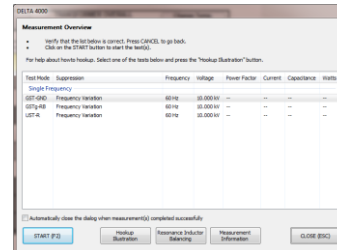
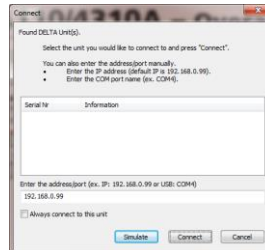
Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)				Measured	@ 20°C	CorrFactor	mA	Watts		
20	H1					GSTg-RB	0.50				1.140				
21	H2					GSTg-RB	0.50				0.900				
22	H3					GSTg-RB	0.50				0.900				
23	N/A					GSTg-RB	0.50								
24	X1					GSTg-RB	0.50								
25	X2					GSTg-RB	0.50								
26	X3					GSTg-RB	0.50								
27	X0					GSTg-RB	0.50								

■ Run a test

Connection and Measurement Screen same as Overall Test

Show DFR results same as Overall Test

Review measurement information



Delta 4110/4310A – Surge Arrester Test

Hookup Diagram

Transformer - Surge Arresters Tests

Number of Tests: 8

	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	ORDER	Test Mode	Test kV	DIRECT		IR
											mA	Watts	
28									GST-GND				
29									GST-GND				
30									GST-GND				
31									GST-GND				
32									GST-GND				
33									GST-GND				
34									GST-GND				
35									GST-GND				

■ Select Number of Tests

■ Enter:
 Location
 SN
 MFR
 Overall Catalog
 Unit Catalog
 Type
 Rated kV
 Order

Single

Top

Middle

Bottom

Delta 4110/4310A – Surge Arrester Test

Hookup Diagram		Transformer - Surge Arresters Tests								Number of Tests: <u>8</u>			
	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	ORDER	Test Mode	Test kV	DIRECT		IR
											mA	Watts	
28									GST-GND				
29									GST-GND				
30									GST-GND				
31									GST-GND				
32									GST-GND				
33									GST-GND				
34									GST-GND				
35									GST-GND				

■ Select Test Mode

UST-R
UST-B
UST-RB
GST-GND
GSTg-R
GSTg-B
GSTg-RB

Delta 4110/4310A – Surge Arrester Test

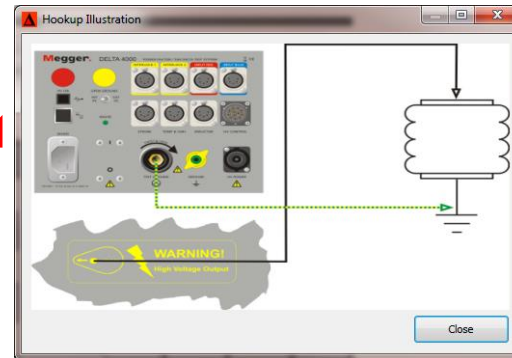
Hookup Diagram		Transformer - Surge Arresters Tests								Number of Tests: <u>8</u>			
	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	ORDER	Test Mode	Test kV	DIRECT		IR
											mA	Watts	
28									GST-GND				
29									GST-GND				
30									GST-GND				
31									GST-GND				
32									GST-GND				
33									GST-GND				
34									GST-GND				
35									GST-GND				

■ Enter Test kV

Delta 4110/4310A – Surge Arrester Test

Hookup Diagram		Transformer - Surge Arresters Tests								Number of Tests: 8				
	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated KV	ORDER	Test Mode	Test KV	DIRECT			
											mA	Watts	IR	
28									GST-GND					
29									GST-GND					
30									GST-GND					
31									GST-GND					
32									GST-GND					
33									GST-GND					
34									GST-GND					
35									GST-GND					

Review Hookup Diagrams



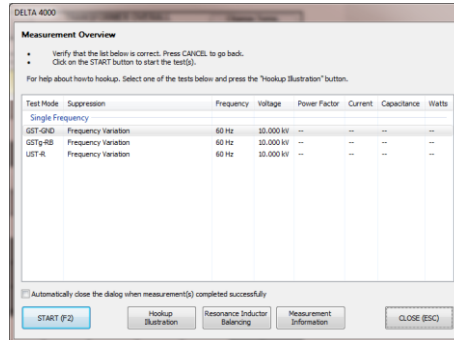
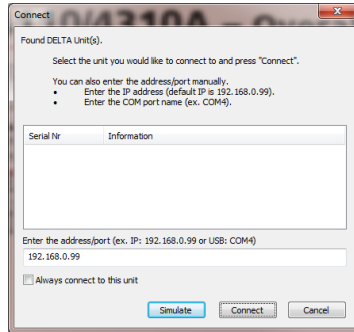
Delta 4110/4310A – Surge Arrester Test

Hookup Diagram		Transformer - Surge Arresters Tests								Number of Tests: <u>8</u>			
	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated KV	ORDER	Test Mode	Test KV	DIRECT		IR
											mA	Watts	
28									GST-GND				
29									GST-GND				
30									GST-GND				
31									GST-GND				
32									GST-GND				
33									GST-GND				
34									GST-GND				
35									GST-GND				

■ Run a test

Connection and Measurement Screen same as Overall Test

Review measurement information



Delta 4110/4310A – Hot Collar Test

Bushing Hot Collar Tests								
Test No.	Dsg	Serial #	Skirt #	Test Mode	Test KV	DIRECT		IR
						mA	Watts	
36	H1			GST-GND	10.00			
37	H2			GST-GND	10.00			
38	H3			GST-GND	10.00			
39	N/A			GST-GND	10.00			
40	X1			GST-GND	2.00			
41	X2			GST-GND	2.00			
42	X3			GST-GND	2.00			
43	X0			GST-GND	2.00			
44				GST-GND				
45				GST-GND				

■ Designation based on Bushing Nameplate

■ Enter:
Serial #
Skirt #

Delta 4110/4310A – Hot Collar Test

Bushing Hot Collar Tests								
Test No.	Dsg	Serial #	Skirt #	Test Mode	Test KV	DIRECT		IR
						mA	Watts	
36	H1			GST-GND	10.00			
37	H2			GST-GND	10.00			
38	H3			GST-GND	10.00			
39	N/A			GST-GND	10.00			
40	X1			GST-GND	2.00			
41	X2			GST-GND	2.00			
42	X3			GST-GND	2.00			
43	X0			GST-GND	2.00			
44				GST-GND				
45				GST-GND				

■ Select Test Mode

UST-R
UST-B
UST-RB
GST-GND
GSTg-R
GSTg-B
GSTg-RB

Delta 4110/4310A – Hot Collar Test

Bushing Hot Collar Tests								
Test No.	Dsg	Serial #	Skirt #	Test Mode	Test kV	DIRECT		IR
						mA	Watts	
36	H1			GST-GND	10.00			
37	H2			GST-GND	10.00			
38	H3			GST-GND	10.00			
39	N/A			GST-GND	10.00			
40	X1			GST-GND	2.00			
41	X2			GST-GND	2.00			
42	X3			GST-GND	2.00			
43	X0			GST-GND	2.00			
44				GST-GND				
45				GST-GND				

■ Test kV based on Nameplate

Can be manually entered

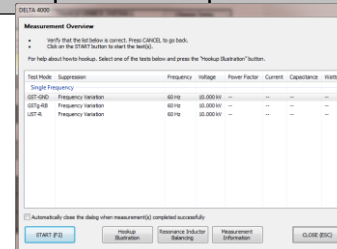
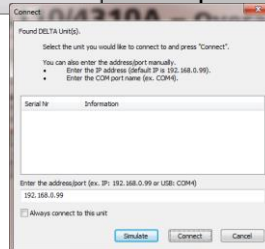
Delta 4110/4310A – Hot Collar Test

Bushings Hot Collar Tests								
Test No.	Dsg	Serial #	Skirt #	Test Mode	Test KV	DIRECT		IR
						mA	Watts	
36	H1			GST-GND	10.00			
37	H2			GST-GND	10.00			
38	H3			GST-GND	10.00			
39	N/A			GST-GND	10.00			
40	X1			GST-GND	2.00			
41	X2			GST-GND	2.00			
42	X3			GST-GND	2.00			
43	X0			GST-GND	2.00			
44				GST-GND				
45				GST-GND				

■ Run a test

Connection and Measurement Screen same as Overall Test

Review measurement information



Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS Number of Tests: 33 Hookup Diagram

CONNECTIONS:		PHASE A Enter connection				U-S-T-R		PHASE B Enter connection				U-S-T-R		PHASE C Enter connection				U-S-T-R		IR
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR			
					mA	Watts				mA	Watts				mA	Watts				
47																				
48																				
49																				
50																				
51																				

■ Enter tap information

Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS Number of Tests: 33 Hookup Diagram

CONNECTIONS:			PHASE A Enter connection				U-S-T-R		PHASE B Enter connection				U-S-T-R		PHASE C Enter connection				U-S-T-R		IR
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR				
					mA	Watts				mA	Watts				mA	Watts					
47																					
48																					
49																					
50																					
51																					

■ Enter Phase Connections

H1-H3, H2-H1, H3-H1, etc

Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS Number of Tests: 33 Hookup Diagram

CONNECTIONS:			PHASE A Enter connection				UST-R	PHASE B Enter connection				UST-R	PHASE C Enter connection				UST-R	
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR	
					mA	Watts				mA	Watts				mA	Watts		
47																		
48																		
49																		
50																		
51																		

 Select Test Mode

Each phase can use a different test mode

Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS

Number of Tests: 33

Hookup Diagram

CONNECTIONS:		PHASE A Enter connection				UST-R		PHASE B Enter connection				UST-R		PHASE C Enter connection				UST-R		
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR			
					mA	Watts				mA	Watts				mA	Watts				
47																				
48																				
49																				
50																				
51																				

■ Test kV based on Nameplate

Can be manually entered

Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS

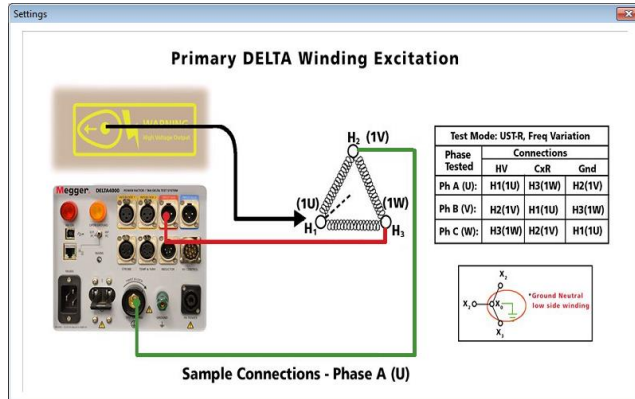
Number of Tests: 33

Hookup Diagram

CONNECTIONS:		PHASE A Enter connection				UST-R		PHASE B Enter connection				UST-R		PHASE C Enter connection				UST-R		IR
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR			
					mA	Watts				mA	Watt				mA	Watts				
47																				
48																				
49																				
50																				
51																				

Review Hookup Diagrams

Diagram will change if Y selected for Primary



Delta 4110/4310A – Exciting Current Test

EXCITING CURRENT TESTS

Number of Tests: 33

Hookup Diagram

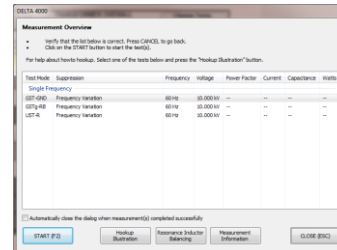
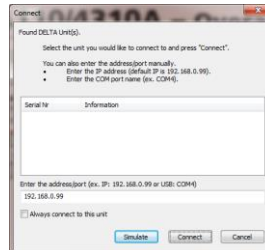
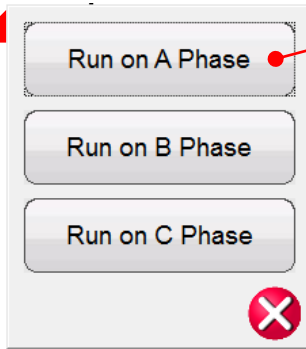
CONNECTIONS:			PHASE A Enter connection			UST-R		PHASE B Enter connection			UST-R		PHASE C Enter connection			UST-R		
DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		IR	
					mA	Watts				mA	Watts				mA	Watts		
47																		
48																		
49																		
50																		
51																		

■ Run a test

Each phase chosen separately

Connection and Measurement Screen same as Overall Test

Review measurement information



Delta 4110/4310A – TTR Test

URNS RATIO TEST

Number of Tests: 33

51	kV		Ref Test		Hookup											
DETC	LTC	H Voltage	L Voltage	Calc. Ratio	PHASE A				PHASE B				PHASE C			
					kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error
					52				53				54			
					55				56				57			
					58				59				60			
					61				62				63			
					64				65				66			
					67				68				69			

■ Enter Tap Information

DETC Tap Label
 LTC Tap Label
 H Voltage
 L Voltage

H Voltage & L Voltage required to calculate ratio

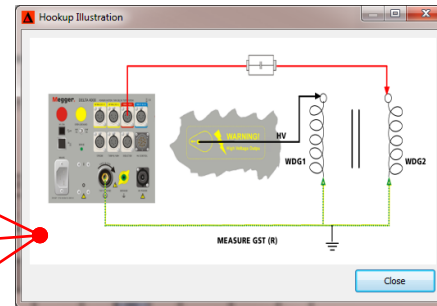
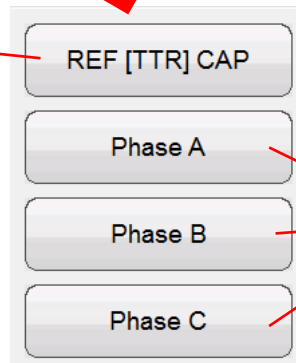
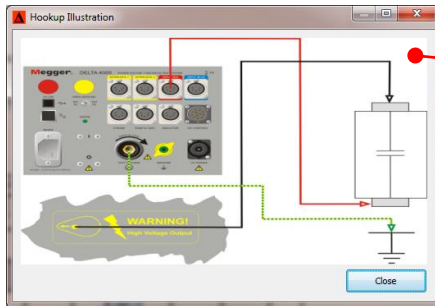
Delta 4110/4310A – TTR Test

URNS RATIO TEST

Number of Tests: 33

Ref Test					PHASE A				PHASE B				PHASE C			
DETC	LTC	H Voltage	L Voltage	Calc. Ratio	kV	Cap. (pF)	T Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error
51					52				53				54			
					55				56				57			
					58				59				60			
					61				62				63			
					64				65				66			
					67				68				69			

Review Hookup Diagrams



Delta 4110/4310A – TTR Test

URNS RATIO TEST

Number of Tests: 33

URNS RATIO TEST					Number of Tests: <u>33</u>											
51	kV	●	Ref Test		PHASE A				PHASE B				PHASE C			
DETC	LTC	H Voltage	L Voltage	Calc. Ratio	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error
					52	●			53	●			54	●		
					55				56				57			
					58				59				60			
					61				62				63			
					64				65				66			
					67				68				69			

Enter Test kV

Reference Capacitor
Phase A
Phase B
Phase C

Delta 4110/4310A – TTR Test

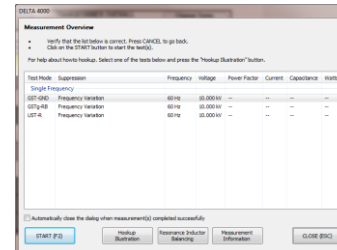
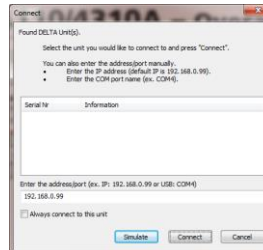
URNS RATIO TEST

Number of Tests: 33

51					KV					Ref Test					Hookup				
					PHASE A					PHASE B					PHASE C				
DETC	LTC	H Voltage	L Voltage	Calc. Ratio		kV	Cap. (pF)	Turns Ratio	% Error		kV	Cap. (pF)	Turns Ratio	% Error		kV	Cap. (pF)	Turns Ratio	% Error
					52					53					54				
					55					56					57				
					58					59					60				
					61					62					63				
					64					65					66				
					67					68					69				

Run test on Reference Capacitor

Connection and Measurement Screen same as Overall Test



Delta 4110/4310A – TTR Test

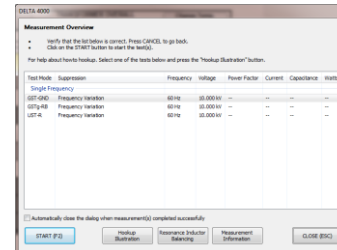
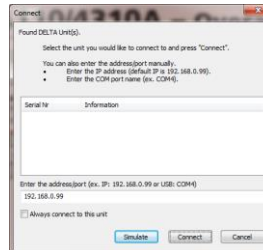
URNS RATIO TEST

Number of Tests: 33

TURNS RATIO TEST					Number of Tests: 33													
51	kV		Ref Test		Hookup													
DETC	LTC	H Voltage	L Voltage	Calc. Ratio	PHASE A				PHASE B				PHASE C					
					kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error		
					52					53					54			
					55					56					57			
					58					59					60			
					61					62					63			
					64					65					66			
					67					68					69			

Run test on Tap + Phase

Connection and Measurement Screen same as Overall Test



Delta 4110/4310A – TTR Test

URNS RATIO TEST

Number of Tests: 33

51 KV Ref Test					Hookup													
DETC	LTC	H Voltage	L Voltage	Calc. Ratio	PHASE A				PHASE B				PHASE C					
					kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error		
				52					53					54				
				55					56					57				
				58					59					60				
				61					62					63				
				64					65					66				
				67					68					69				

Turns Ratio based on Reference Capacitor capacitance and Phase capacitance

% Error based on Calc Ratio and Turns Ratio

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control Add Row Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

Add rows from the test table

Remove rows from the test table

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

Enter Insulation information

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

Select Test Mode

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

Select suppression mode

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

■ Enter Test kV

A single test will be run at the Test kV, followed by 250V DFR sweep (default setting)

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										

Enter Test Frequency

Settings will be used if no frequency entered

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control

Add Row

Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDE	IR
							MEAS.	@ 20°C	CORR.	mA	Watts		
1		UST-R	Freq Variation										



Enter Correction Factor

Delta 4110/4310A – Manual Test

MULTIPLE QUICK TESTS

Delta Control Add Row Remove Row

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST kV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mV	Watts		
1		UST-R	Freq Variation										

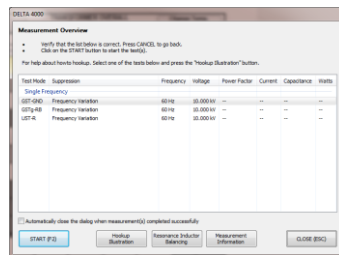
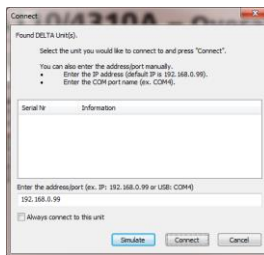
■ Run a test

Connection and Measurement Screen same as Overall Test





Review measurement information


■ Test can also be run using Delta Control

Measurement data will appear in PowerDB form when Delta Control is closed



Delta 4110/4310A – Overall Test ITC

Multiple Test 		TRANSFORMER OVERALL TEST SET UP						Hookup Diagram		Temp Corr. Table 			TRANSFORMER OVERALL TEST RESULTS				Change Temp. Corr. Table	
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR		
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts				
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00											
2	C _{HG}	GSTg-RB	H	L		G	10.00											
3	C _{HL}	UST-R	H	L		G	10.00											

 Change Temp Corr. Table to ITC

Overall Individual Temperature Correction provides a correction factor specific to a particular transformer, which is more accurate than the temperature correction table

Delta 4110/4310A – Overall Test ITC

Multiple Test <input checked="" type="checkbox"/>		TRANSFORMER OVERALL TEST SET UP						Hookup Diagram		ITC		TRANSFORMER OVERALL TEST RESULTS					Set Individual Temp. Corr.	
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR		
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts				
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00											
2	C _{HG}	GSTg-RB	H	L		G	10.00	✗										
3	C _{HL}	UST-R	H	L		G	10.00	✗										

■ Select Set Individual Temp. Corr

Requires Oil Temp from Nameplate

Requires Ambient Temp from Header

Ambient Temp gathered from Delta automatically if not populated

OIL VOLUME GAL

OIL TEMP °C

IMPEDANCE %

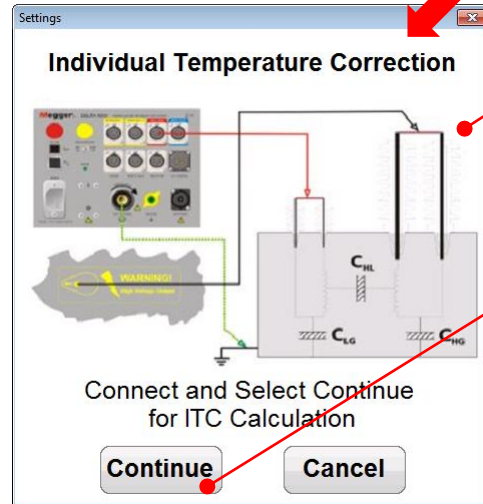
DATE 10/29/2018

AMBIENT TEMP. °F

HUMIDITY %

Delta 4110/4310A – Overall Test ITC

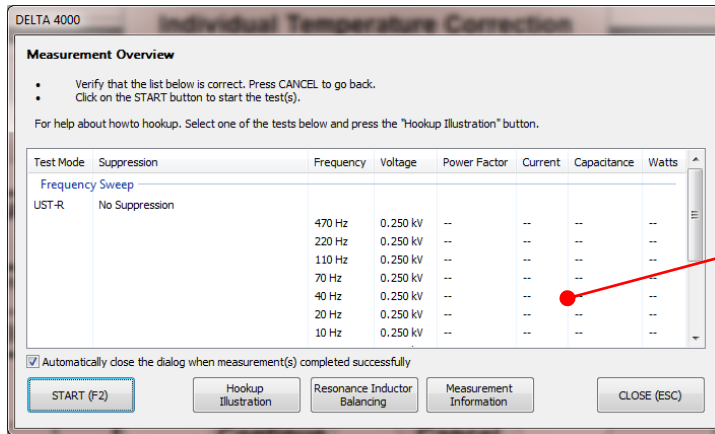
Multiple Test <input checked="" type="checkbox"/>		TRANSFORMER OVERALL TEST SET UP					Hookup Diagram		ITC		TRANSFORMER OVERALL TEST RESULTS					Set Individual Temp. Corr.	
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRTY		%VDF	IR	
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts			
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00										
2	C _{HG}	GSTg-RB	H	L		G	10.00	✗									
3	C _{HL}	UST-R	H	L		G	10.00	✗									



Review Connection Diagram

Click Continue

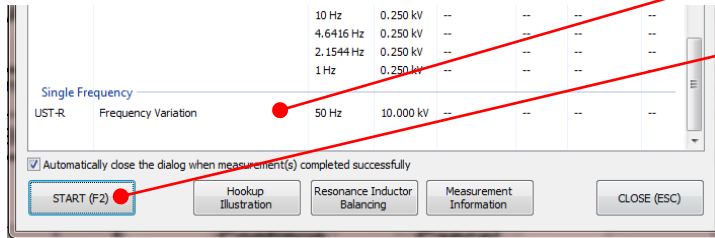
Delta 4110/4310A – Overall Test ITC



■ Review Test Setup

*ITC runs a DFR sweep on C_{HL}
In addition, the overall test is conducted to save time*

■ Click Start



Delta 4110/4310A – Overall Test ITC

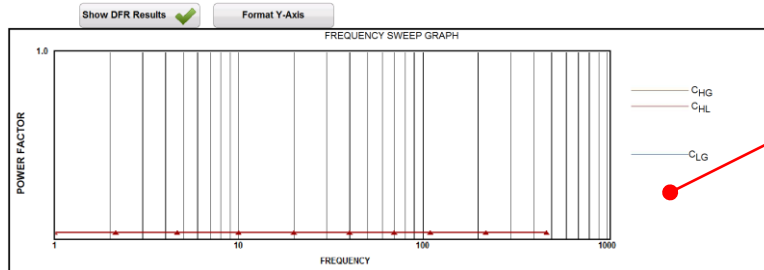
Multiple Test <input checked="" type="checkbox"/>		TRANSFORMER OVERALL TEST SET UP				Hookup Diagram		ITC		TRANSFORMER OVERALL TEST RESULTS				Set Individual Temp. Corr.		
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00					0.945				
2	C _{HG}	GSTg-RB	H	L		G	10.00	✗				0.945				
3	C _{HL}	UST-R	H	L		G	10.00	✓	6,743.00	0.33	0.31	0.945	21.1839	0.3527	1.00	G
4	C _{HL'}	Test 1 Minus Test 2														
5	C _{LG} + C _{HL}	GST-GND	L	H		G	10.00					0.945				
6	C _{LG}	GSTg-RB	L	H		G	10.00	✗				0.945				
7	C _{HL}	UST-R	L	H		G	10.00					0.945				

■ When test completes:

Overall Corr. Factor populated with ITC for all rows

CHL results populated

DFR selected and results available in graph



Delta 4110/4310A – Bushing ITC

Hookup Diagram		Transformer - Bushing C1 Tests								Temp Corr. Table	Apply C1 Correction Factor from First Bushing to All Bushings					
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	Corr Factor	mA	Watts		
11	H1					UST-R		✗								
12	H2					UST-R		✗								
13	H3					UST-R		✗								
14	N/A					UST-R		✗								
15	X1					UST-R		✗								
16	X2					UST-R		✗								
17	X3					UST-R		✗								
18	N/A					UST-R		✗								
19						UST-R		✗								

Change Temp Corr. Table to ITC

Bushing Individual Temperature Correction provides a correction factor specific to a particular bushing, which is more accurate than temperature correction tables

Delta 4110/4310A – Bushing ITC

Hookup Diagram		Transformer - Bushing C1 Tests					ITC		Set Individual Temp. Corr. <input checked="" type="radio"/>		Apply C1 Correction Factor from First Bushing to All Bushings <input type="radio"/>					
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	Corr Factor	mA	Watts		
11	H1					UST-R		✗								
12	H2					UST-R		✗								
13	H3					UST-R		✗								
14	N/A					UST-R		✗								
15	X1					UST-R		✗								
16	X2					UST-R		✗								
17	X3					UST-R		✗								
18	N/A					UST-R		✗								
19						UST-R		✗								

■ Select Set Individual Temp. Corr

Requires Oil Temp from Nameplate

Requires Ambient Temp from Header

Ambient Temp gathered from Delta automatically if not populated

OIL VOLUME

OIL TEMP °C

IMPEDANCE %

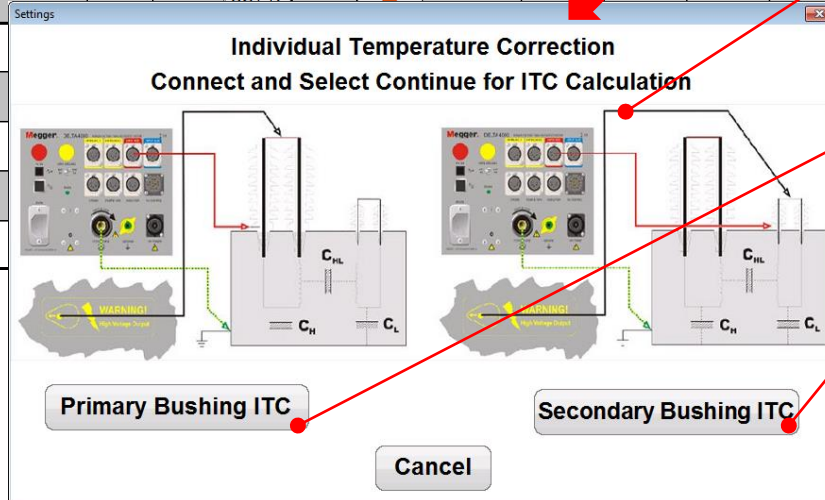
DATE

AMBIENT TEMP. °F

HUMIDITY %

Delta 4110/4310A – Bushing ITC

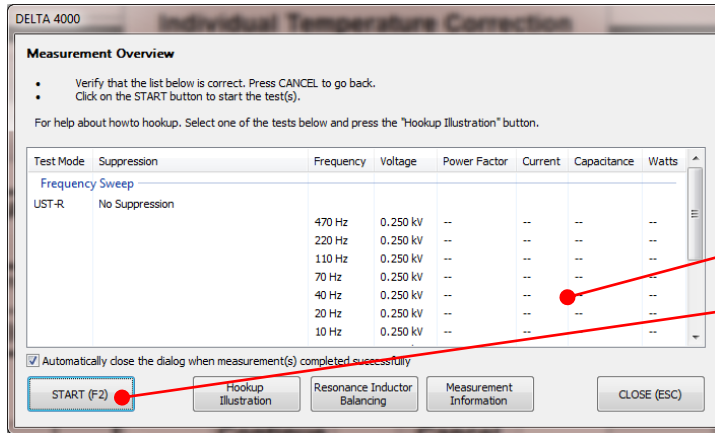
Hookup Diagram		Transformer - Bushing C1 Tests					ITC		Set Individual Temp. Corr.		Apply C1 Correction Factor from First Bushing to All Bushings					
Test No.	Bushing Nameplate					Test Mode	TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			RECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	Corr Factor	nA	Watts		
11	H1					UST-R		✗								
12	H2					UST-R		✗								
13	H3					UST-R		✗								
14	N/A					UST-R		✗								
15	X1															
16	X2															
17	X3															
18	N/A															
19																



Review Connection Diagram

Select Primary or Secondary Bushing ITC

Delta 4110/4310A – Bushing ITC



■ Review Test Setup

■ Click Start

Delta 4110/4310A – Bushing ITC

Hookup Diagram		Transformer - Bushing C1 Tests					ITC		Set Individual Temp. Corr.		Apply C1 Correction Factor from First Bushing to All Bushings					
Test No.	Bushing Nameplate					Test Mode	TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap.(pF)					Measured	@ 20°C	Corr Factor	mA	Watts		
11	H1					UST-R		✗				0.970				
12	H2					UST-R		✗				0.970				
13	H3					UST-R		✗				0.970				
14	N/A					UST-R		✗				0.970				
15	X1					UST-R		✗				1.005				
16	X2					UST-R		✗				1.005				
17	X3					UST-R		✗				1.005				
18	N/A					UST-R		✗				1.005				

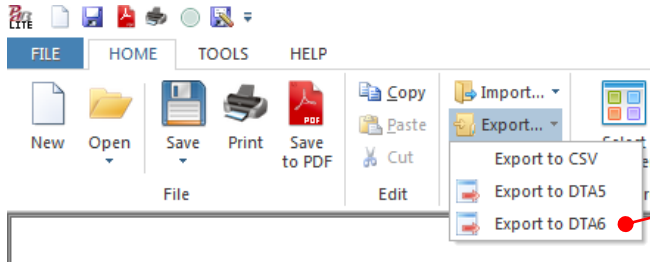
■ When test completes:

Correction factor for primary bushings populated

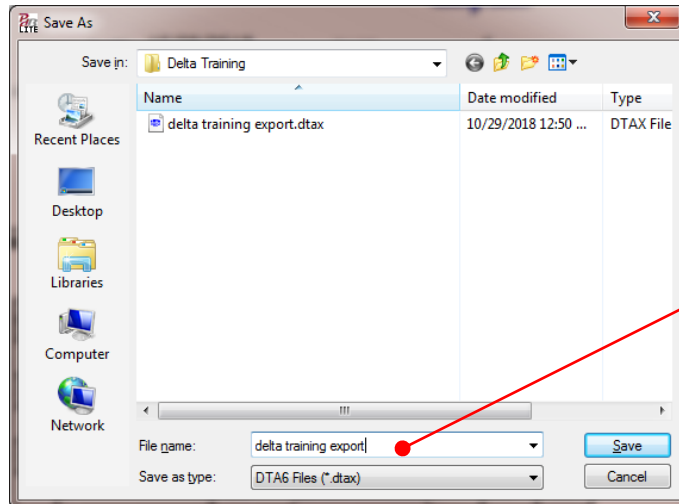
Correction factor for secondary bushings populated

Requires running ITC twice to populate correction factors for primary and secondary bushings

Delta 4110/4310A – Export to DTA6

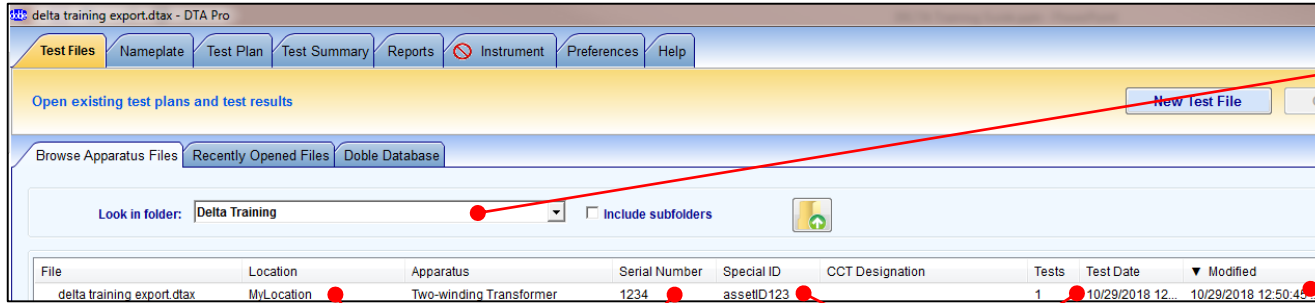


■ After you have completed your tests, select Export to DTA6



■ Give the file a name and click save

Delta 4110/4310A – Export to DTA6



■ In DTA6, select folder containing exported file

DATE 10/29/2018 PAGE 1

AMBIENT TEMP. 85 °F JOB # job123

SUBSTATION MySubstation HUMIDITY 45 % ASSET ID assetID123

POSITION MyPosition TEST STATUS Pass

EQUIPMENT LOCATION MyLocation

Show Bushing Nameplate

NAMEPLATE DATA

MFR Megger CLASS OFAF PHASES 3

SER NO 1234 COOLANT OIL REASON Commission

YEAR 1999 TANK TYPE SEALED WEIGHT 1000 lb

WINDING MATERIAL Cu

OIL VOLUME 1 GAL

OIL TEMP 33 °C

IMPEDANCE 8 %

WEATHER Sunny

BIL 1000000 kV

Diagram # 3 (ANSI)

BUSHING NAMEPLATE

Dsg	SERIAL NUM	MFR	TYPE/CLASS	kV	AMPS	YEAR
H1	1	A	SOLID-PORC	1	100	1999
H2	2	A	SOLID-PORC	1	100	1999
H3	3	A	SOLID-PORC	1	100	1999
N/A	4	A	SOLID-PORC	1	100	1999
X1	5	ABB	EPOXY	2	200	1989
X2	6	ABB	EPOXY	2	200	1989
X3	7	ABB	EPOXY	2	200	1989
N/A	8	ABB	EPOXY	2	200	1989

■ The file will appear in the list

■ Parameters will match exported file

Delta 4110/4310A – Export to DTA6

Overall Test ✓

Bushing C1 ✓

Bushing C2 ✓

Hot Collar Test ✓

Exciting Current ✓

TTR ✓

Surge Arresters ✓

Oil Test 1 Overall Oil Test

Oil Test 2 LTC Chamber Oil Test

Manual Tests ✓

delta training export.dtax - DTA Pro

Test Files Nameplate **Test Plan** Test Summary Reports Instrument Preferences Help

Two-winding Transformer New Test Session Save Close

Test List Overall Administration History Notes (By Session)

Test Session		
Test Names	# Test Runs	Last Run
Overall	1	10/29/2018
Bushings	1	10/29/2018
Exciting Current	1	10/29/2018
Doble Ratio	1	10/29/2018
Leakage Reactance	0	
Surge Arrester	1	10/29/2018
Insulating Fluid	1	10/29/2018
Diagnostic	1	10/29/2018
Manually Entered Tests	0	
Manually Entered Turns Ratio	0	

Nameplate Summary	
Item	Count
Bushings	8
Leakage Reactance	0
Surge Arresters	9

■ Tests will be mapped to DTA6

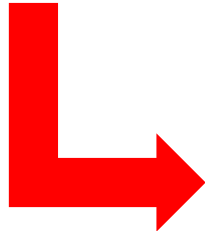
Bushing contain C1, C2 and Hot Collar Tests

Overall Oil tests mapped to Insulating Fluid

Delta 4110/4310A – Export to DTA6

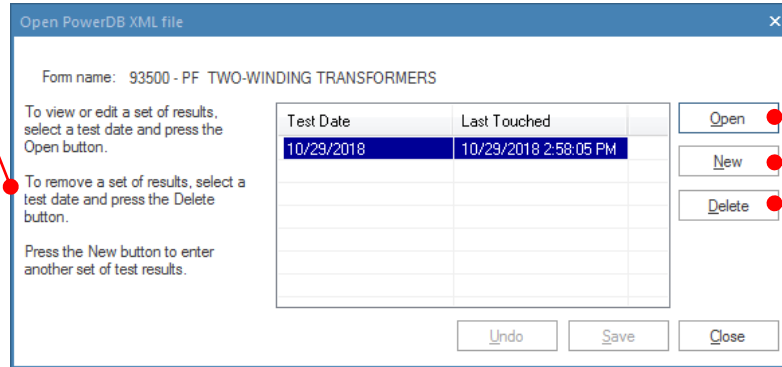
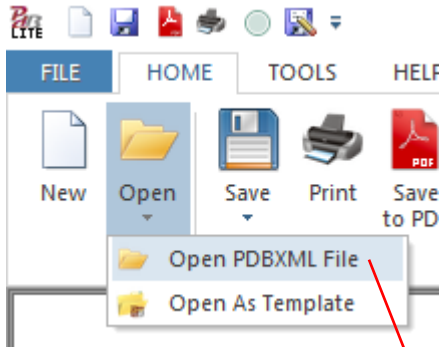
Multiple Test <input checked="" type="checkbox"/>		TRANSFORMER OVERALL TEST SET UP						Hookup Diagram		Temp Corr. Table		TRANSFORMER OVERALL TEST RESULTS						Change Temp. Corr. Table	
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR			
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts					
1	CHG + CHL	GST-GND	H	L		G	10.00		9,578.00	0.33	0.24	0.745	30.0903	0.4935	1.00	G			
2	CHG	GSTg-RB	H	L		G	10.00	✗	3,000.00	0.50	0.37	0.745	9.4249	0.2356	1.00	G			
3	CHL	UST-R	H	L		G	10.00	✗	6,743.00	0.33	0.25	0.745	21.1839	0.3527	1.00	G			
4	CHL		Test 1 Minus Test 2						6,578.00				20.6654	0.2579		Invalid			
5	CLG + CHL	GST-GND	L	H		G	10.00		9,578.00	0.33	0.24	0.745	30.0903	0.4935	1.00	G			
6	CLG	GSTg-RB	L	H		G	10.00	✗	3,000.00	0.50	0.37	0.745	9.4249	0.2356	1.00	G			
7	CHL	UST-R	L	H		G	10.00		6,743.00	0.33	0.25	0.745	21.1839	0.3527	1.00	G			
8	CHL		Test 5 Minus Test 6						6,578.00				20.6654	0.2579		Invalid			

■ Example of mapped Overall Test



Overall Test Setup													
Connections				Inputs		Test Results					Ratings		
#	HV Lead	Red Measure Lead	Blue Measure Lead	Insulation	Test kV	Corr. Factor	mA	Watts	PF (%)	PF Corr. (%)	Capacitance (pF)	Ask FRANK™	Manual
1				CH+CHL	10.000	0.75	30.090	0.493	0.328	0.244	9578.0		Good <input type="button" value="G"/>
2	HV Winding	LV Winding	Unused	CH	10.000	0.75	9.425	0.236	0.500	0.372	3000.0	U Unrated	Good <input type="button" value="G"/>
3				CHL(UST)	10.000	0.75	21.184	0.353	0.333	0.248	6743.0	U Unrated	Good <input type="button" value="G"/>
4	Test 1 - Test 2 (calculated)			CHL		1.00	20.665	0.258	0.125	0.125	6578.0		Unrated <input type="button" value="U"/>
5				CL+CHL	10.000	0.75	30.090	0.493	0.328	0.244	9578.0		Good <input type="button" value="G"/>
6	LV Winding	HV Winding	Unused	CL	10.000	0.75	9.425	0.236	0.500	0.372	3000.0	U Unrated	Good <input type="button" value="G"/>
7				CHL(UST)	10.000	0.75	21.184	0.353	0.333	0.248	6743.0		Good <input type="button" value="G"/>
8	Test 5 - Test 6 (calculated)			CHL		1.00	20.665	0.258	0.125	0.125	6578.0	U Unrated	Unrated <input type="button" value="U"/>

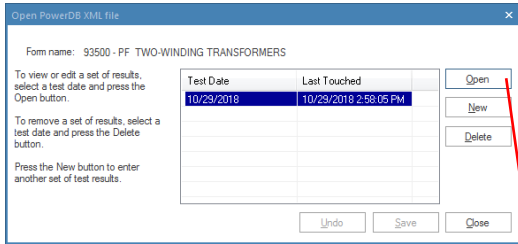
Delta 4110/4310A – Opening a file



- When you open a saved file, you have multiple options:

Open
New
Delete

Delta 4110/4310A – Opening a file



DATE 10/29/2018 PAGE 1

AMBIENT TEMP 85 °F JOB # job123

SUBSTATION MySubstation HUMIDITY 45 % ASSET ID assetID123

POSITION MyPosition TEST STATUS Pass

EQUIPMENT LOCATION MyLocation

NAMEPLATE DATA

MFR Megger CLASS DP4F PHASES 3

SER NO 1234 COOLANT OIL REASON Commission

YEAR 1999 TANK TYPE SEALED WEIGHT 1000

WINDING MATERIAL Cu

OIL VOLUME 1 GAL

OIL TEMP 33 °C

IMPEDANCE 8 %

WEATHER Sunny

BL 1000000 kv

BUSHING NAMEPLATE

Qty	SERIAL NUM	MFR	TYPE/CLASS	kv	AMPS	YEAR
H1	1	A	SOLID-PORC	1	100	1999
H2	2	A	SOLID-PORC	1	100	1999
H3	3	A	SOLID-PORC	1	100	1999
N/A	4	A	SOLID-PORC	1	100	1999
X1	5	ABB	EPOXY	2	200	1999
X2	6	ABB	EPOXY	2	200	1999
X3	7	ABB	EPOXY	2	200	1999
N/A	8	ABB	EPOXY	2	200	1999

Diagram # 3 (ANSI)

VOLTAGE (KV) RVA # TAPS NOMINAL CHANGER TAP SETTING

L-L	L-G	S0	0.5S	S	3	DET
333		500	0.5S	S	3	DET
444		500	0.5S	33	17	DLTC

COMMENTS

Select Tests: Overall Test Bushing C1 Bushing C2 Surge Arresters Settings Reasonable Test Voltages

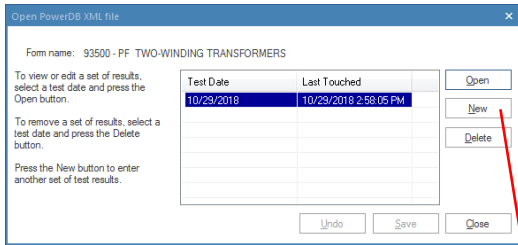
Hot Cellar test ITR Existing Current Manual Tests Communications Log

TRANSFORMER OVERALL TEST SET UP

Test No	Insulation Testing	Test Mode	TEST LEAD CONNECTIONS				TEST KV	DPR	Capacitance C (pF)	POWER FACTOR %				IR		
			HV	Mid	Blue	Shield				Measured	@ 20°C	Corr Factor	IRa		IRb	%VDF
1	CHG + CHL	GST-GND	H	L	L	G	10.00		9,578.00	0.33	0.24	0.745	30.0903	0.4935	1.00	G
2	CHG	GSTg-RB	H	L		G	10.00		3,000.00	0.50	0.37	0.745	9.4248	0.2356	1.00	G
3	CHL	UST-R	H	L		G	10.00		6,743.00	0.33	0.25	0.745	21.1839	0.3527	1.00	G
4	CHL	Test 1 Minus Test 2							6,578.00				20.6654	0.2579		Invalid
5	CLG + CHL	GST-GND	L	H		G	10.00		9,578.00	0.33	0.24	0.745	30.0903	0.4935	1.00	G
6	CLG	GSTg-RB	L	H		G	10.00		3,000.00	0.50	0.37	0.745	9.4248	0.2356	1.00	G
7	CHL	UST-R	L	H		G	10.00		6,743.00	0.33	0.25	0.745	21.1839	0.3527	1.00	G
8	CHL	Test 8 Minus Test 6							6,578.00				20.6654	0.2579		Invalid
9	CHG	C _{lg} Minus H Bushings							-17,229.0				-54.1267	-0.8225		
10	CLG	C _{lg} Minus L Bushings							-17,229.0				-54.1267	-0.8225		
Oil Test 1	Overall Oil Test	UST-R	L	H		G	10.00		6,743.00	0.33	0.16	0.555	21.1839	0.3527		
Oil Test 2	LTC Changer Oil Test	UST-R	L	H		G	10.00		6,743.00	0.33	0.16	0.555	21.1839	0.3527		

■ Open allows you to view previous results and continue testing

Delta 4110/4310A – Opening a file



DATE 10/29/2018 PAGE 1

AMBIENT TEMP. °F JOB #

SUBSTATION MySubstation HUMIDITY % ASSET ID assetID123

POSITION MyPosition TEST STATUS

EQUIPMENT LOCATION MyLocation

Show Bushing Nameplate

NAMEPLATE DATA

MFR Megger CLASS OFAF PHASES 3

SER NO 1234 COOLANT OIL REASON Commission

YEAR 1999 TANK TYPE SEALED WEIGHT 1000

WINDING MATERIAL Cu

OIL VOLUME 1

OIL TEMP °C

IMPEDANCE %

WEATHER

BL 1000000 KV

Diagram # 3 (ANS)

VOLTAGE (KV)	KVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY 333	500	0.87	5	3	DETC	3
SECONDARY 444	800	0.65	33	17	OLTC	

COMMENTS

Tests: Overall Test Bushing C1 Bushing C2 Surge Arresters Settings Recalculate Test Voltages

Hot Cooler Test ITR Exciting Current Manual Tests Communications Log

TRANSFORMER OVERALL TEST SET UP

Test No.	Inquisition Tested	Test Mode	TEST LEAD CONNECTIONS	TEST EV	DPR	Capacitance C (pF)	POWER FACTOR %	DIRECT	IR
			HV Red Blue Gnd			Measured @ 20°C	Corr Factor	IRa	IRVDF
1	CHG + CHL	GST-GND	H L G	10.00					
2	CHG	GSTg-RB	H L G	10.00	<input checked="" type="checkbox"/>				
3	CHL	UST-R	H L G	10.00	<input checked="" type="checkbox"/>				
4	CHL								
5	CLG + CHL	GST-GND	L H G	10.00					
6	CLG	GSTg-RB	L H G	10.00	<input checked="" type="checkbox"/>				
7	CHL	UST-R	L H G	10.00					
8	CHL								
9	CHG								
10	CLG								
Oil Test 1	Overall Oil Test	UST-R	L H G	10.00					
Oil Test 2	LTC Cooler Oil Test	UST-R	L H G	10.00					

■ New creates a new test date within the file

Nameplate information is copied over

Test data is blank, ready for a new set of results

Delta 4110/4310A – Opening a file

Open PowerDB XML file

Form name: 93500 - PF TWO-WINDING TRANSFORMERS

To view or edit a set of results, select a test date and press the Open button.

To remove a set of results, select a test date and press the Delete button.

Press the New button to enter another set of test results.

Test Date	Last Touched
10/30/2019	10/29/2018 3:08:47 PM
10/29/2018	10/29/2018 2:58:05 PM

Open

New

Delete

Undo Save Close

- After a new test is saved, it will show in the list when the file is opened
- Highlight a date and select Delete to remove it from the file

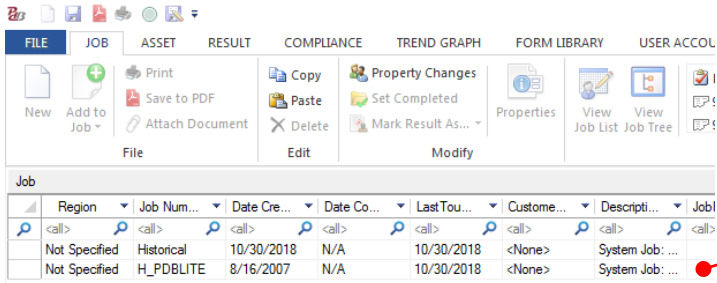
Delta 4110/4310A – PowerDB Pro

Basic functionality of PowerDB Pro will be covered in this section

PowerDB Pro functions similar to PowerDB Lite,
but with a database backend

*For more information about PowerDB Pro and its features, contact
Brad.Perry@powerdb.com or Mark.Meyer@powerdb.com*

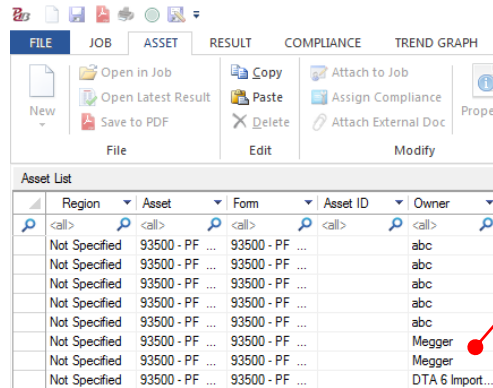
Delta 4110/4310A – PowerDB Pro



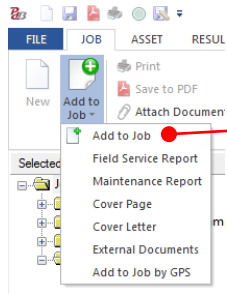
■ Open a job
or

■ Open an asset

Double click to open



Delta 4110/4310A – PowerDB Pro



Enter or Select a Owner

abc
DTA 6 Inport Example
Megger

Owner: Delta Training

< Back Next > Finish Cancel



Enter or Select a Site

<Insert Test Form At This Level>

Site: <Insert Test Form At This Level>

< Back Next > Finish Cancel



Select the Tests to Perform

90000 - TRANSFORMER
90511 - MICROHMETER MEASUREMENTS - DLRO 10X
90512 - MICROHMETER MEASUREMENTS - DLRO 200/600
90515 - MICROHMETER MEASUREMENTS - DLRO 10HDX
91510 - PF MISCELLANEOUS EQUIPMENT
91515 - PF BUSHING
92500 - PF AIR MAG CIRCUIT BREAKER
92510 - PF OIL CIRCUIT BREAKER
92520 - PF SF6 DEAD TANK CIRCUIT BREAKER
92525 - PF SF6 LIVE TANK CIRCUIT BREAKER
92529 - PF SF6 LIVE TANK CIRCUIT BREAKER
92530 - PF VACUUM CIRCUIT BREAKER
92550 - PF VACUUM CIRCUIT RECLOSER
92600 - OCR
92610 - OCR COUNTER
93500 - PF TWO-WINDING TRANSFORMERS
94500 - PF THREE-WINDING TRANSFORMERS
95000 - PF AUTO TRANSFORMER WITH TERTIARY

Show All for Instrument: Current Transformer
Group by Type Only
Normal (Grouped by Family/Type)
Show All

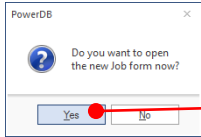
Asset Name: 93500 - PF TWO-WINDING TRANSFDF

Preferred Forms

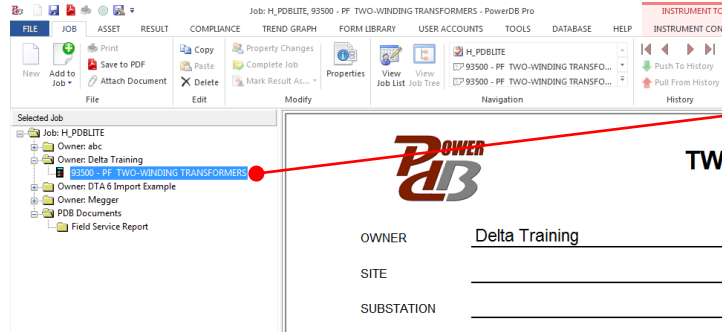
< Back Finish > Cancel

- Add to job
- Select Owner or enter new
- Select <Insert Test Form At This Level>
- Select form 93500 – PF Two-Winding Transformer
- Select Finish

Delta 4110/4310A – PowerDB Pro

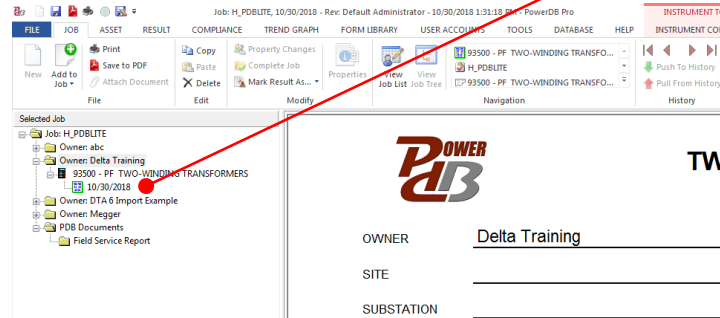


Select Yes to open the form

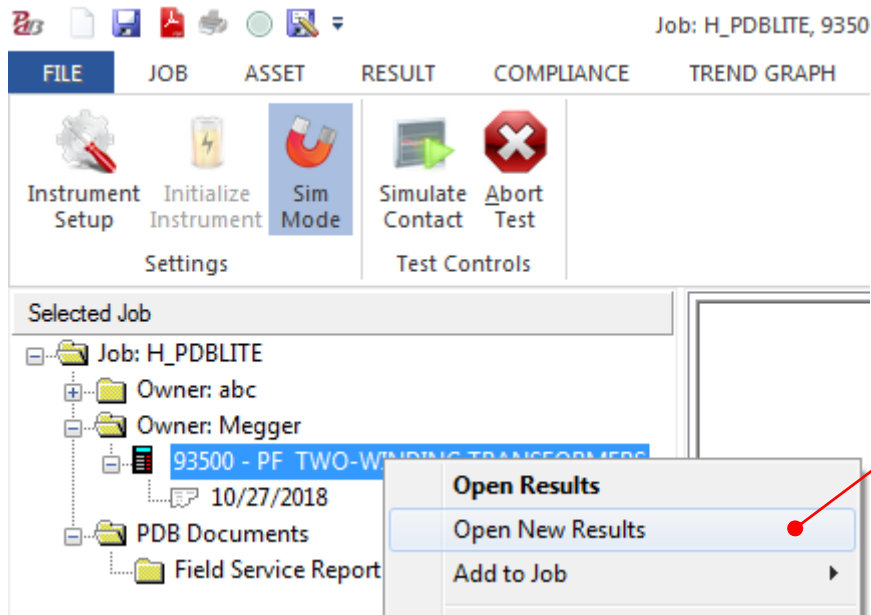


The form will appear in the list under the owner

Saving the form will show the test date in the database



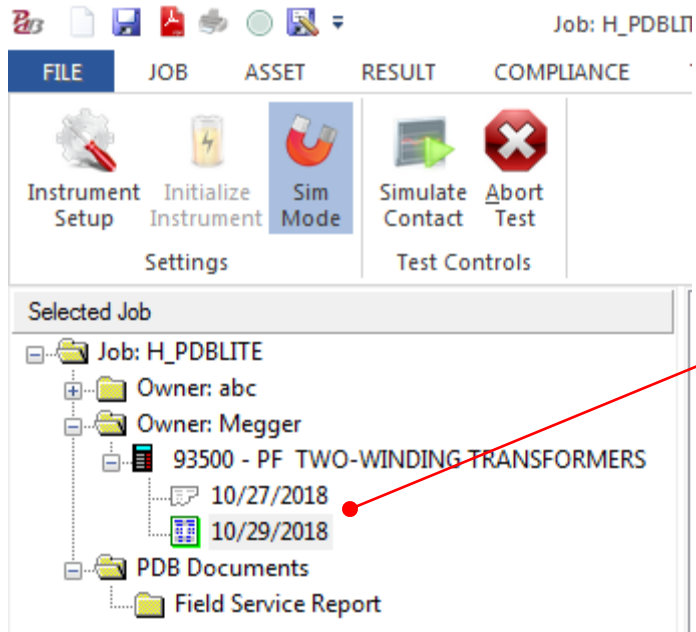
Delta 4110/4310A – PowerDB Pro New Result



To add new test data, right click on the form and select “Open New Results”

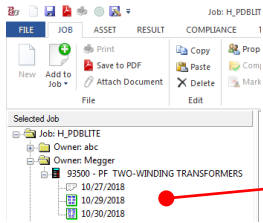
Similar to “New” in PowerDB Lite

Delta 4110/4310A – PowerDB Pro New Result



After saving, two results will appear in the database

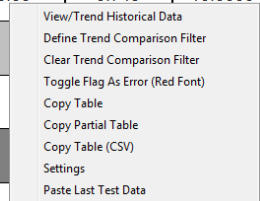
Delta 4110/4310A – PowerDB Pro Trending



■ To trend a result, you need multiple tests

Multiple Test		TRANSFORMER OVERALL TEST SET UP						Hookup Diagram		Temp Corr. Table		TRANSFORMER OVERALL TEST RESULTS		
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			Equival	
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00		1,000.00	0.47	0.35	0.745	10.0000	
2	C _{HG}	GSTg-RB	H	L		G	10.00							
3	C _{HL}	UST-R	H	L		G	10.00							
4	C _{HL}		Test 1 Minus Test 2											

■ Open a result, find the test you want to trend, and right click



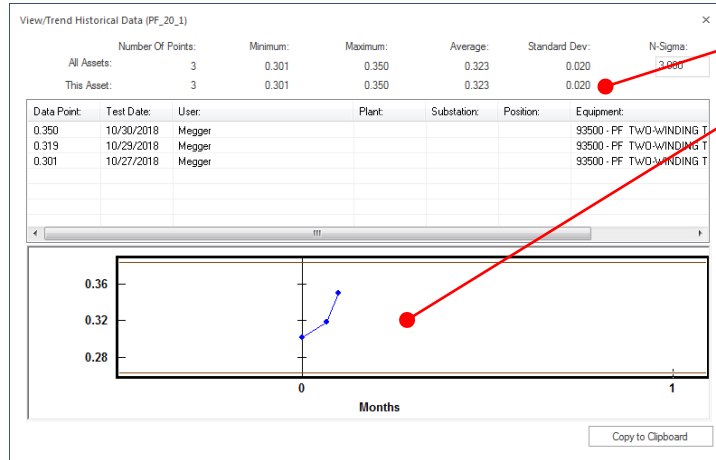
Delta 4110/4310A – PowerDB Pro Trending

Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST KV	DFR	Capacitance C (pF)	POWER FACTOR %			Equival mA
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	
			Test 1 Minus Test 2										
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.00		1,000.00	0.47	0.35	0.745	10.0000
2	C _{HG}	GSTg-RB	H	L		G	10.00	✘					
3	C _{HL}	UST-R	H	L		G	10.00	✘					
4	C _{HL}		Test 1 Minus Test 2										

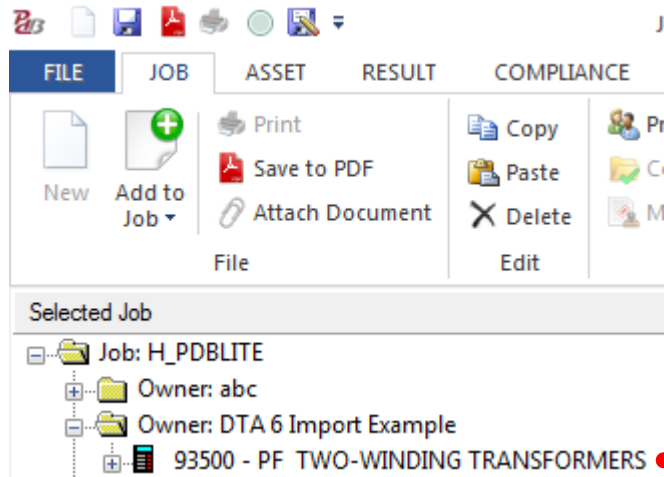
- View/Trend Historical Data
- Define Trend Comparison Filter
- Clear Trend Comparison Filter
- Toggle Flag As Error (Red Font)
- Copy Table
- Copy Partial Table
- Copy Table (CSV)
- Settings
- Paste Last Test Data

Select View/Trend Historical Data

Historical data for this test will be displayed, with a graph



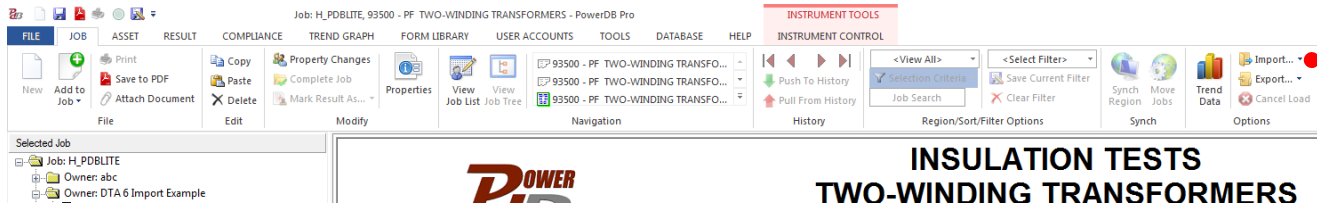
Delta 4110/4310A – PowerDB Pro DTA6 Import



Add a form that matches the asset to be imported

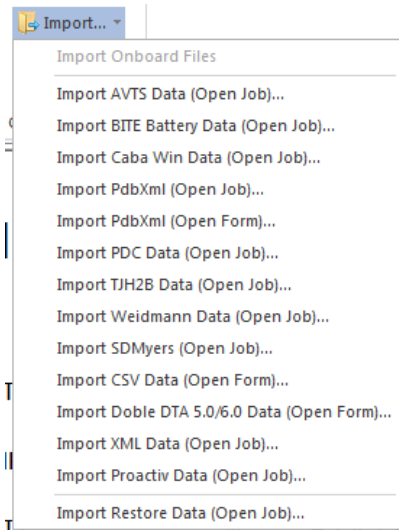
*Two-winding
Three-winding
etc*

Delta 4110/4310A – PowerDB Pro DTA6 Import

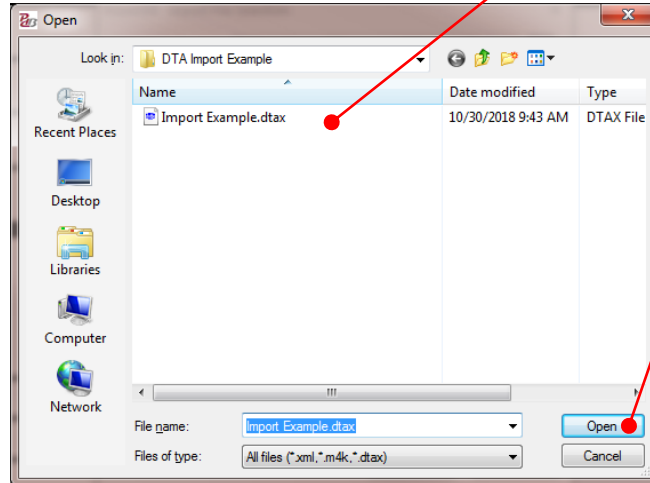
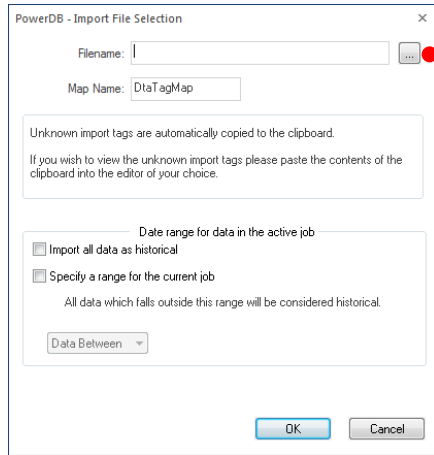


With the form open, select Import

Select Import Doble DTA 5.0/6.0 Data



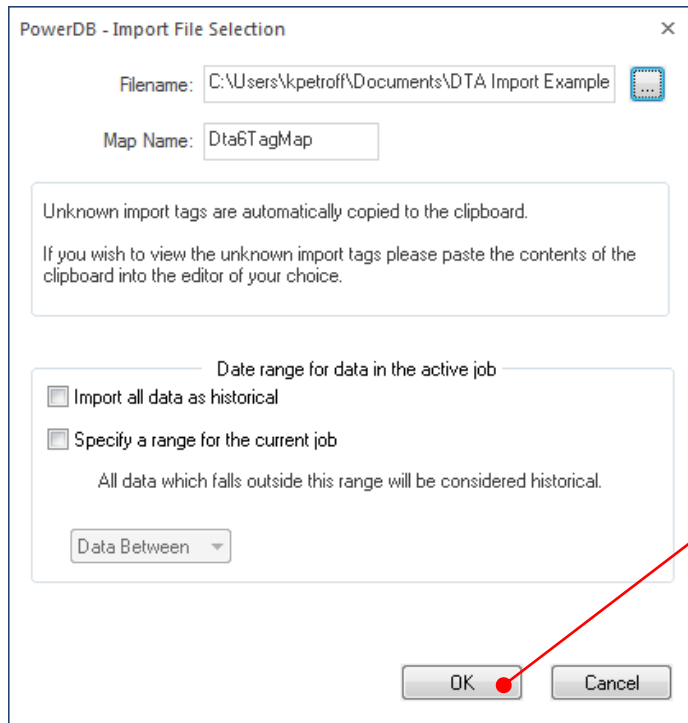
Delta 4110/4310A – PowerDB Pro DTA6 Import



Select the file
you want to
import

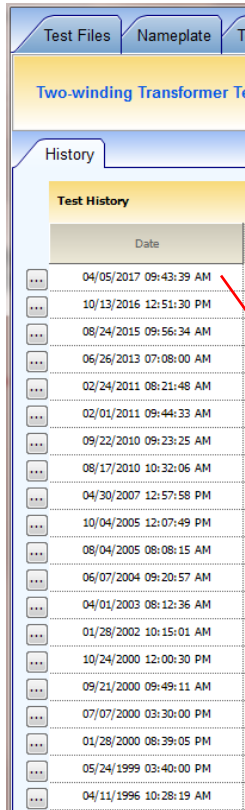
Select Open

Delta 4110/4310A – PowerDB Pro DTA6 Import



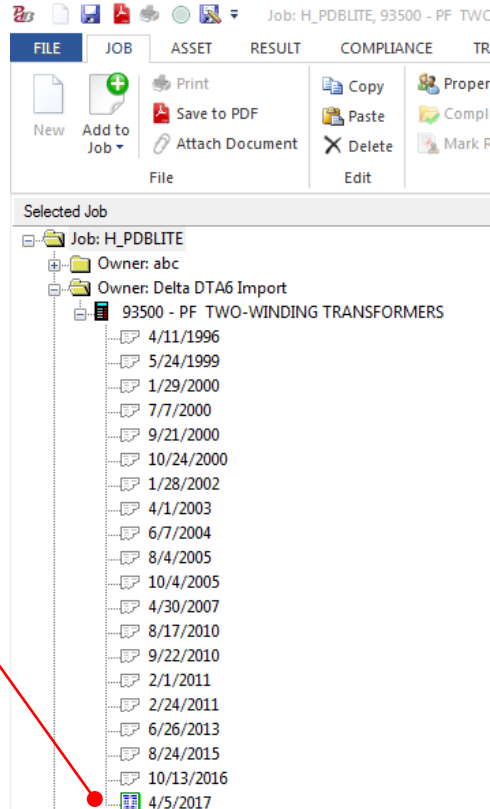
- Select OK
- Wait for import to complete

Delta 4110/4310A – PowerDB Pro DTA6 Import



The screenshot shows the 'Test History' table in PowerDB Pro. The table has a 'Date' column and lists test dates in ascending order. A red arrow points from the top row of the table to the corresponding entry in the 'Selected Job' view on the right.

Date
04/05/2017 09:43:39 AM
10/13/2016 12:51:30 PM
08/24/2015 09:56:34 AM
06/26/2013 07:08:00 AM
02/24/2011 08:21:48 AM
02/01/2011 09:44:33 AM
09/22/2010 09:23:25 AM
08/17/2010 10:32:06 AM
04/30/2007 12:57:58 PM
10/04/2005 12:07:49 PM
08/04/2005 08:08:15 AM
06/07/2004 09:20:57 AM
04/01/2003 08:12:36 AM
01/28/2002 10:15:01 AM
10/24/2000 12:00:30 PM
09/21/2000 09:49:11 AM
07/07/2000 03:30:00 PM
01/28/2000 08:39:05 PM
05/24/1999 03:40:00 PM
04/11/1996 10:28:19 AM



The screenshot shows the 'Selected Job' view in PowerDB Pro. The job is 'Job: H_PDBLITE' with owner 'Delta DTA6 Import'. The test dates are listed in ascending order, matching the 'Test History' table. A red arrow points from the top row of the table to the corresponding entry in the 'Selected Job' view.

Date
4/11/1996
5/24/1999
1/29/2000
7/7/2000
9/21/2000
10/24/2000
1/28/2002
4/1/2003
6/7/2004
8/4/2005
10/4/2005
4/30/2007
8/17/2010
9/22/2010
2/1/2011
2/24/2011
6/26/2013
8/24/2015
10/13/2016
4/5/2017

■ Verify Test Dates were imported

PowerDB lists test dates in ascending order

Delta 4110/4310A – PowerDB Pro DTA6 Import

- Verify Nameplate Information



Two-winding Transformer Nameplate

Company and Location
 Company: American Electric Power Corp. Location: MOBILE WH8553
 Division: Mobile/Mobile Special ID: 13527

Transformer Details
 Serial Number: [] Winding Configuration: High Voltage Delta, Low Voltage Wye
 # of Phases: Three Configuration: Δ-Y Class: OA/FA/FOA Manufacturer: Westinghouse Electric Mfr Location: USA CCT Designation: WH8553 Oil Volume: 1964.0 UG Weight: 74100.0 BIL: 450.0 kV
 Phase Configuration based on windings: Internally Connected

Required for Expert System
 Year of Mfr.: 1981 Tank Type: NZ Blanket
 MVA/KVA: 20.0 Rated kV: H 139.10 X 7.57 Winding: L-L L-L
 Coolant: Oil

NAMEPLATE DATA

MFR: Westinghouse Electric CLASS: OA_FA_FOA PHASES: 3
 SER NO: [] COOLANT: Oil REASON: []
 YEAR: 1981 TANK TYPE: N2BLANKETED WEIGHT: 74100 [Undo]
 WINDING MATERIAL: Cu
 OIL VOLUME: 1,964 [UG]
 TEMP: 13 °C
 IMPEDANCE: %
 WEATHER: Sunny
 BIL: 450 kV

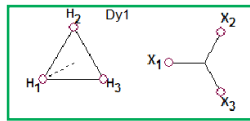


Diagram # 11 (ANSI)

	VOLTAGE (kV)	MVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
	L-L	L-G					
PRIMARY:	139.1		20	83.01	5	3	DETC
SECOND:	7.565		20	1,526.37	1		OLTC

Delta 4110/4310A – PowerDB Pro DTA6 Import

Session Date: 4/5/2017 9:43:39 AM

Overall Test Setup

#	Connections			Inputs		Test Results					Ratings		Notes	
	HV Lead	Red Measure Lead	Blue Measure Lead	Insulation	Test kV	Corr. Factor	mA	Watts	PF (%)	PF Corr. (%)	Capacitance (pF)	Aik FRANK™		Manual
1				OH-CHL	10.024	1.00	34.115	1.146	0.336	0.337	9049.2	Good	Unrated	U
2	HV Winding	LV Winding	Unused	OH	10.005	1.00	10.171	0.342	0.336	0.337	2697.9	Good	Unrated	U
3				CHL(UST)	10.005	1.00	23.940	0.797	0.333	0.334	6350.2	Good	Unrated	U
4	Test 1 - Test 2 (calculated)				CHL	1.00	23.944	0.804	0.336	0.337	6351.2	Good	Unrated	U
5				CL-CHL	10.042	1.00	57.523	2.301	0.400	0.401	15258.3	Good	Unrated	U
6	LV Winding	HV Winding	Unused	CL	10.042	1.00	33.576	1.497	0.446	0.447	8906.2	Good	Unrated	U
7				CHL(UST)	10.003	1.00	23.936	0.793	0.331	0.332	6349.1	Good	Unrated	U
8	Test 5 - Test 6 (calculated)				CHL	1.00	23.947	0.804	0.336	0.337	6352.1	Good	Unrated	U
Winding without Attached Bushing Calculation														
	OH-CL			OH	1.00		6.183	0.143	0.232	0.233	1640.1		Unrated	U
	CL-CL			CL	1.00		31.803	1.401	0.441	0.442	8435.8		Unrated	U

Test: Overall | Session Date: 4/5/2017 9:43:39 AM | 20 of 20 | FRANK™ Live



■ Verify Test Data

Open corresponding dates in DTA and PowerDB to verify data imported correctly

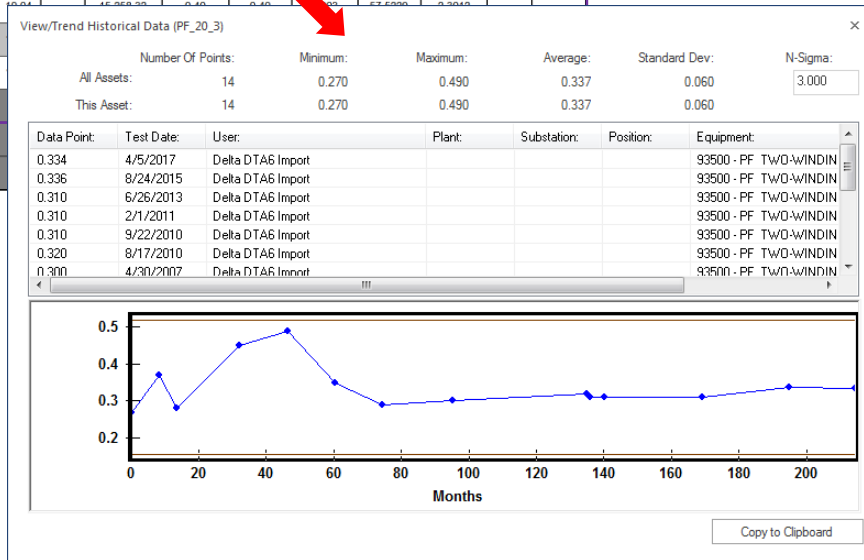
Test No	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			Equivalent @ 10 kV		%VDF	IR Auto/Man
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts		
										Corr Factor	Corr Factor	Corr Factor	mA	Watts		
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.02		9,049.17	0.34	0.34	1.003	34.1149	1.1461		
2	C _{HG}	GSTg-RB	H	L		G	10.00	✗	2,697.93	0.34	0.34	1.003	10.1711	0.3422		G
3	C _{HL}	UST-R	H	L		G	10.01	✗	6,350.19	0.33	0.33	1.003	23.9399	0.7969		G
4	C _{HL} '	Test 1 Minus Test 2							6,351.25				23.9439	0.8039		Valid
5	C _{LG} + C _{HL}	GST-GND	L	H		G	10.04		15,258.32	0.40	0.40	1.003	57.5229	2.3012		
6	C _{LG}	GSTg-RB	L	H		G	10.04	✗	8,906.25	0.45	0.45	1.003	33.5762	1.4974		G
7	C _{HL}	UST-R	L	H		G	10.00		6,349.11	0.33	0.33	1.003	23.9358	0.7932		
8	C _{HL} '	Test 5 Minus Test 6							6,352.08				23.9467	0.8039		Valid
9	C _{HG} '	C _{HG} Minus H Bushings							1,640.09				6.1830	0.1434		
10	C _{LG} '	C _{LG} Minus L Bushings							8,435.84				31.8028	1.4010		

Delta 4110/4310A – PowerDB Pro DTA6 Import

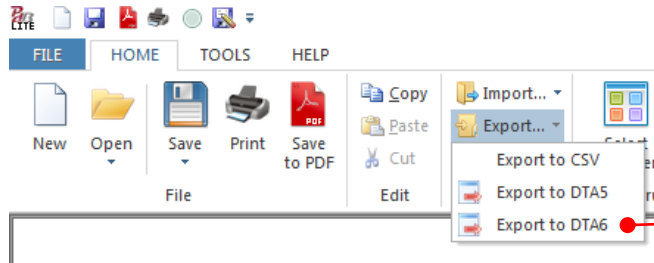
- Trending immediately available after import

Right click and select View/Trend Historical Data

TRANSFORMER OVERALL TEST SET UP							Hookup Diagram		Temp Corr. Table		TRANSFORMER OVERALL TEST RESULTS				Change Temp. Corr. Table		
Test No.	Insulation Tested	Test Mode	Test Lead Connections				TEST kV	DFR	Capacitance C (pF)	POWER FACTOR %			Equivalent @ 10 kV		%VDF	IR Auto/Man	
			HV	Red	Blue	Gnd				Measured	@ 20°C	Corr Factor	mA	Watts			
1	C _{HG} + C _{HL}	GST-GND	H	L		G	10.02		9,049.17	0.34	0.34	1.003	34.1149	1.1461			
2	C _{HG}	GSTg-RB	H	L		G	10.00	✘	2,697.93	0.34	0.34	1.003	10.1711	0.3422		G	
3	C _{HL}	UST-R	H	L		G	10.01	✘	6,350.19	0.33	0.33	1.003	23.9399	0.7969		G	
4	C _{HL}		Test 1 Minus Test 2						6,351.25				23.9439	0.8039		Valid	
5	C _{LG} + C _{HL}	GST-GND	L	H		G											
6	C _{LG}	GSTg-RB	L	H		G											
7	C _{HL}	UST-R	L	H		G											
8	C _{HL}		Test 5 Minus Test 6														
9	C _{HG}		C _{HG} Minus H Bushings														
10	C _{LG}		C _{LG} Minus L Bushings														



Delta 4110/4310A – PowerDB Pro DTA6 Export

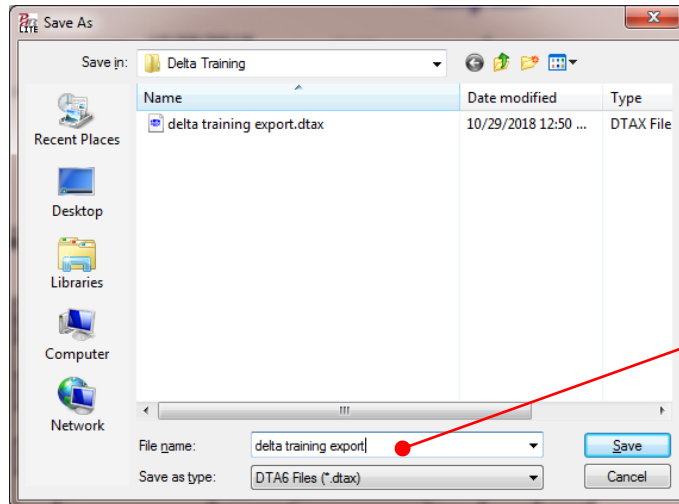


- Same as Lite

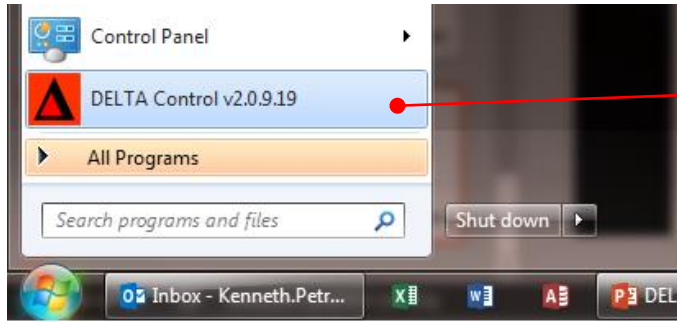
Contact PowerDB to have this feature enabled for your form

- After testing is complete, select Export to DTA6

- Give the file a name and click save



Delta 4110/4310A – Delta Control



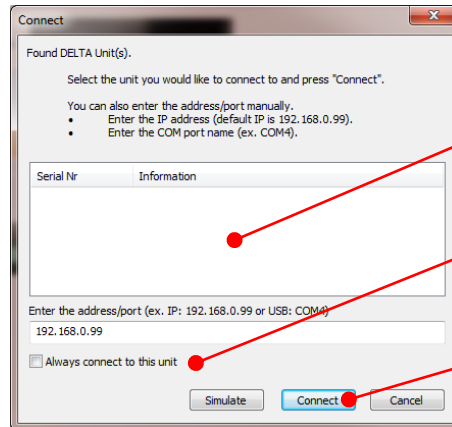
■ Open Delta Control

■ Connect

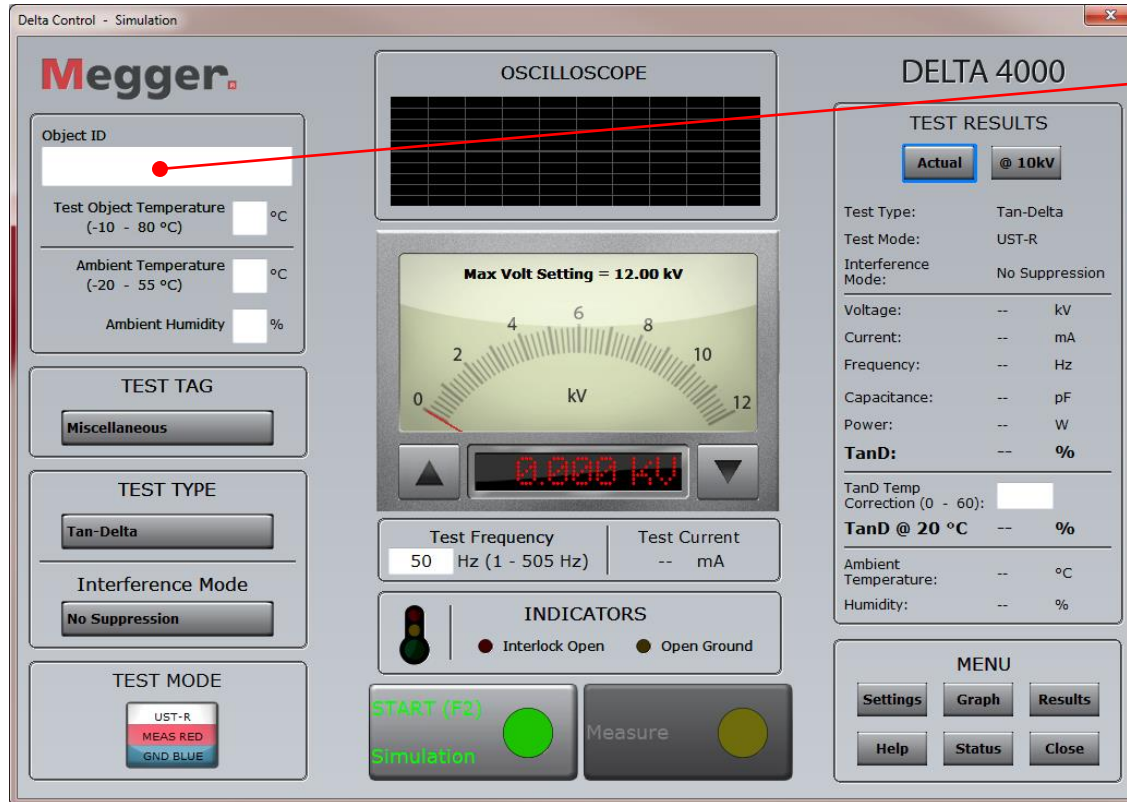
Serial Nr & information should automatically populate.

Select "Always connect to this unit" to skip connection step next time tests are run

Click Connect

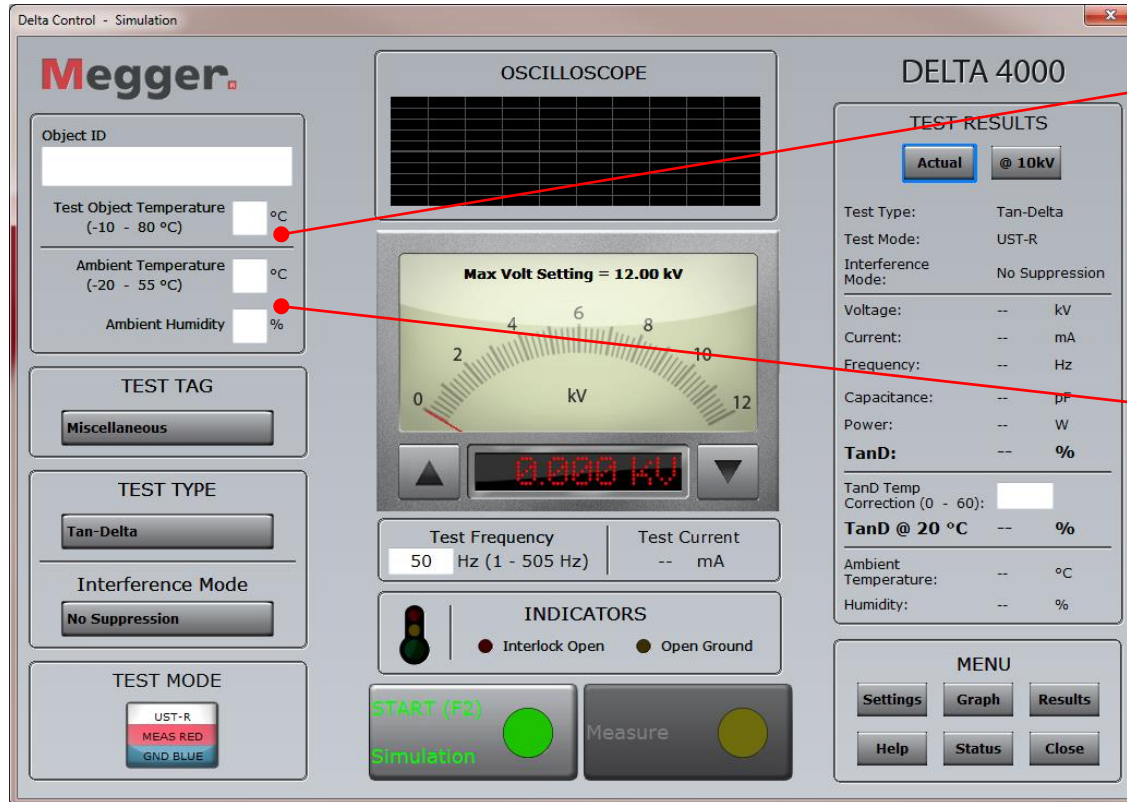


Delta 4110/4310A – Delta Control



■ Enter Object ID
aka Test ID

Delta 4110/4310A – Delta Control



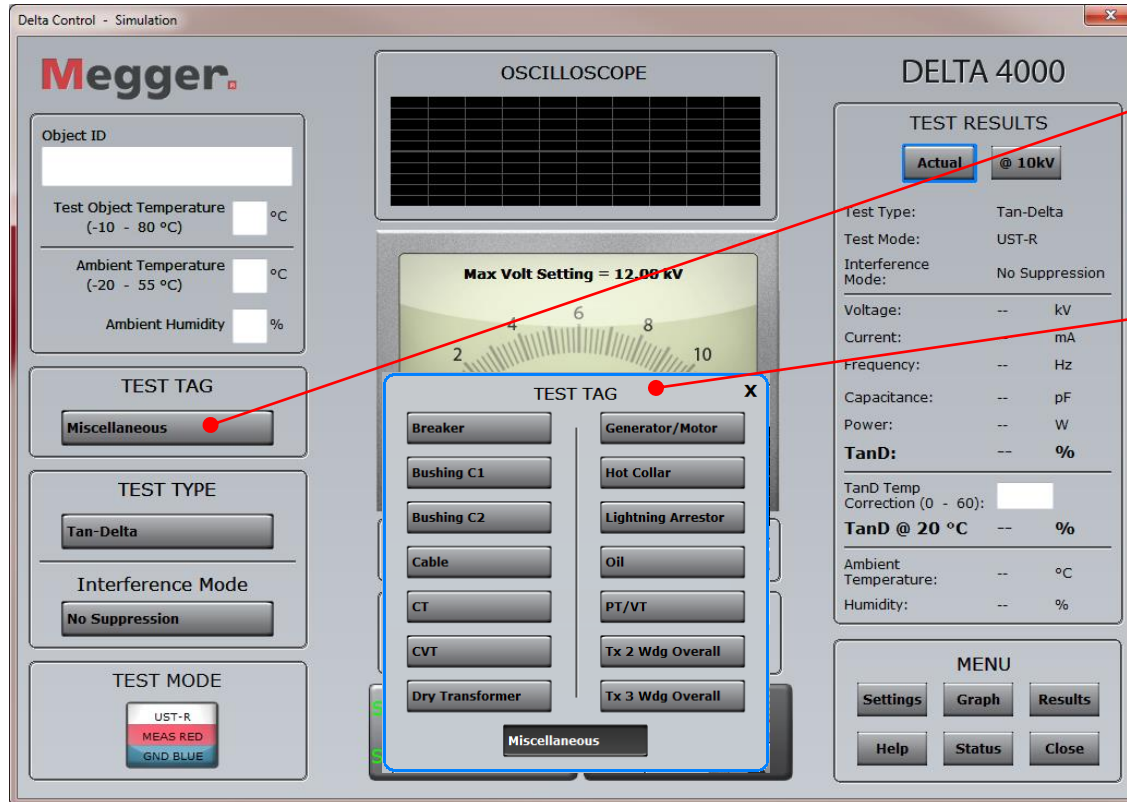
■ Enter Test Object Temperature

aka Oil Temp

■ Enter Ambient Temperature and Humidity

Will populate automatically after running a test if blank

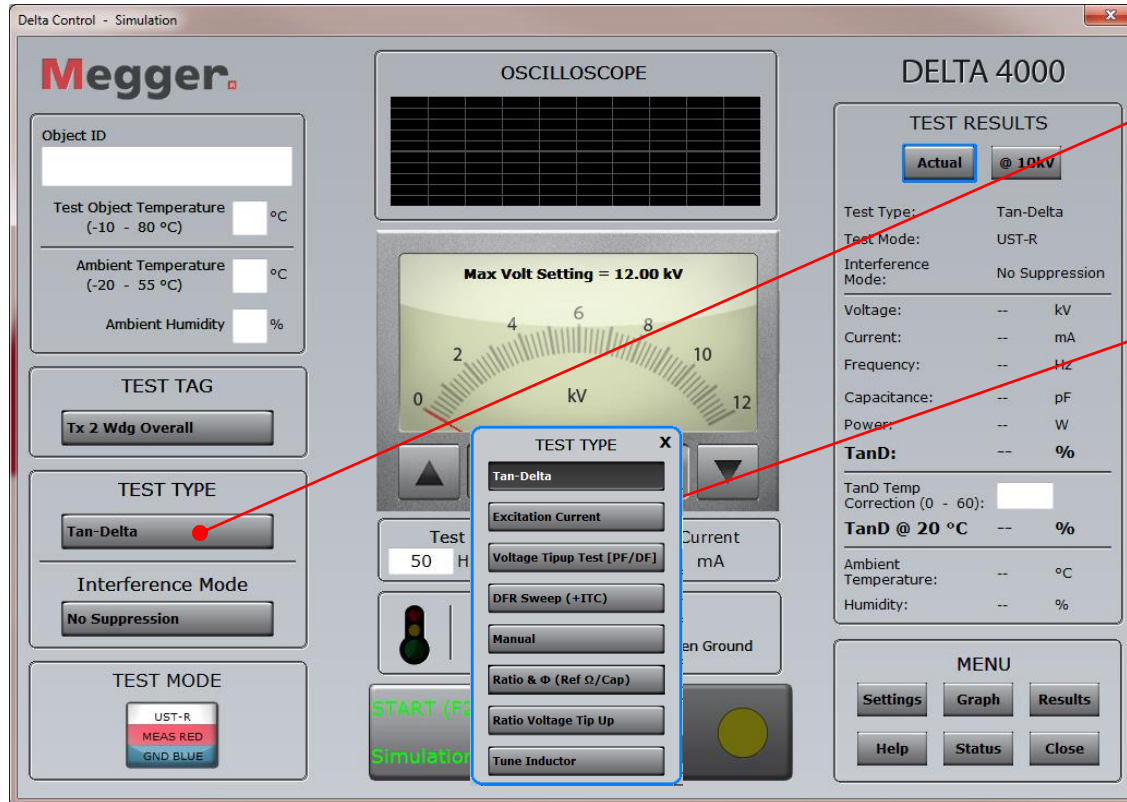
Delta 4110/4310A – Delta Control



Click Test Tag

Select Test Tag

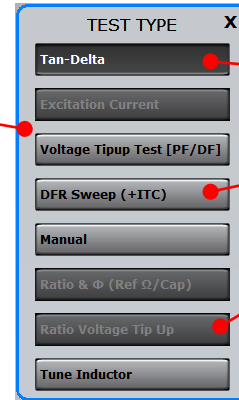
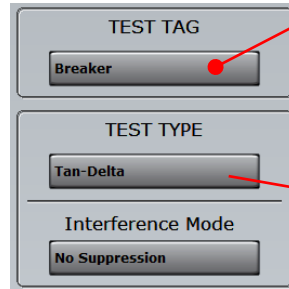
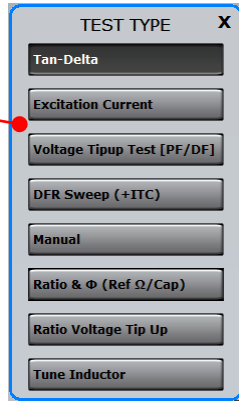
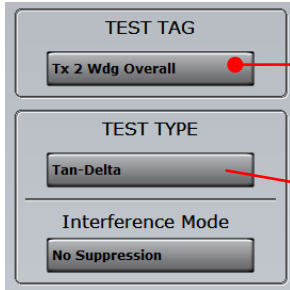
Delta 4110/4310A – Delta Control



Click Test Type

Select Test Type

Delta 4110/4310A – Delta Control



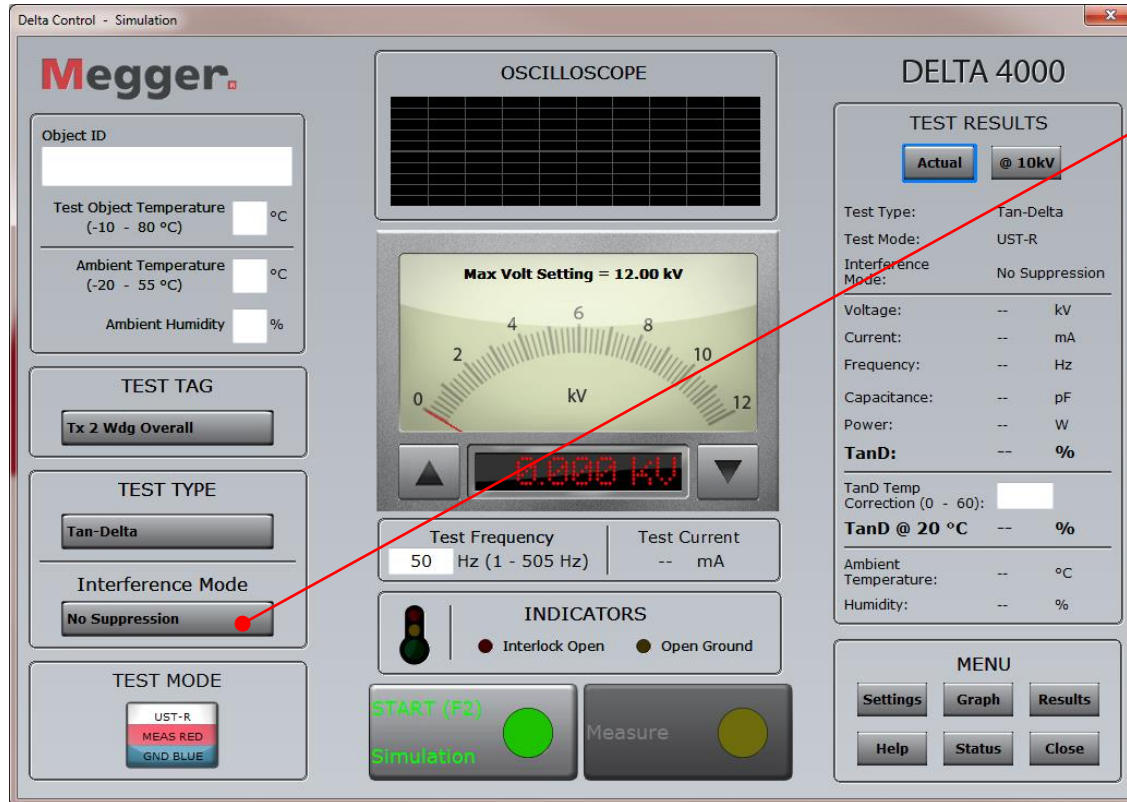
Test Type Limited by Test Tag

Currently Selected

Available for selection

Unavailable

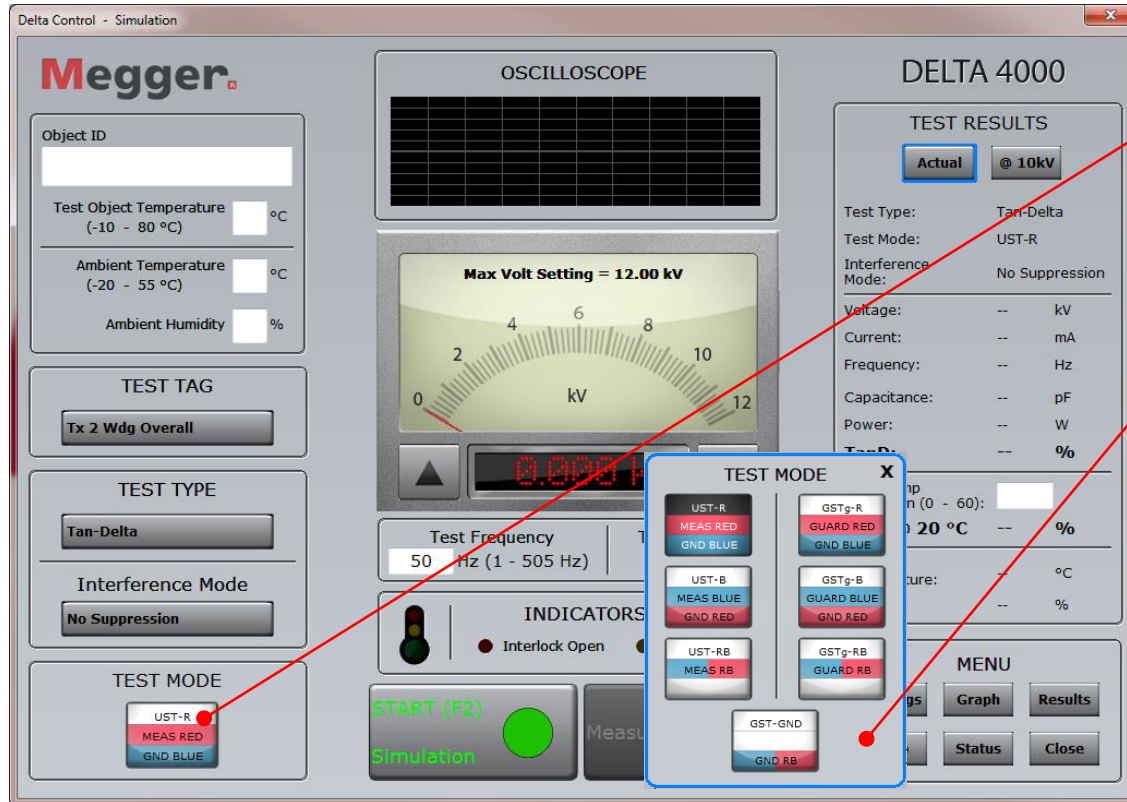
Delta 4110/4310A – Delta Control



■ Recommended Interference Mode selected based on Test Type

■ Cannot be changed for some Test Types

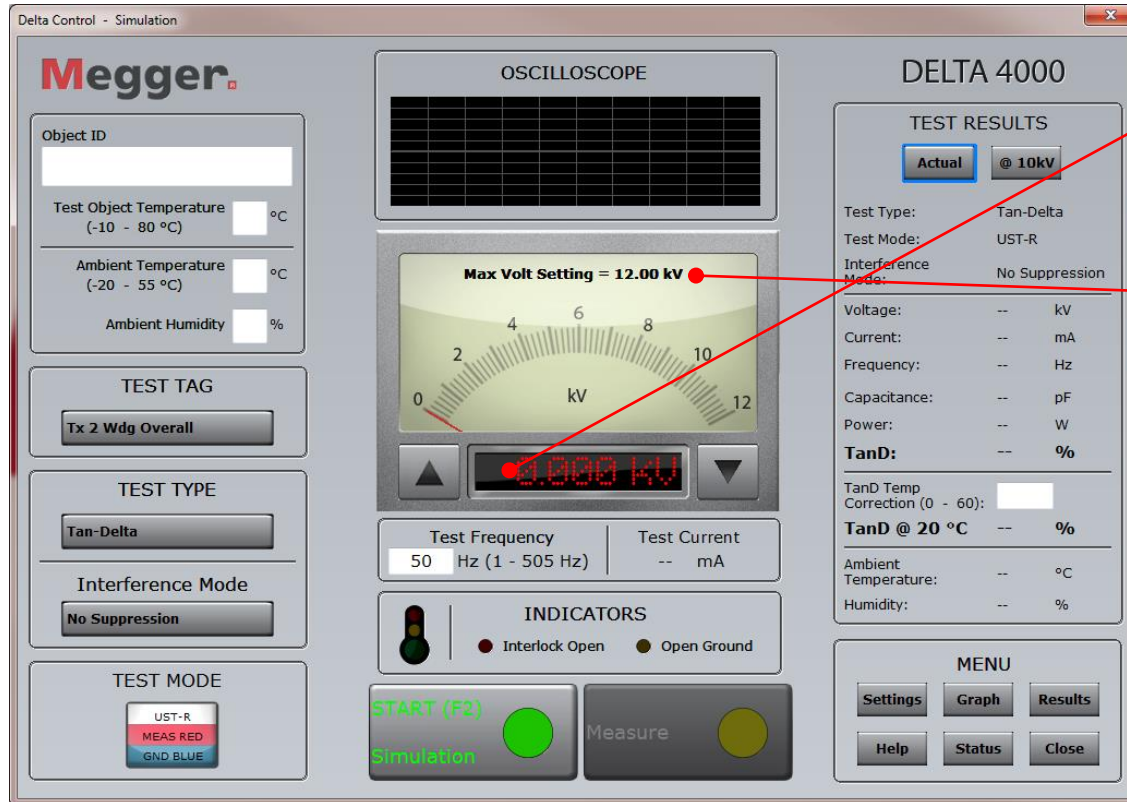
Delta 4110/4310A – Delta Control



Click Test Mode

Select Test Mode

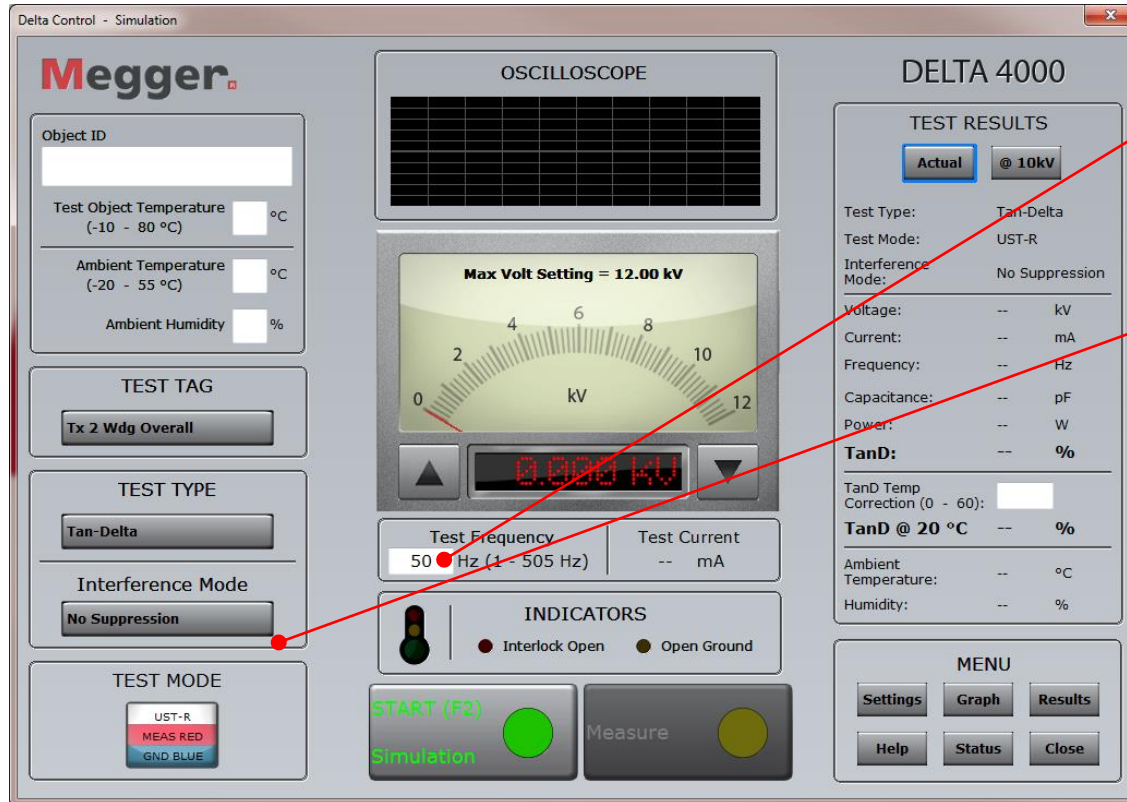
Delta 4110/4310A – Delta Control



■ Set Test Voltage

■ Limited by Max Voltage Setting

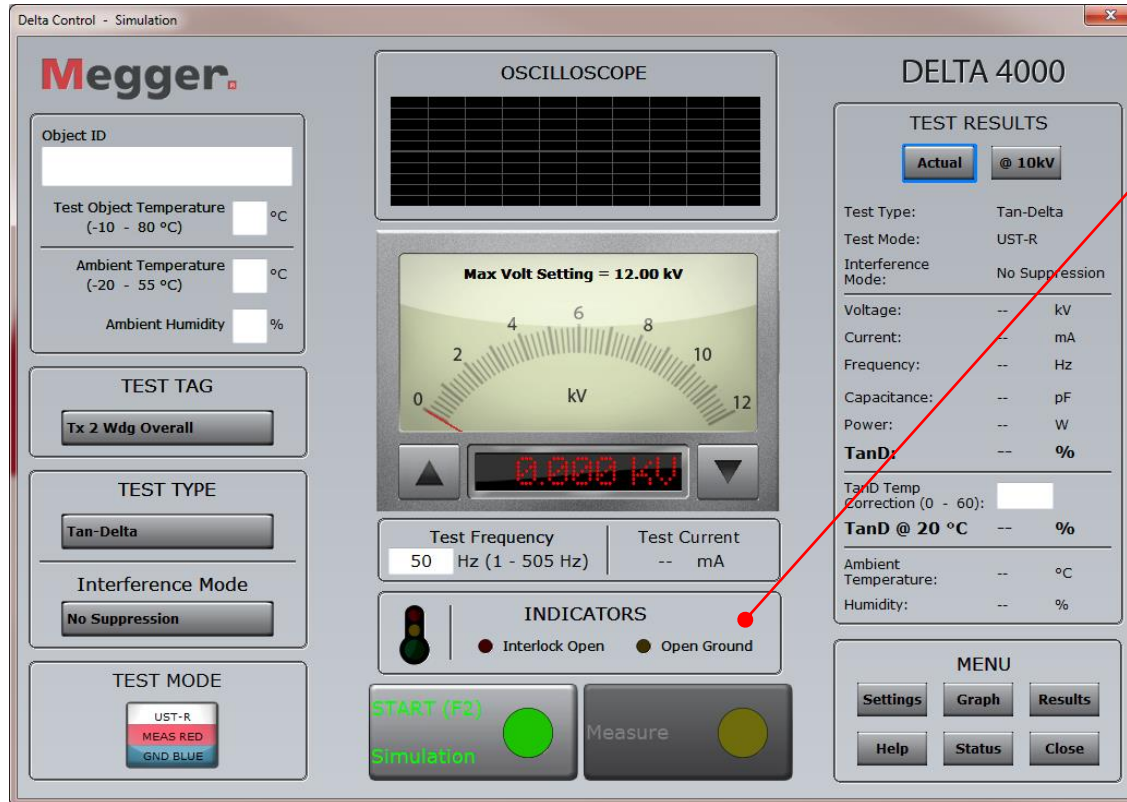
Delta 4110/4310A – Delta Control



Set Test Frequency

Not available in Frequency Variation Suppression mode

Delta 4110/4310A – Delta Control



Check indicators

Delta 4110/4310A – Delta Control

Megger

Object ID

Test Object Temperature (-10 - 80 °C)

Ambient Temperature (-20 - 55 °C)

Ambient Humidity %

TEST TAG

Tx 2 Wdg Overall

TEST TYPE

Tan-Delta

Interference Mode

No Suppression

TEST MODE

UST-R
MEAS RED
GND BLUE

OSCILLOSCOPE

Max Volt Setting = 12.00 kV

0 2 4 6 8 10 12 kV

0.000 kV

Test Frequency: 50 Hz (1 - 505 Hz)

Test Current: -- mA

INDICATORS

Interlock Open

Open Ground

START (F2) Simulation

Measure

DELTA 4000

TEST RESULTS

Actual @ 10kV

Test Type: Tan-Delta

Test Mode: UST-R

Interference Mode: No Suppression

Voltage: -- kV

Current: -- mA

Frequency: -- Hz

Capacitance: -- pF

Power: -- W

TanD: -- %

TanD Temp Correction (0 - 60):

TanD @ 20 °C: -- %

Ambient Temperature: -- °C

Humidity: -- %

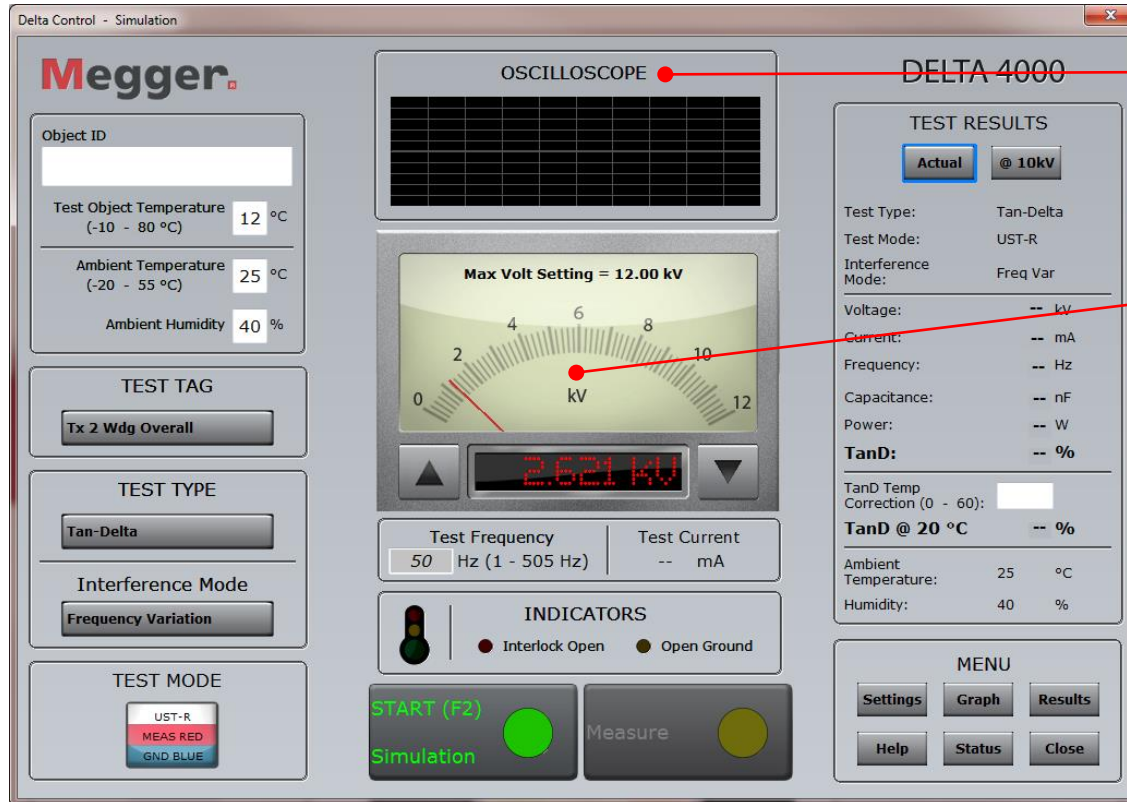
MENU

Settings Graph Results

Help Status Close

Start Test

Delta 4110/4310A – Delta Control



Waveform during test

Output Voltage during test

Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, there are control panels for Object ID, Test Object Temperature (12 °C), Ambient Temperature (25 °C), Ambient Humidity (40%), TEST TAG (Tx 2 Wdg Overall), TEST TYPE (Tan-Delta), Interference Mode (Frequency Variation), and TEST MODE (UST-R, MEAS RED, GND BLUE). The center features an OSCILLOSCOPE, a Max Volt Setting = 12.00 kV gauge, Test Frequency (50 Hz), Test Current (-- mA), and INDICATORS (Interlock Open, Open Ground). The right side shows the DELTA 4000 TEST RESULTS panel, which is highlighted with a red box and a red arrow pointing to it from the text 'Review Test Results'. The test results include: Actual @ 10kV, Test Type: Tan-Delta, Test Mode: UST-R, Interference Mode: Freq Var, Voltage: 2.621 kV, Current: 10.000 mA, Frequency: 50.0 Hz, Capacitance: 95.00 nF, Power: 22.00 W, TanD: 0.378 %, TanD Temp Correction (0 - 60): --, TanD @ 20 °C: -- %, Ambient Temperature: 25 °C, Humidity: 40 %. A MENU panel at the bottom right contains buttons for Settings, Graph, Results, Help, Status, and Close.

Review Test Results

Delta 4110/4310A – Delta Control

Megger

Object ID

Test Object Temperature (-10 - 80 °C) 12 °C

Ambient Temperature (-20 - 55 °C) 25 °C

Ambient Humidity 40 %

TEST TAG

Tx 2 Wdg Overall

TEST TYPE

Tan-Delta

Interference Mode

Frequency Variation

TEST MODE

UST-R
MEAS RED
GND BLUE

OSCILLOSCOPE

Max Volt Setting = 12.00 kV

0 2 4 6 8 10 12 kV

22.1 kV

Test Frequency 50 Hz (1 - 505 Hz) | Test Current -- mA

INDICATORS

Interlock Open | Open Ground

START (F2) Simulation Measure

DELTA 4000

TEST RESULTS @ 10kV

Actual @ 10kV

Test Type: Tan-Delta
Test Mode: UST-R
Interference Mode: Freq Var

Voltage: 2.621 kV
Current @ 10 kV: 38.15 mA
Frequency: 50.0 Hz
Capacitance: 95.00 nF
Power @ 10 kV: 320.2 W
TanD: 0.378 %

TanD Temp Correction (0 - 60): 0.970
TanD @ 20 °C 0.367 %

Ambient Temperature: 25 °C
Humidity: 40 %

MENU

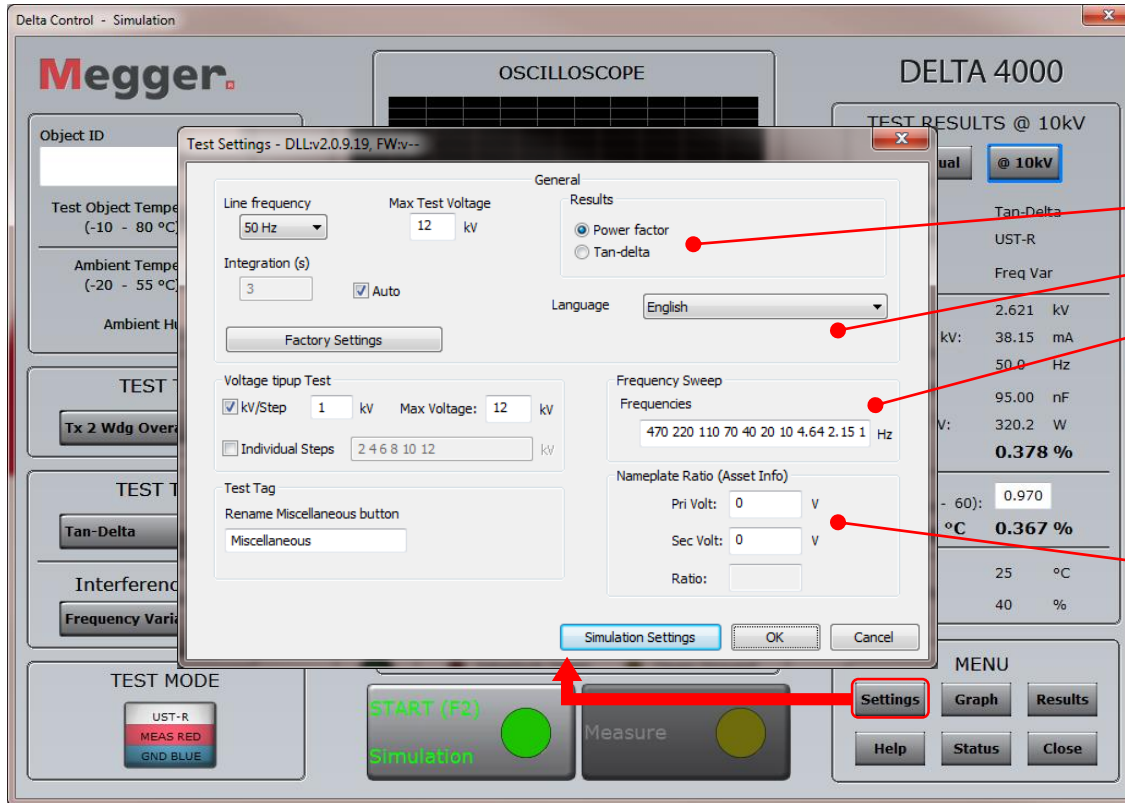
Settings Graph Results
Help Status Close

View test results as measured or @ 10kV

Current and Power @ 10kV

Enter a temperature correction value

Delta 4110/4310A – Delta Control



■ Settings can be adjusted

■ Results display

■ Language

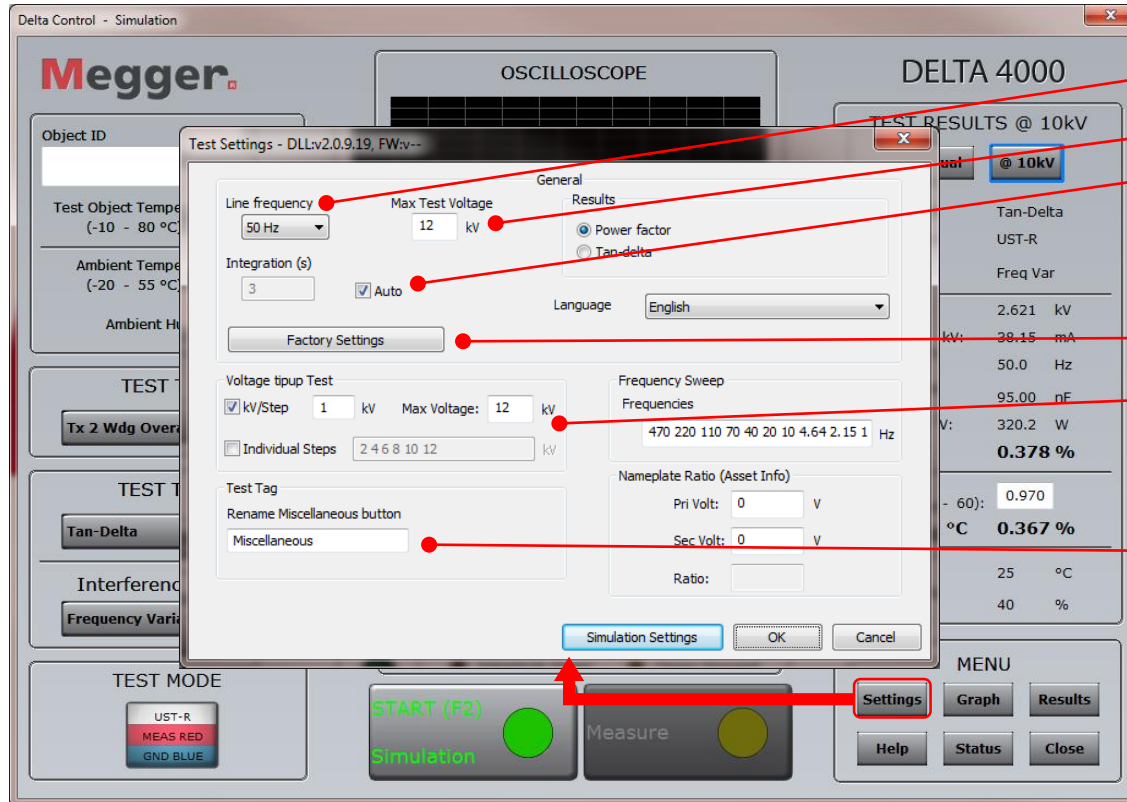
■ Frequency Sweep Frequencies

A certain range of frequencies is required for ITC. When in doubt, select Factory Settings to restore values.

■ Nameplate Ratio

Use when running ratio tests

Delta 4110/4310A – Delta Control



Set line frequency

Set Max Test kV

Set Frequency Variation Integration

*# of steps in measurement.
Set to Auto when in doubt*

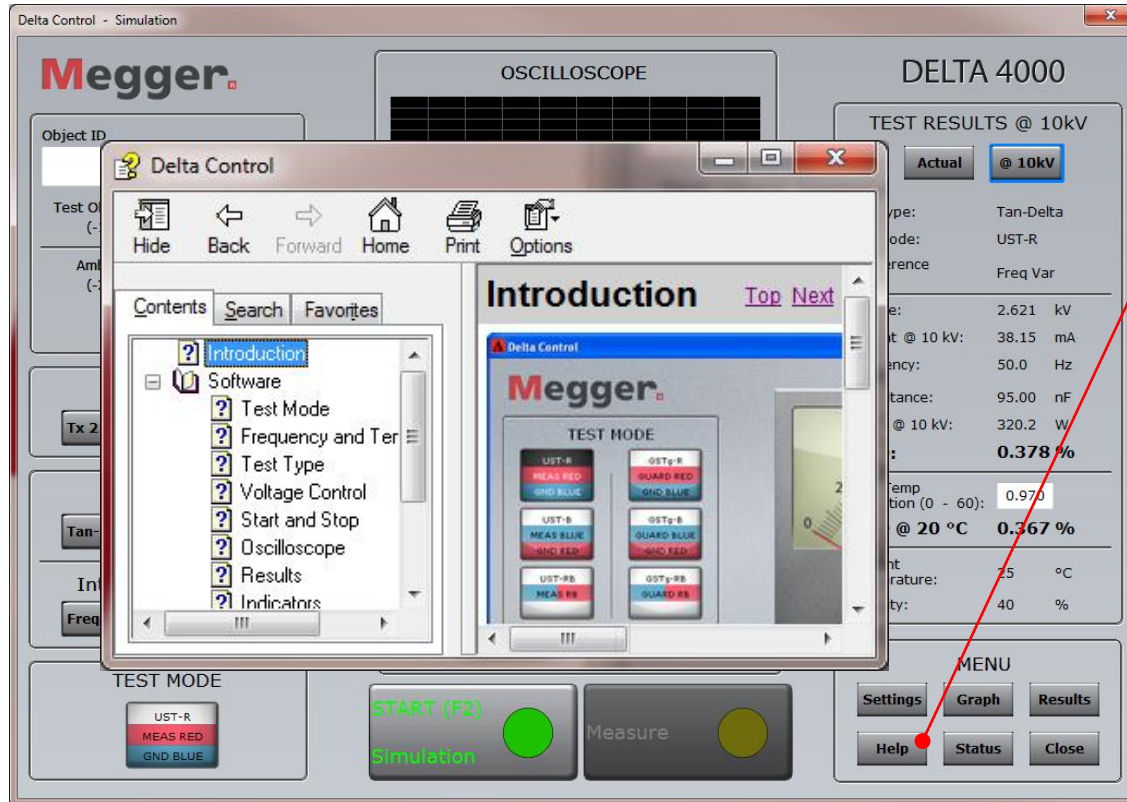
Reset Settings

Voltage tip up options

Individual Steps can be any voltage values below Max Test Voltage

Rename Miscellaneous test button

Delta 4110/4310A – Delta Control



■ Help
Review Delta Control Help

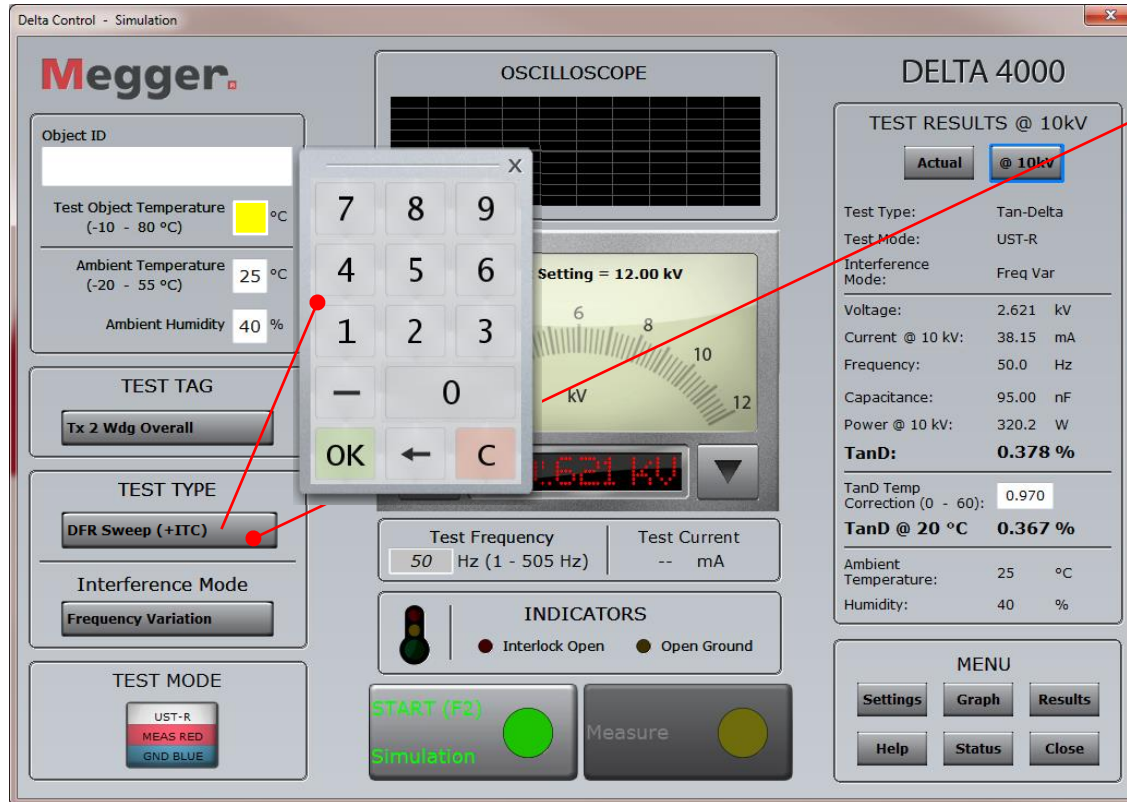
Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, there are control panels for Object ID, Test Object Temperature (12 °C), Ambient Temperature (25 °C), Ambient Humidity (40%), TEST TAG (Tx 2 Wdg Overall), TEST TYPE (Tan-Delta), Interference Mode (Frequency Variation), and TEST MODE (UST-R, MEAS RED, GND BLUE). The central System Status window shows measurement and climate data, including Frequency (--- Hz), Voltage (--- kV), In Current (--- mA), Out Current (--- mA), HV unit %RH (---), Transf. Temp. (--- °C), HV unit Temp. (--- °C), External Temp. (--- °C), External %RH (---), Serial nr, CTRL Unit Serial nr (---), HVU Unit Serial nr (---), Version (API DLL: 2.0.9.19, HVU CRB: ---, CTRL AMX: ---, CTRL MBX: ---, CTRL FPGA: ---), and Calibration (CTRL Calibrated: ---). The right panel shows DELTA 4000 TEST RESULTS @ 10kV with buttons for Actual and @ 10kV. Test results include: Test Type: Tan-Delta, Test Mode: UST-R, Interference Mode: Freq Var, Voltage: 2.621 kV, Current @ 10 kV: 38.15 mA, Frequency: 50.0 Hz, Capacitance: 95.00 nF, Power @ 10 kV: 320.2 W, TanD: 0.378 %, TanD Temp Correction (0 - 60): 0.970, TanD @ 20 °C: 0.367 %, Ambient Temperature: 25 °C, Humidity: 40 %. A MENU section at the bottom right contains buttons for Settings, Graph, Results, Help, Status, and Close.

■ Status

View live information about the Delta

Delta 4110/4310A – Delta Control

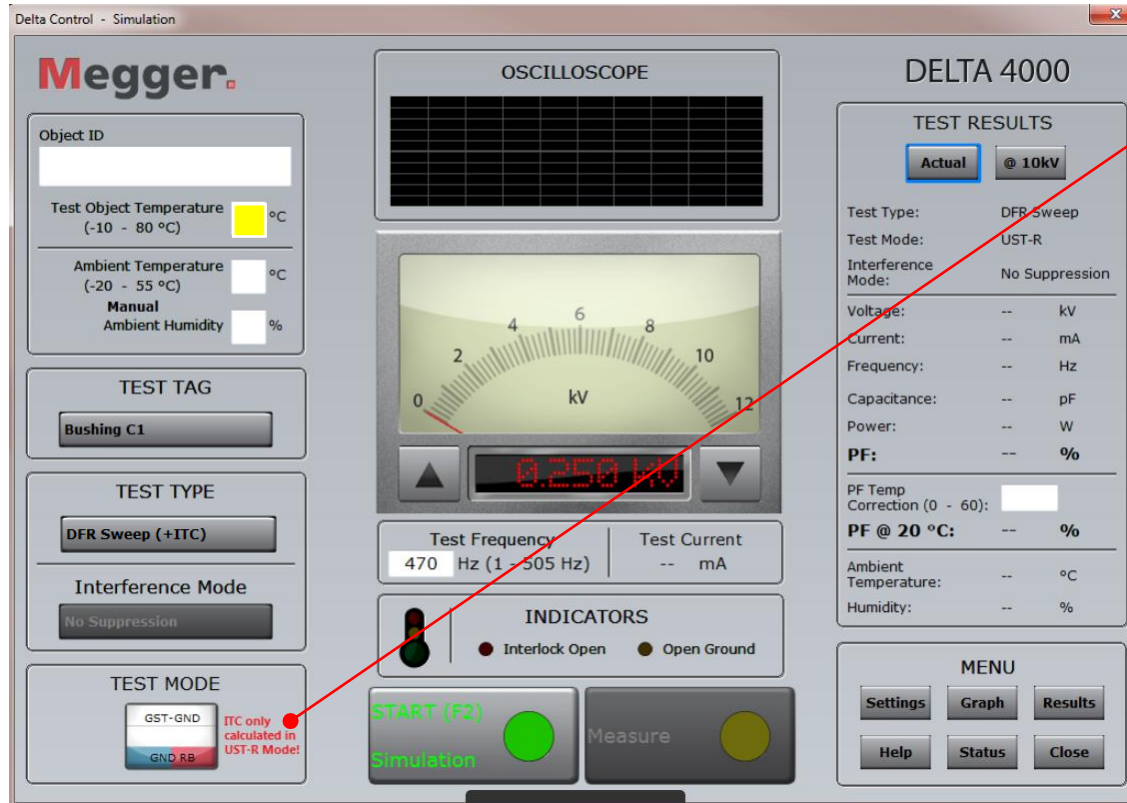


■ DFR Sweep + ITC

Test object temperature required for ITC.

Pop-up will appear if Test Object Temperature is blank after selecting DFR Sweep (+ITC) test type

Delta 4110/4310A – Delta Control



■ ITC can only be calculated with UST-R Test Mode!

If a different test mode is selected, a message will appear that ITC only calculated in UST-R Mode!

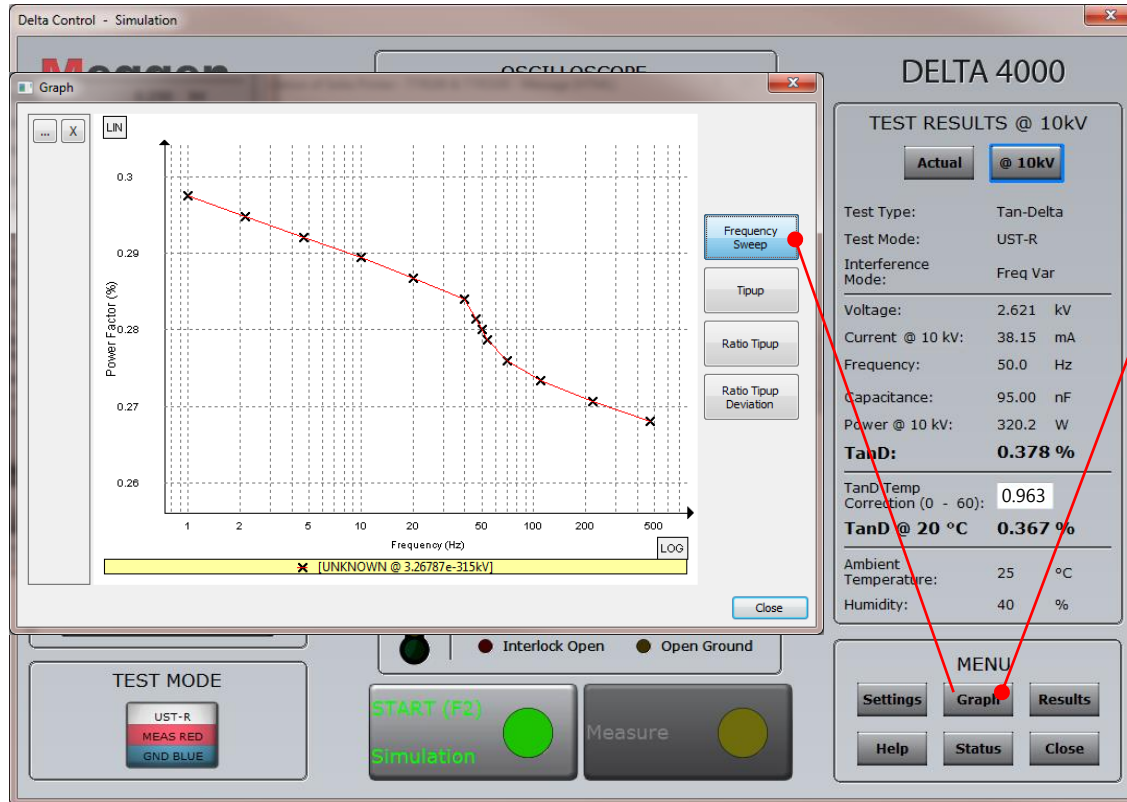
Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, the Megger logo is at the top. Below it, the 'Object ID' field is empty. Test parameters include: Test Object Temperature (-10 - 80 °C) at 12 °C, Ambient Temperature (-20 - 55 °C) at 25 °C, and Ambient Humidity at 40 %. The 'TEST TAG' section shows 'Tx 2 Wdg Overall'. Under 'TEST TYPE', 'DFR Sweep (+ITC)' is selected. 'Interference Mode' is set to 'Frequency Variation'. 'TEST MODE' is set to 'UST-R' (MEAS RED, GND BLUE). The central 'OSCILLOSCOPE' area is currently blank. Below it, a 'Max Volt Setting = 12.00 kV' gauge shows a needle pointing to approximately 1.2 kV, with a digital display showing '2.621 kV'. Test Frequency is 50 Hz (1 - 505 Hz) and Test Current is -- mA. The 'INDICATORS' section shows a green light for 'Interlock Open' and a yellow light for 'Open Ground'. At the bottom, there are 'START (F2) Simulation' and 'Measure' buttons. On the right, the 'DELTA 4000' test results are shown for a 10kV test. The 'TEST RESULTS @ 10KV' section includes: Actual vs @ 10kV (selected), Test Type: Tan-Delta, Test Mode: UST-R, Interference Mode: Freq Var, Voltage: 2.621 kV, Current @ 10 kV: 38.15 mA, Frequency: 50.0 Hz, Capacitance: 95.00 nF, Power @ 10 kV: 320.2 W, TanD: 0.378 %, TanD Temp Correction (0 - 60): 0.963 (highlighted with a red dot), TanD @ 20 °C: 0.367 %, Ambient Temperature: 25 °C, and Humidity: 40 %. A 'MENU' section at the bottom right contains buttons for Settings, Graph, Results, Help, Status, and Close.

■ ITC Calculated

When the frequency sweep completes, ITC will be populated.

Delta 4110/4310A – Delta Control

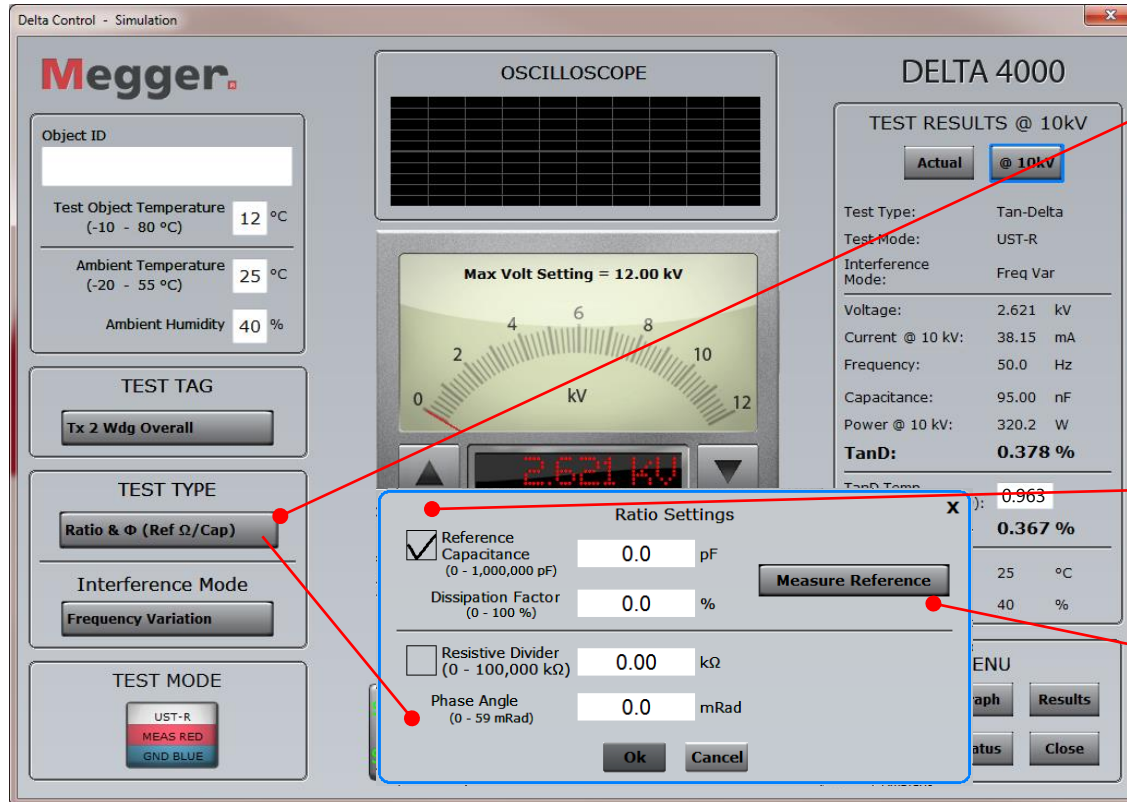


DFR Sweep Graph

Select Graph to view the DFR Sweep graph

Can be viewed during the test

Delta 4110/4310A – Delta Control



Ratio & \emptyset (Ref Ω /Cap)

After selecting Ratio & \emptyset (Ref Ω /Cap) a pop up will appear asking for the values of the Reference Capacitor or Resistive Divider

Select Reference Capacitance or Resistive Divider and enter the values

If the values are unknown, click Measure Reference

Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, the Megger logo is visible. Below it, there are input fields for Object ID, Test Object Temperature (12 °C), Ambient Temperature (25 °C), and Ambient Humidity (40 %). A TEST TAG section shows 'Tx 2 Wdg Overall'. The TEST TYPE section has 'Ratio & Φ (Ref Ω /Cap)' selected. The TEST MODE section shows 'UST-R', 'MEAS RED', and 'GND BLUE'. In the center, an OSCILLOSCOPE window is empty, and a gauge shows 'Max Volt Setting = 12.00 kV' with a needle pointing to approximately 1.2 kV. On the right, the DELTA 4000 TEST RESULTS @ 10kV are displayed, including Actual and @ 10kV tabs, and various test parameters like Voltage (2.621 kV), Current @ 10 kV (38.15 mA), Frequency (50.0 Hz), Capacitance (95.00 nF), Power @ 10 kV (320.2 W), and TanD (0.378 %). A Ratio Settings dialog box is open in the foreground, showing 'Reference Capacitance' set to 0.0 pF and a 'Measure Reference' button. A smaller warning dialog box is also present, stating 'Select a voltage and click the Start button.' with 'OK' and 'Cancel' buttons.

■ Ratio & \emptyset
(Ref Ω /Cap)

Click OK

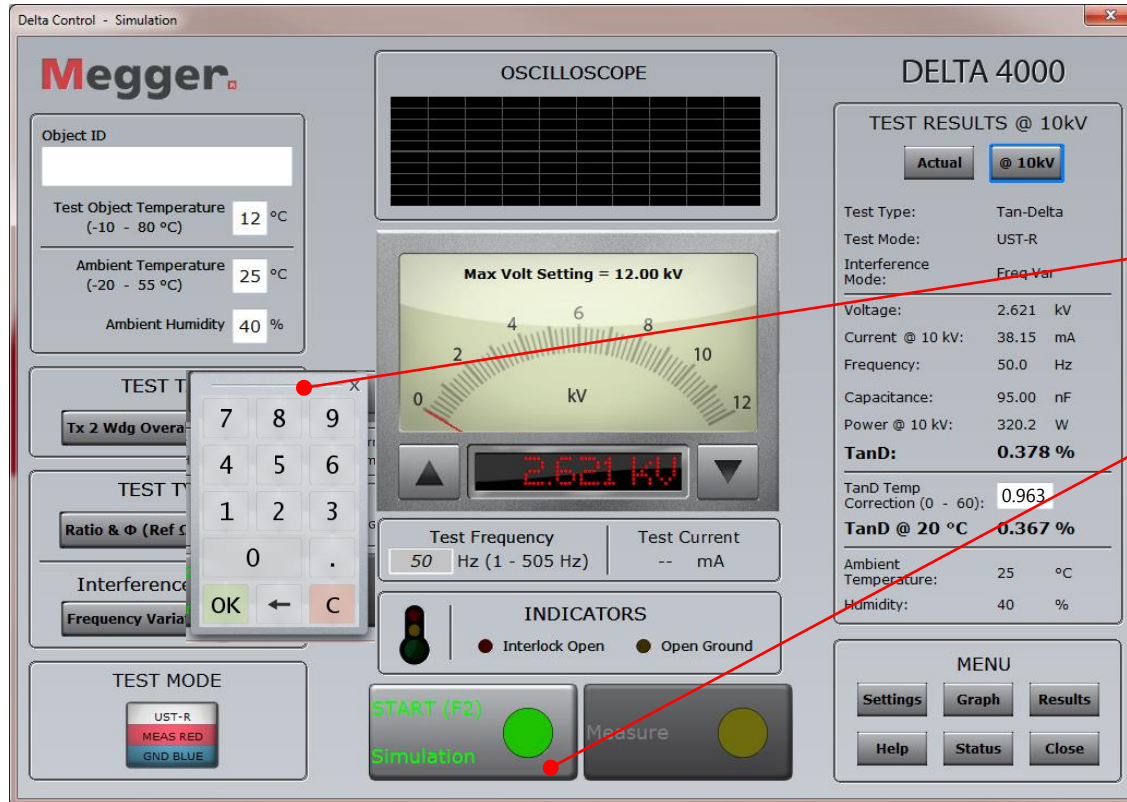
Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, the Megger logo is visible above a control panel with fields for Object ID, Test Object Temperature (12 °C), Ambient Temperature (25 °C), and Ambient Humidity (40 %). Below these are buttons for TEST TAG (Tx 2 Wdg Overall), TEST TYPE (Ratio & Φ (Ref Ω /Cap)), Interference Mode (Frequency Variation), and TEST MODE (UST-R, MEAS RED, GND BLUE). The center features an OSCILLOSCOPE and a large analog-style gauge for Max Volt Setting (12.00 kV) with a digital display showing 12.15 kV. On the right, the DELTA 4000 TEST RESULTS @ 10kV are shown, including Actual and @ 10kV tabs, and various test parameters like Voltage (2.621 kV), Current @ 10 kV (38.15 mA), Frequency (50.0 Hz), Capacitance (95.00 nF), Power @ 10 kV (320.2 W), and TanD (0.378 %). A pop-up dialog box titled 'Ratio Settings' is open, showing 'Reference Capacitance' set to 0.0 pF and a 'Measure Reference' button. A smaller warning dialog box is also present, stating 'Select a voltage and click the Start button.' with 'OK' and 'Cancel' options.

■ Ratio & \emptyset
(Ref Ω /Cap)

*Click OK to the pop up that
appears after clicking
Measure Reference*

Delta 4110/4310A – Delta Control

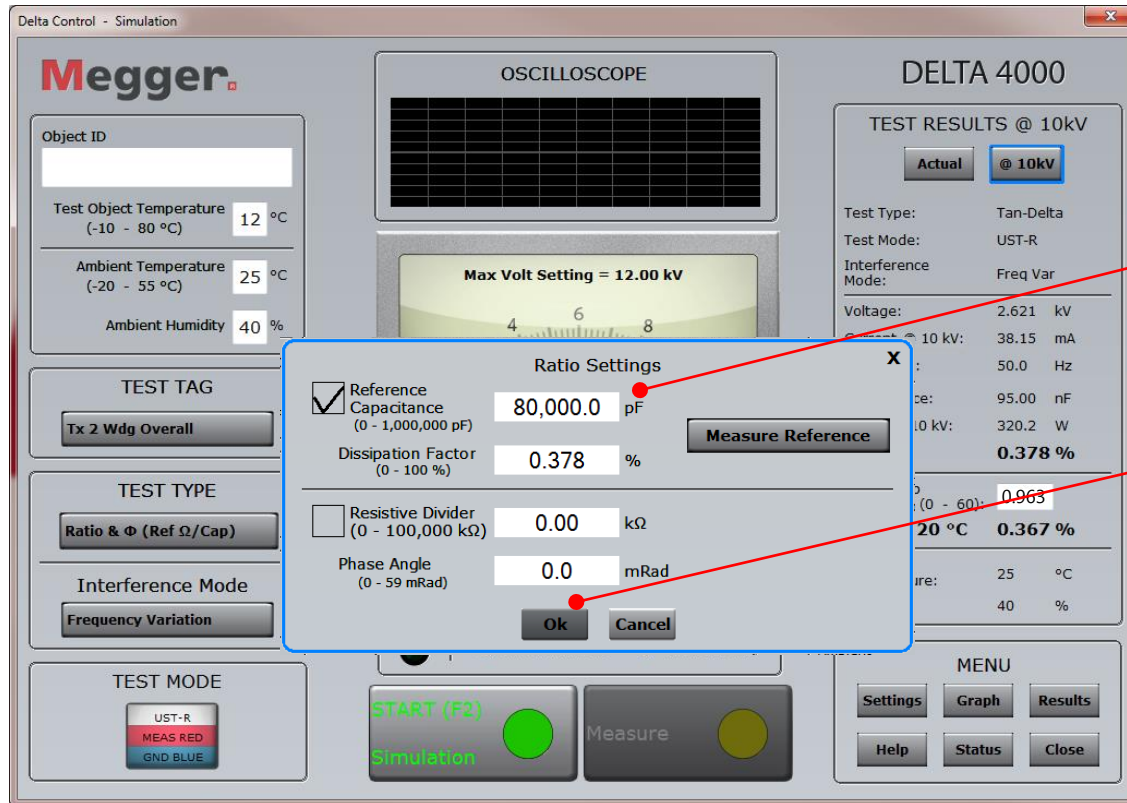


■ Ratio & Ø
(Ref Ω/Cap)

Set a test voltage to test the reference capacitor or resistive divider

Run the test on the reference capacitor or resistive divider

Delta 4110/4310A – Delta Control

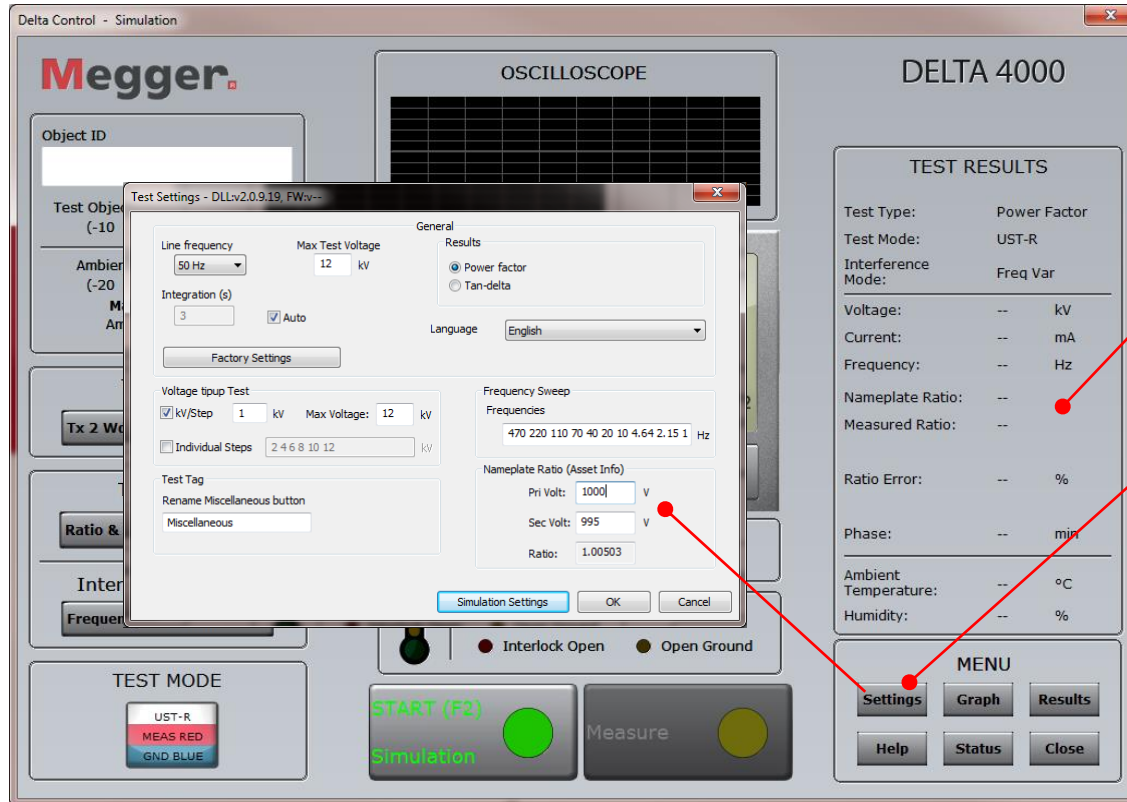


■ Ratio & Φ (Ref Ω /Cap)

After the test completes, the values of the reference capacitor or resistive divider will be displayed.

Click OK

Delta 4110/4310A – Delta Control

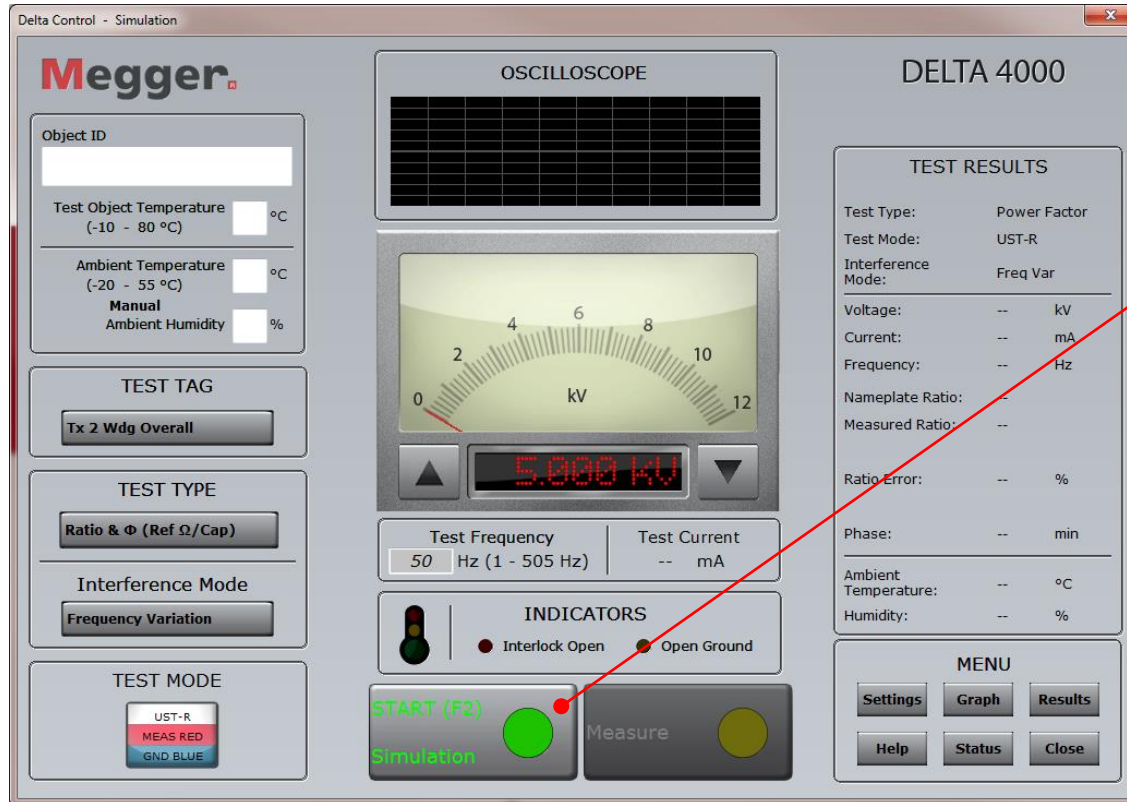


■ Ratio & Ø (Ref Ω/Cap)

Note that the Test Results have been updated to display Ratio & Ø (Ref Ω/Cap) results

Enter Tap voltages under settings if they have not been set. Used to calculate Nameplate Ratio and Ratio Error

Delta 4110/4310A – Delta Control



■ Ratio & Φ
(Ref Ω /Cap)

Run a test

Delta 4110/4310A – Delta Control

The screenshot displays the Delta Control simulation interface. On the left, there are control panels for 'Object ID', temperature and humidity settings, 'TEST TAG' (Tx 2 Wdg Overall), 'TEST TYPE' (Ratio & Φ (Ref Ω /Cap)), 'Interference Mode' (Frequency Variation), and 'TEST MODE' (UST-R, MEAS RED, GND BLUE). The center features an 'OSCILLOSCOPE' and a 'Max Volt Setting = 12.00 kV' gauge with a digital display showing 5.000 kV. Below the gauge are 'Test Frequency' (50 Hz) and 'Test Current' (mA) fields. The bottom center has 'INDICATORS' (Interlock Open, Open Ground) and 'START (F2) Simulation' and 'Measure' buttons. On the right, the 'DELTA 4000' panel shows 'TEST RESULTS' for 'Ratio & Φ '.

TEST RESULTS	
Test Type:	Ratio & Φ
Test Mode:	UST-R
Interference Mode:	Freq Var
Voltage:	5.000 kV
Current:	10.00 mA
Frequency:	50.0 Hz
Nameplate Ratio:	1.0050:1
Measured Ratio:	1.0025:1
Ratio Error:	-0.25 %
Phase:	-1231.0 min
Ambient Temperature:	-- °C
Humidity:	-- %

■ Ratio & Φ
(Ref Ω /Cap)

Review results

Delta 4110/4310A – Delta Control

Delta Control - Simulation

Megger

Object ID

Test Object Temperature (-10 - 80 °C) °C

Ambient Temperature (-20 - 55 °C) °C

Manual Ambient Humidity %

TEST TAG

Tx 2 Wdg Overall

TEST TYPE

Ratio Voltage Tip Up

Interference Mode

Frequency Variation

TEST MODE

UST-R
MEAS RED
GND BLUE

OSCILLOSCOPE

Max Volt Setting = 12.00 kV

0 2 4 6 8 10 12 kV

5.000 kV

Test Frequency 50 Hz (1 - 505 Hz) | Test Current -- mA

INDICATORS

Interlock Open | Open Ground

START (F2) Simulation Measure

DELTA 4000

TEST RESULTS

Test Type: Ratio & Ø
Test Mode: UST-R
Interference Mode: Freq Var

Voltage: 5.000 kV
Current: 10.00 mA
Frequency: 50.0 Hz

Nameplate Ratio: 1.0050:1
Measured Ratio: 1.0025:1

Ratio Error: -0.25 %

Phase: -1231.0 min

Ambient Temperature: -- °C
Humidity: -- %

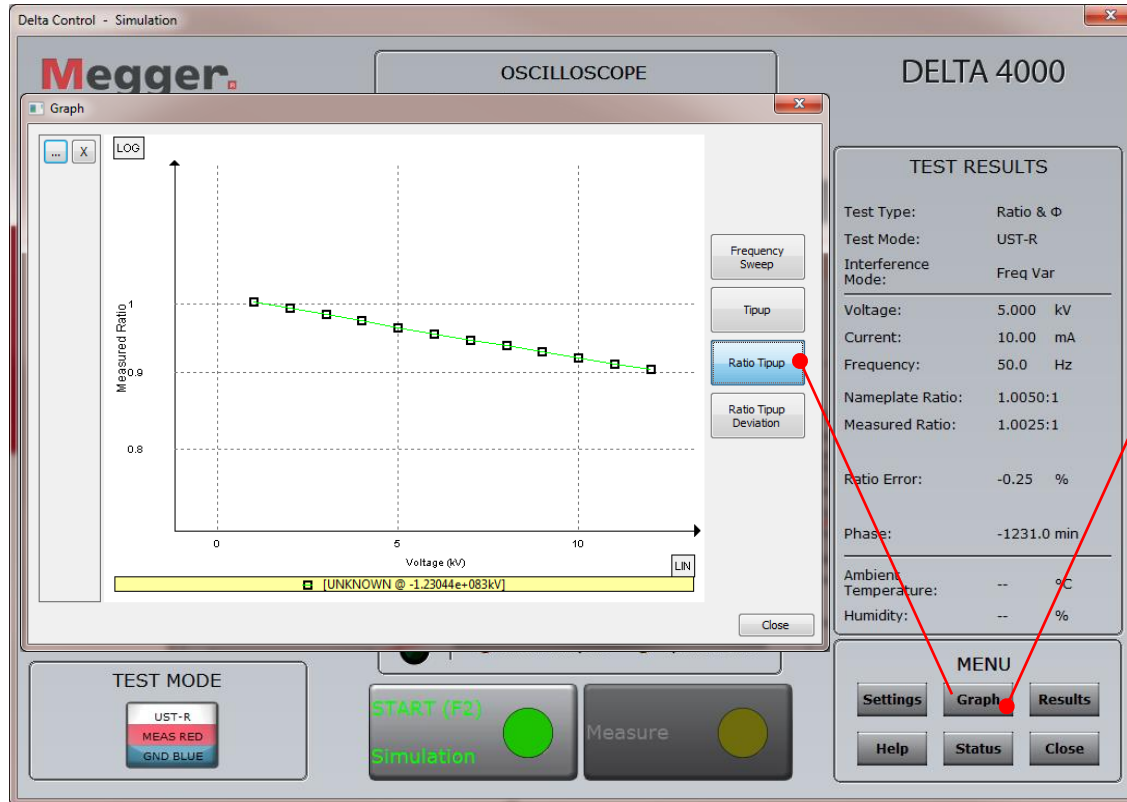
MENU

Settings Graph Results
Help Status Close

Ratio Voltage Tip Up

Similar to Ratio & Ø (Ref Ω /Cap), but over tip up voltages set in settings

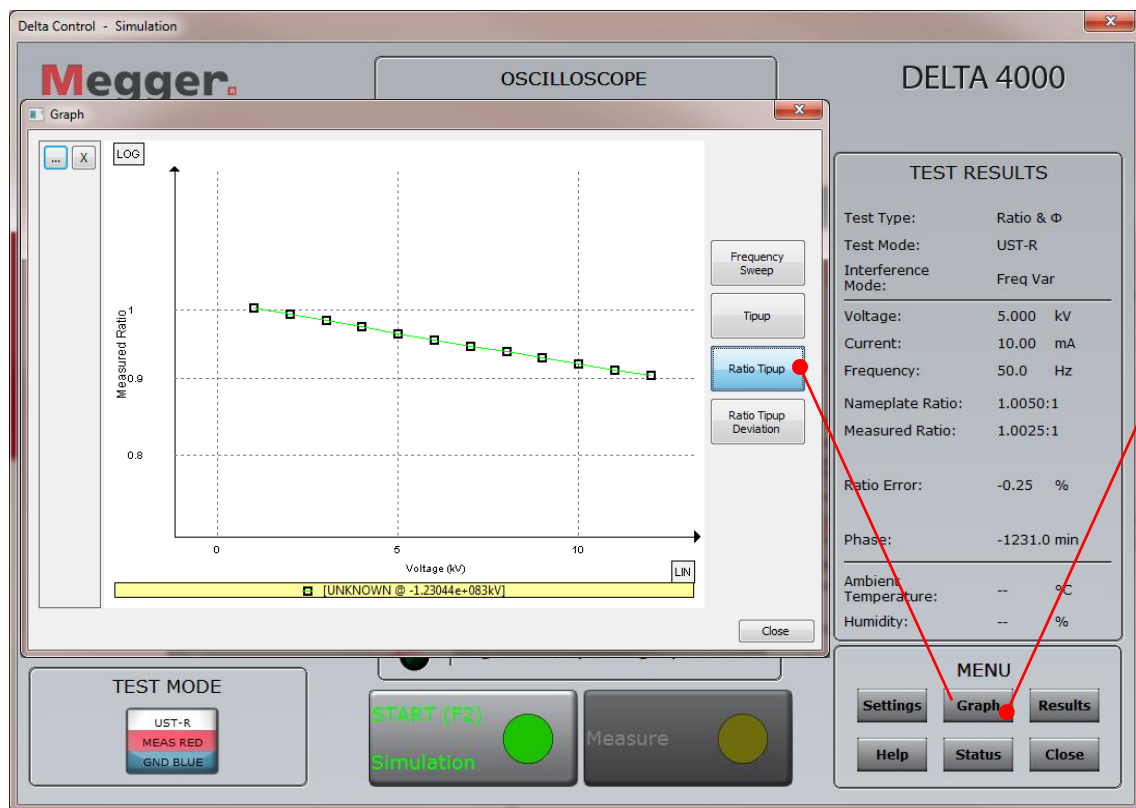
Delta 4110/4310A – Delta Control



Ratio Voltage Tip Up

During testing and after the test is complete, you can view the graph

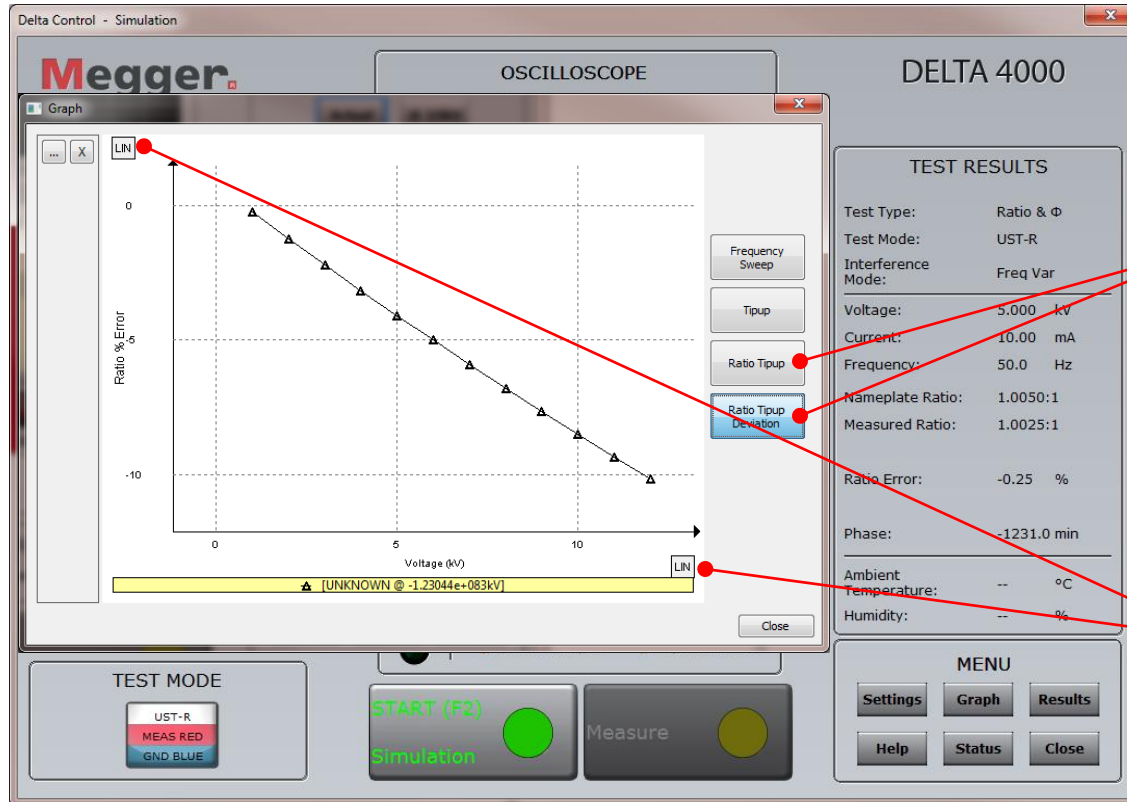
Delta 4110/4310A – Delta Control



Ratio Voltage Tip Up

When testing is complete, you can view the graph

Delta 4110/4310A – Delta Control

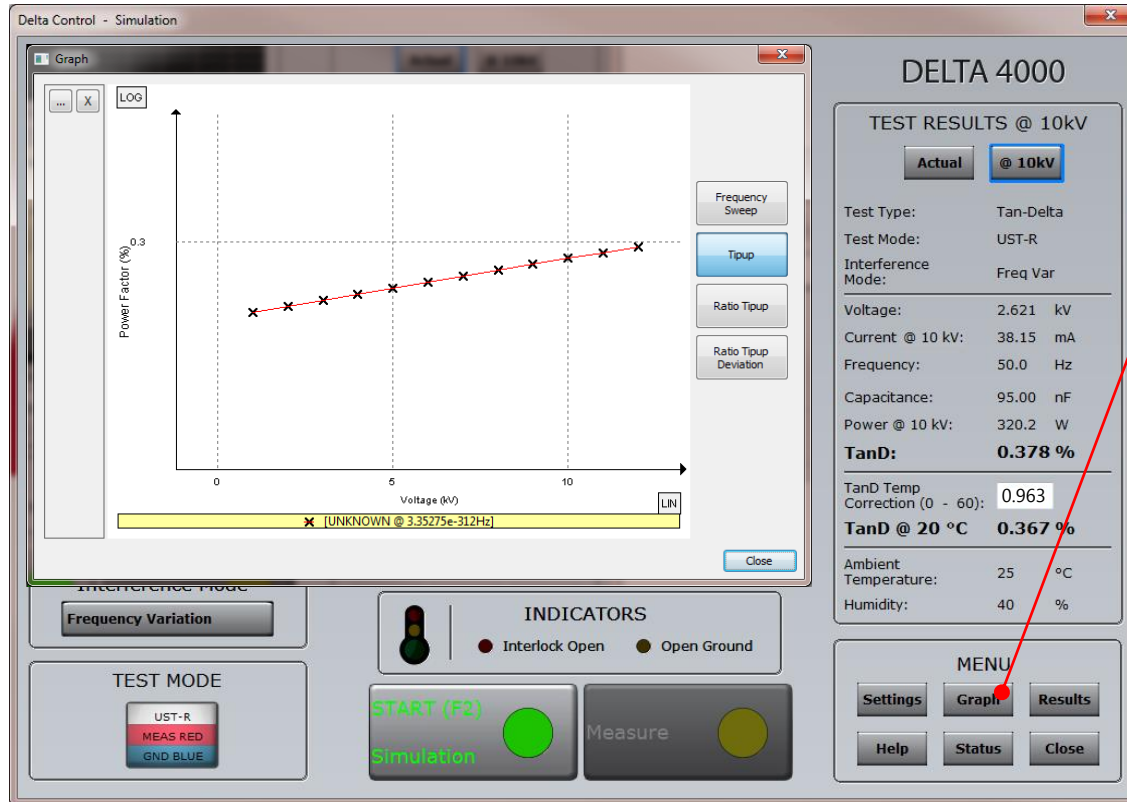


Ratio Voltage Tip Up

Two graphs are available for Ratio Voltage Tip Up, Ratio Tipup and Ratio Tipup Deviation

Choose LIN/LOG to manipulate the X or Y Axis

Delta 4110/4310A – Delta Control

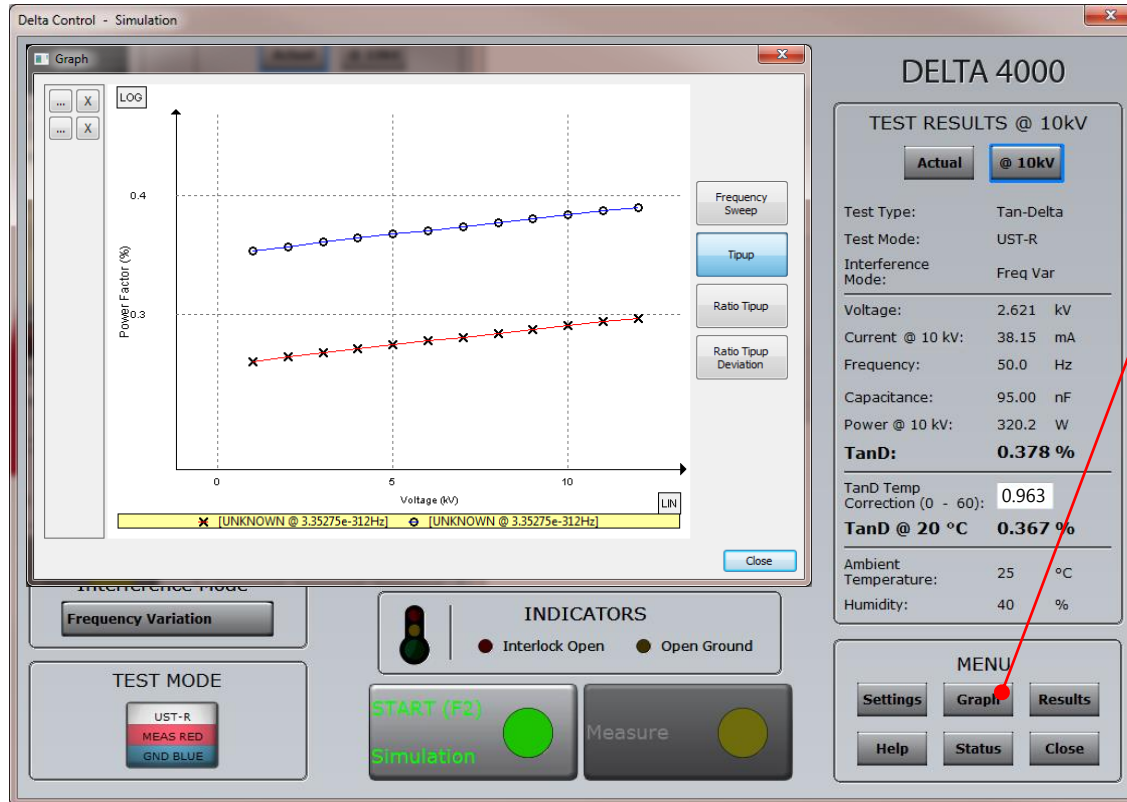


Tipup Graph

Graphs are available for Voltage Tipup Test [PF/DF]

Can be viewed during the test

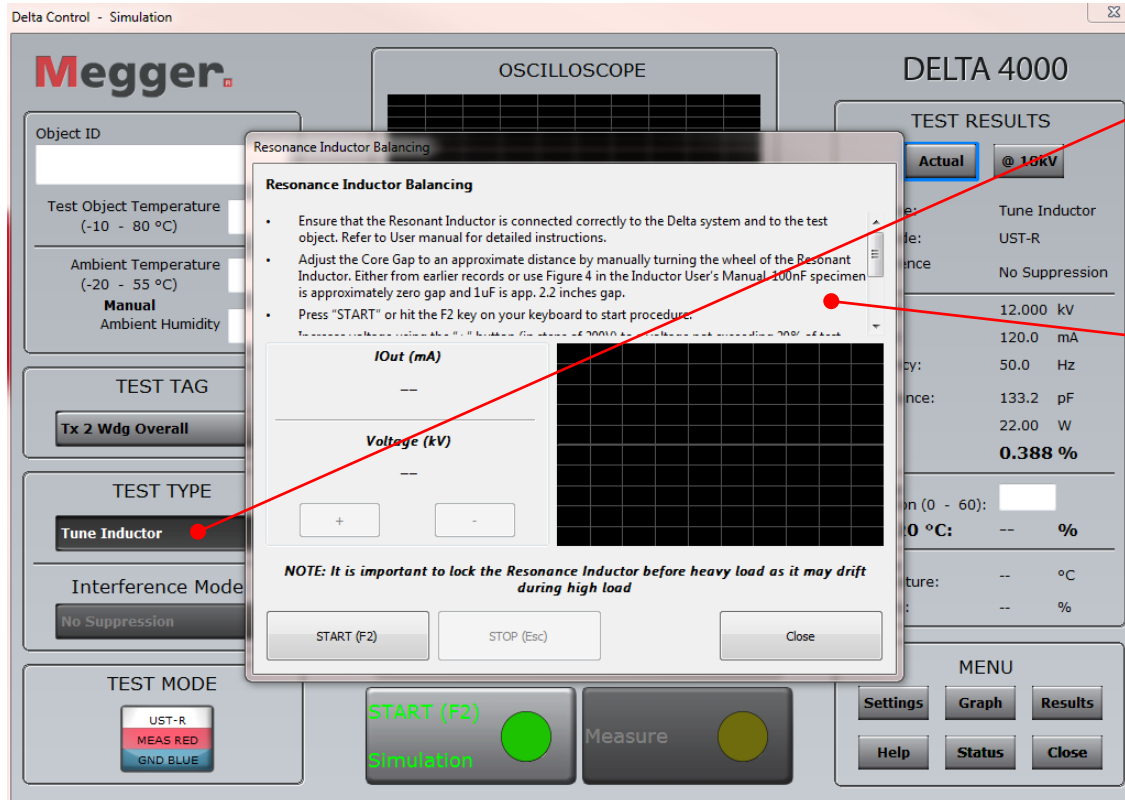
Delta 4110/4310A – Delta Control



Tipup Graph

Multiple Tipups and sweeps will be presented on the graph if run during the same instance of Delta Control

Delta 4110/4310A – Delta Control



■ Tune Inductor

Selecting Tune inductor brings up the Resonance Inductor Balancing

Follow the procedure in the Text Box

Delta 4110/4310A – Delta Control

Delta Control - Simulation

Megger

Object ID

Test Object Temperature (-10 - 80 °C) °C

Ambient Temperature (-20 - 55 °C) °C

Manual Ambient Humidity %

TEST TAG

Tx 2 Wdg Overall

TEST TYPE

Voltage Tipup Test [PF/DF]

Interference Mode

Frequency Variation

TEST MODE

UST-R
MEAS RED
GND BLUE

OSCILLOSCOPE

DELTA 4000

TEST RESULTS

Actual @ 10kV

Test Type: Volt Tipup
Test Mode: UST-R
Interference Mode: No Suppression

Voltage: 12.000 kV
Current: 120.0 mA
Frequency: 50.0 Hz
Capacitance: 133.2 pF
Power: 22.00 W
PF: 0.388 %

PF Temp Correction (0 - 60):
PF @ 20 °C: -- %

Ambient Temperature: -- °C
Humidity: -- %

MENU

Settings Graph Results
Help Status Close

1.000 kV

Test Frequency 50 Hz (1 - 505 Hz) Test Current -- mA

INDICATORS

Interlock Open Open Ground

START (F2) Simulation Measure

■ Tune Inductor

After tuning the inductor is complete, the Test Type will be set to Voltage Tipup Test