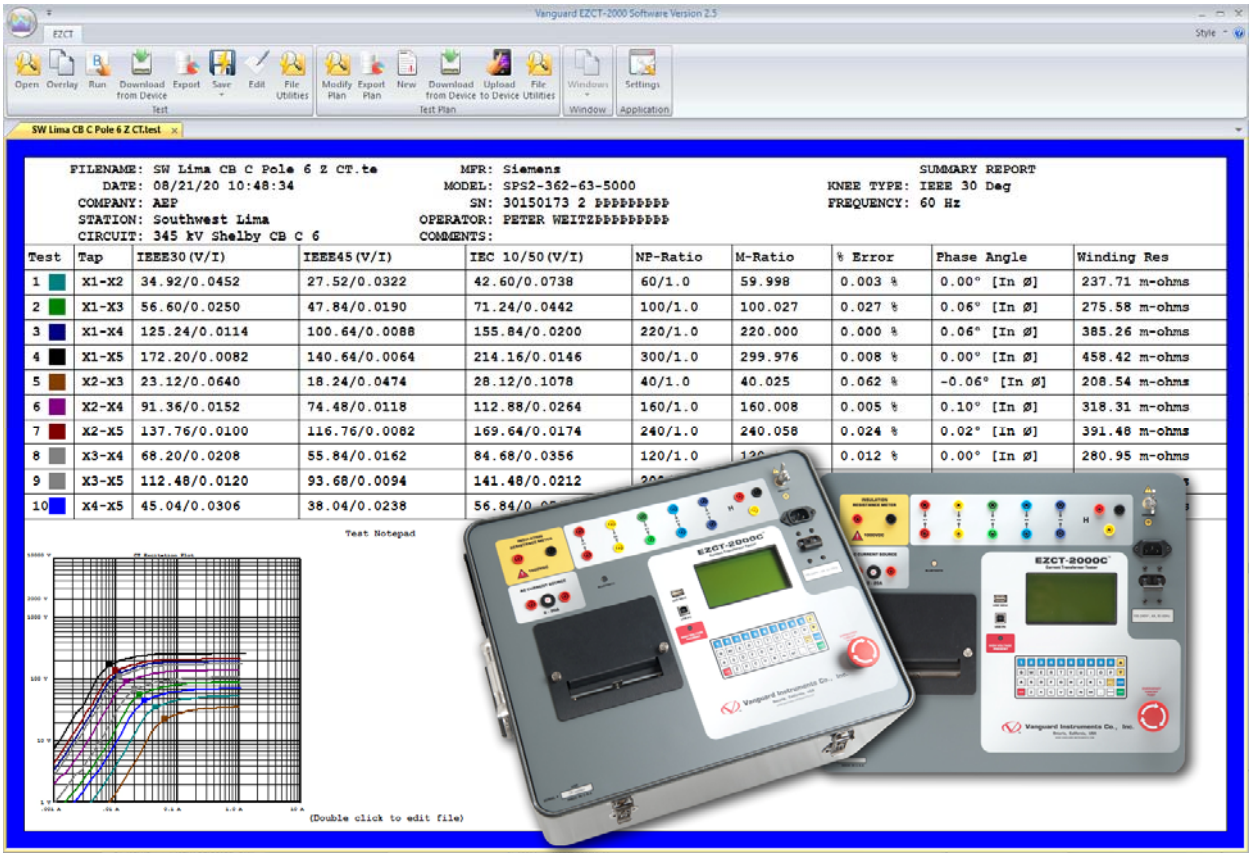
EZCT-2000 Software

VERSION 2.x USER'S MANUAL

For Use with Vanguard's

EZCT-S2, EZCT-S2A, EZCT-2000, EZCT-2000A, EZCT-2000B, EZCT-2KA, EZCT-2000C

Current Transformer Testers



Test	Tap	IEEE30 (V/I)	IEEE45 (V/I)	IEC 10/50 (V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	34.92/0.0452	27.52/0.0322	42.60/0.0738	60/1.0	59.998	0.003 %	0.00° [In Ø]	237.71 m-ohms
2	X1-X3	56.60/0.0250	47.84/0.0190	71.24/0.0442	100/1.0	100.027	0.027 %	0.06° [In Ø]	275.58 m-ohms
3	X1-X4	125.24/0.0114	100.64/0.0088	155.84/0.0200	220/1.0	220.000	0.000 %	0.06° [In Ø]	385.26 m-ohms
4	X1-X5	172.20/0.0082	140.64/0.0064	214.16/0.0146	300/1.0	299.976	0.008 %	0.00° [In Ø]	458.42 m-ohms
5	X2-X3	23.12/0.0640	18.24/0.0474	28.12/0.1078	40/1.0	40.025	0.062 %	-0.06° [In Ø]	208.54 m-ohms
6	X2-X4	91.36/0.0152	74.48/0.0118	112.88/0.0264	160/1.0	160.008	0.005 %	0.10° [In Ø]	318.31 m-ohms
7	X2-X5	137.76/0.0100	116.76/0.0082	169.64/0.0174	240/1.0	240.058	0.024 %	0.02° [In Ø]	391.48 m-ohms
8	X3-X4	68.20/0.0208	55.84/0.0162	84.68/0.0356	120/1.0	120	0.012 %	0.00° [In Ø]	280.95 m-ohms
9	X3-X5	112.48/0.0120	93.68/0.0094	141.48/0.0212	200				
10	X4-X5	45.04/0.0306	38.04/0.0238	56.84/0.0					

Vanguard Instruments Company, Inc.
1520 S. Hellman Ave.
Ontario, California 91761, USA

TEL: (909) 923-9390
FAX: (909) 923-9391

May 2016
Revision 2.0

TABLE OF CONTENTS

CONVENTIONS USED IN THIS DOCUMENT 1
1.0 INTRODUCTION 2
1.1 System Requirements 2
2.0 SOFTWARE INSTALLATION 3
3.0 STARTING AND CONFIGURING THE EZCT-2000 SOFTWARE 6
3.1 Starting the EZCT-2000 Software 6
3.2 The EZCT-2000 Application Workspace 7
3.3 Configuring Default Application Settings 9
3.3.1. Setting the Default Printing Orientation 9
3.3.2. Configuring the Communication Parameters 10
3.3.3. Configuring Localization Options 10
3.3.4. Setting a Custom Logo for Reports 10
3.3.5. Setting the Default Test Record and Test Plan Storage Locations 11
3.3.6. Configuring Default Export Settings 11
3.4 Printer Setup 12
4.0 WORKING WITH TEST RECORDS 13
4.1 Retrieving Test Records From a CT Tester 13
4.2 Opening a Test Record From the PC Hard Drive 16
4.3 Saving a Test Record 17
4.3.1. Saving a Test Record With Its Original Filename 17
4.3.2. Saving a Test Record With a Different Filename 17
4.4 Opening the Default Test Records Folder 18
4.5 Working with Tabulated Test Results 19
4.5.1. Editing a Test Record 21
4.5.2. Printing the Tabulated Test Results 26
4.5.3. Overlaying Test Records 28
5.0 WORKING WITH TEST PLANS 30
5.1 Retrieving Test Plans From a CT Tester 30
5.2 Modifying a Test Plan Stored on the PC 33
5.3 Transferring Test Plans to a CT Tester 36
5.4 Creating Test Plans 38
6.0 RUNNING TESTS 41
Appendix A - Connecting Your CT Tester to a PC 43

LIST OF FIGURES

Figure 1. Typical Test Record Page (Excitation Test) 19
Figure 2. Test Record Page Displaying Summary Report 20
Figure 3. Sample Pass/Fail Report 24
Figure 4. Typical Test Record Printouts (Landscape format) 27
Figure 5. Sample Graph of Overlaid Test Records 29
Figure 6. Sample Tabulated Data from Overlaid Test Records 29

CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- Microsoft® Windows XP, Vista, 7, 8, and 10 will be simply referred to as Windows in this manual
- The general term “CT tester” used in this manual refers to any of the EZCT-2000 compatible Vanguard Current-Transformer Testers (EZCT-S2, EZCT-S2A, EZCT-2000, EZCT-2000A, EZCT-2000B, EZCT-2KA, EZCT-2000C)
- Menu names are referred to as ***Menu Name***
- Menu items are referred to as *Menu Item*
- Dialog boxes and their elements (buttons, options, etc.) are referred to as “Dialog Box Element”
- PC keyboard keys are referred to as **[Key]**. Key combinations are shown as **[Key]+[Key]**.
- File locations, directories, and filenames are shown as “*C:\folder\filename*”
- Important notes are indicated as:

NOTE

Note details

1.0 INTRODUCTION

The EZCT-2000 software is a Windows-based PC software application for use with Vanguard's EZCT line of current-transformer testers (EZCT-S2, EZCT-S2A, EZCT-2000, EZCT-2000A, EZCT-2000B, EZCT-2KA, EZCT-2000C). This software allows users to perform the following tasks:

- Test a current-transformer directly from a PC.
- Create test plans for current-transformers.
    - The test plan can be created on the PC and then transferred to the CT Tester.
    - A test plan can be used to quickly test a current-transformer and obtain test results.
    - A test plan can be retrieved from a CT Tester and saved on the PC hard drive.
- Export test records in Excel®, PDF, and XML formats.
- Retrieve test records stored in a CT Tester.

1.1 System Requirements

The EZCT-2000 software has the following minimum system requirements:

- PC running Microsoft® Windows® XP/Vista/7/8/8.1/10
  (Both 32-bit and 64-bit versions of relevant operating systems are supported)
- 50 Megabytes of hard drive space
- RS-232C (serial) port, USB port, or Bluetooth interface (depending on CT tester model)

2.0 SOFTWARE INSTALLATION

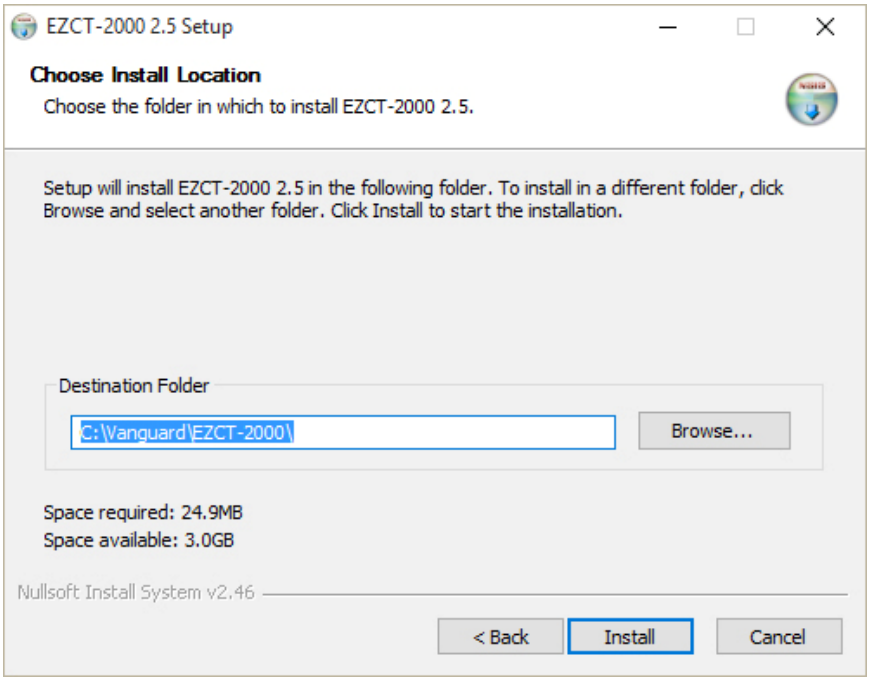
Follow the steps below to install the EZCT-2000 software on your PC.

1. If using the Installation CD that came with your Vanguard CT tester, insert it in your computer's CD/DVD drive and navigate to that drive using Windows Explorer. If using a USB Flash drive that came with your CT tester, insert it into an available USB port and then navigate to that drive using Windows Explorer. If you downloaded the software from the Vanguard web site, navigate to the folder where you extracted the installation files.
2. Double click (or single click in some Windows configurations) on the "*EZCT-2000 Software Rev 2.x.exe*" file to start the installation process. The EZCT-2000 installation wizard will appear as shown below:

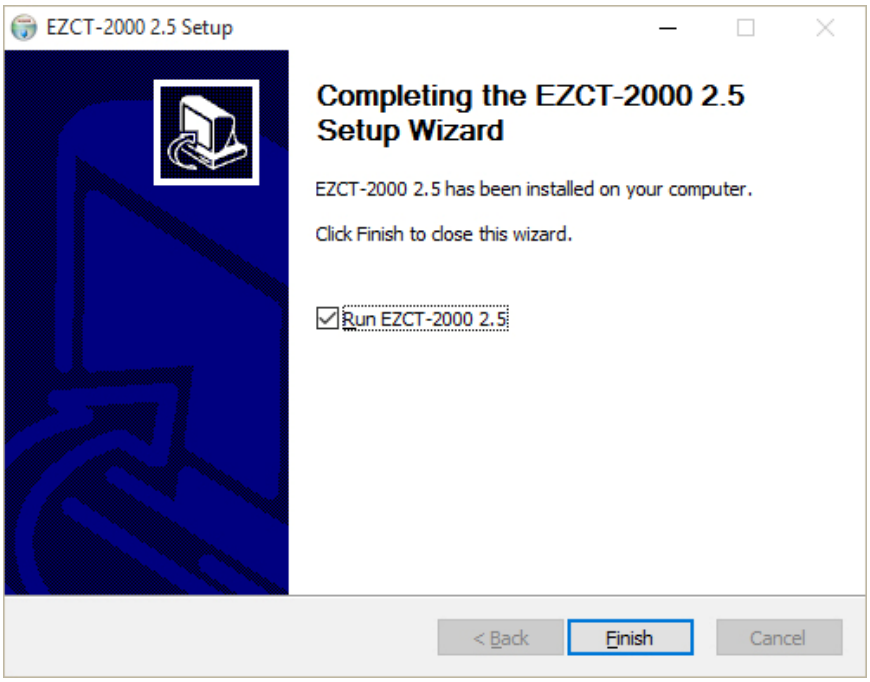
NOTE

If you have administrative rights on the computer you are using, we highly recommend that you right-click on the "EZCT-2000 Software Rev 2.x.exe" file and then selecting "Run as administrator". This will ensure that any necessary drivers will be installed correctly.

3. Click on the “Next” button to continue. The following screen will be displayed showing the location on your hard drive where the software will be installed (C:\Vanguard\EZCT-2000):



4. You may choose a different installation location by clicking on the “Browse…” button and then browsing to the location on your hard drive where you would like to install the software. Click on the “Install” button to continue. The installation wizard will copy files to your hard drive, and the following screen will be displayed once the software has been successfully installed:



5. The "Run EZCT-2000 2.x" check box will be checked by default allowing you to launch the application once you click the "Finish" button. If you do not want to launch the application right away, un-check the "Run EZCT-2000 2.x" check box and then click on the "Finish" button.

3.0 STARTING AND CONFIGURING THE EZCT-2000 SOFTWARE

3.1 Starting the EZCT-2000 Software

The process to launch the EZCT-2000 software is dependent on your version of Windows. The most common installations are listed below:

Windows XP, Vista, 7

1. Click on the Windows “Start” menu button.
2. Click on the *All Programs* menu item.
3. Click on the *Vanguard* menu item.
4. Click on the *EZCT-2000* menu item.

Windows 8, 8.1

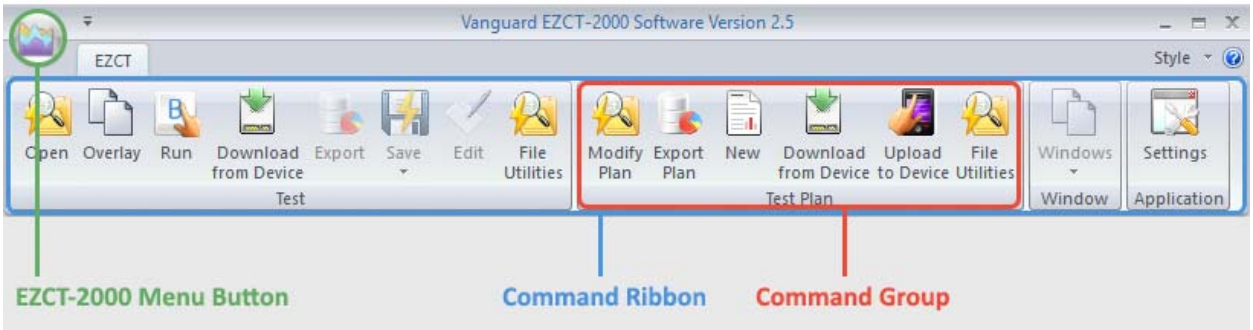
1. Navigate your mouse to the bottom left corner of your screen and click when the "Start" icon appears or simply press the **[Windows]** key on your keyboard.
2. Right click on a blank part of the "Start" screen and then choose *All Apps*.
3. Locate the *EZCT-2000* menu item and click on it.

Windows 10

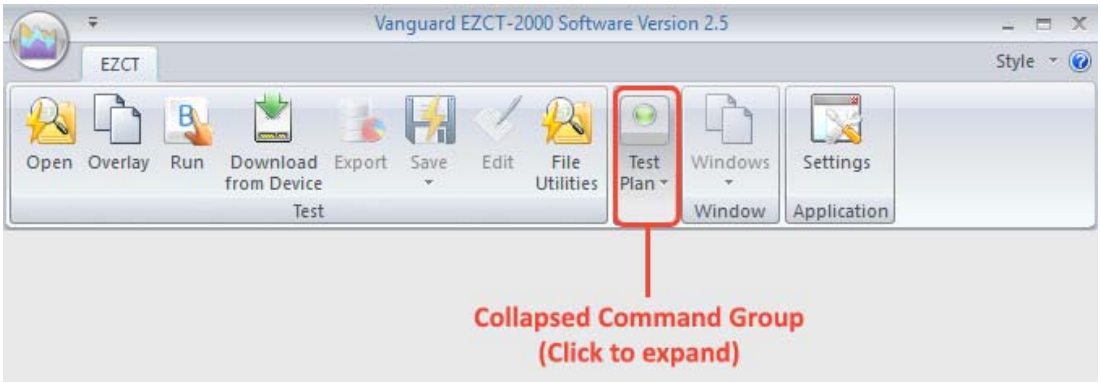
1. Click on the "Start" menu button
2. Click on the *All Apps* menu item.
3. Click on the *Vanguard* menu item.
4. Click on the *EZCT-2000* menu item.

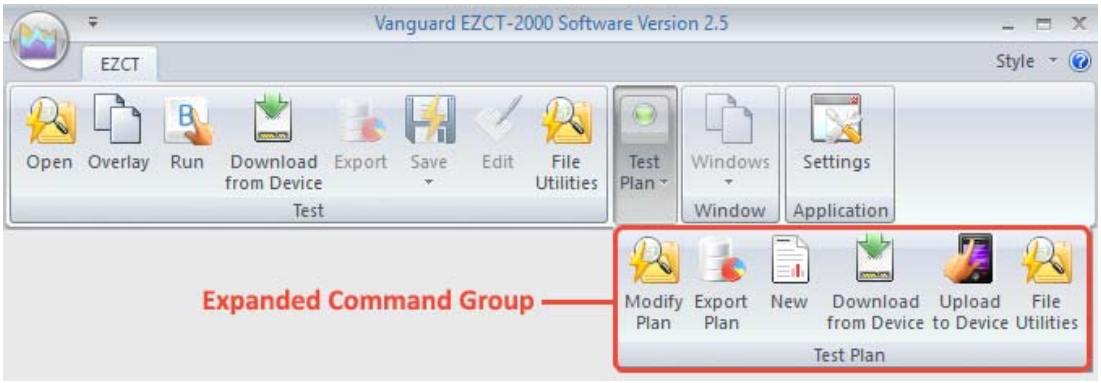
3.2 The EZCT-2000 Application Workspace

Older versions of the EZCT-2000 software used a menu bar and drop-down menus. The current 2.x version of the application uses a command ribbon for faster access to all the functions and features of the EZCT-2000 software as shown below:

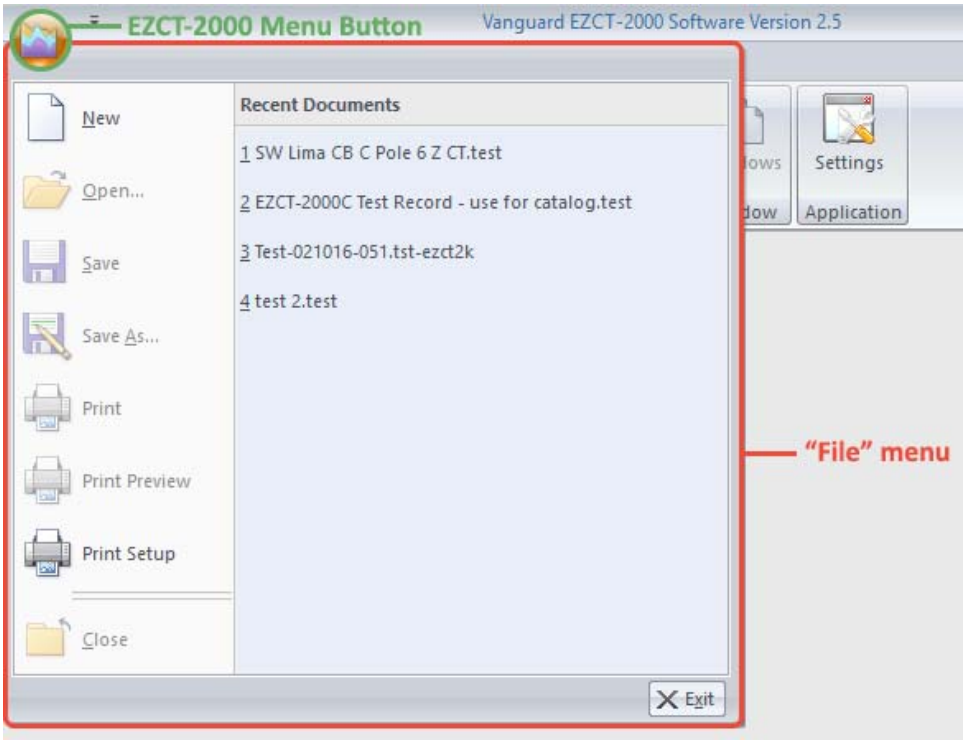


Related commands are grouped together in the command ribbon. If there is not enough space on the screen, some command groups will be collapsed showing only one icon. Click on the command group to view all the commands in that group.





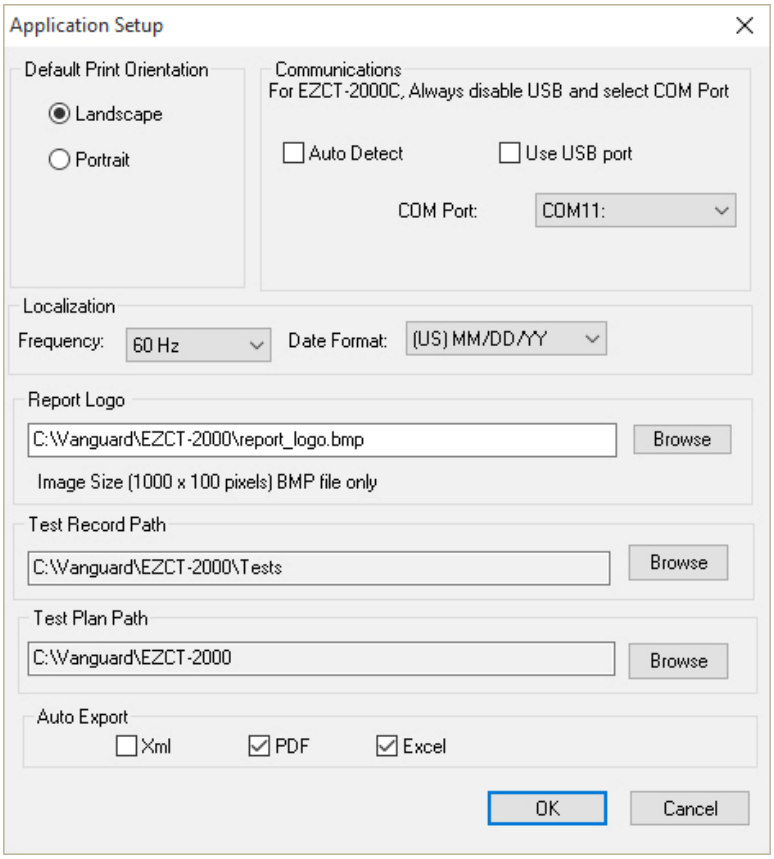
The "File" menu from previous versions has been replaced with the EZCT-2000 Menu Button. Click on this button to view the "File" menu options:



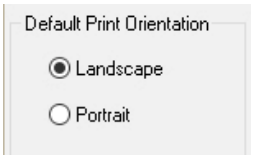
3.3 Configuring Default Application Settings

The EZCT-2000's default settings should be configured before attempting to use it for the first time with a Vanguard current transformer tester. Follow the steps in this section to configure the communication parameters, report and export preferences, and file storage location preferences.

To access the application settings, click on the ***Settings*** icon in the ***Application*** command group on the command ribbon. The following window will be displayed:

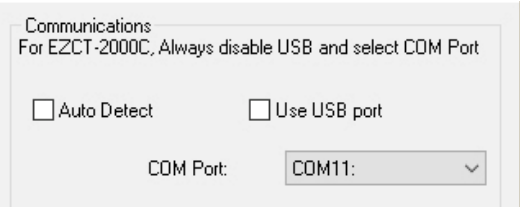


3.3.1. Setting the Default Printing Orientation



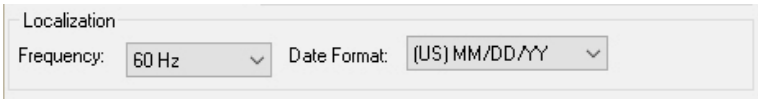
The EZCT-2000 software can generate reports in either Landscape (horizontal) or Portrait (vertical) orientation. To select your preferred orientation, click on the corresponding radio button in the "Default Print Orientation" section.

3.3.2. Configuring the Communication Parameters



This section is used to configure the communication options for connecting your CT tester to the PC. Please see Appendix A for instructions on how to connect your CT tester to the PC.

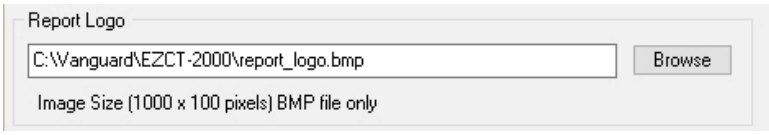
3.3.3. Configuring Localization Options



Select the preferred frequency from the "Frequency" dropdown menu.

Select the preferred date format from the "Date Format" dropdown menu.

3.3.4. Setting a Custom Logo for Reports



The EZCT-2000 software can display a custom logo image at the top of reports. The "Report Logo" input field shows the name and location of the default logo image file. You can select a different logo image file by clicking on the "Browse" button on the right and then locating the logo image file that you would like to use.

3.3.5. Setting the Default Test Record and Test Plan Storage Locations

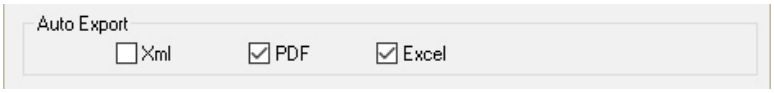
The "Test Record Path" field shows the current default folder where test records are stored and retrieved from. To change the default location for test records, click on the "Browse" button to the right of the field and then select the folder that you would like to use.

The "Test Plan Path" field shows the current default folder where test plans are stored and retrieved from. To change the default location for test plans, click on the "Browse" button to the right of the field and then select the folder that you would like to use.

NOTE

You MUST have "read" and "write" privileges to these folders. Windows Vista, 7, 8, 8.1, and 10 limit write privileges on various folders that are considered "system" folders. Your organization's computer usage policies may also limit your access to certain folders and network locations. We highly recommend saving your test records and test plans in a folder under the "My Documents" folder since you will have "read" and "write" privileges to these folders by default. If you are performing tests and notice that the test results are not being displayed in the software, this is most likely due to the test record path being set to a folder where you do not have "write" privileges.

3.3.6. Configuring Default Export Settings



The EZCT-2000 software can automatically export test reports in PDF, XML, and Excel formats each time you open or save a test record. To enable automatic exporting in your preferred format, check the checkbox next to the format name.

NOTE

If you have selected one or more auto-export formats, the EZCT-2000 software will create a folder with the corresponding format name under the folder where the test record is located. For example, if you had selected the "PDF" export format and your test record was located at "C:\test records", the folder "C:\test records\PDF" will be created and the PDF reports will be saved there.

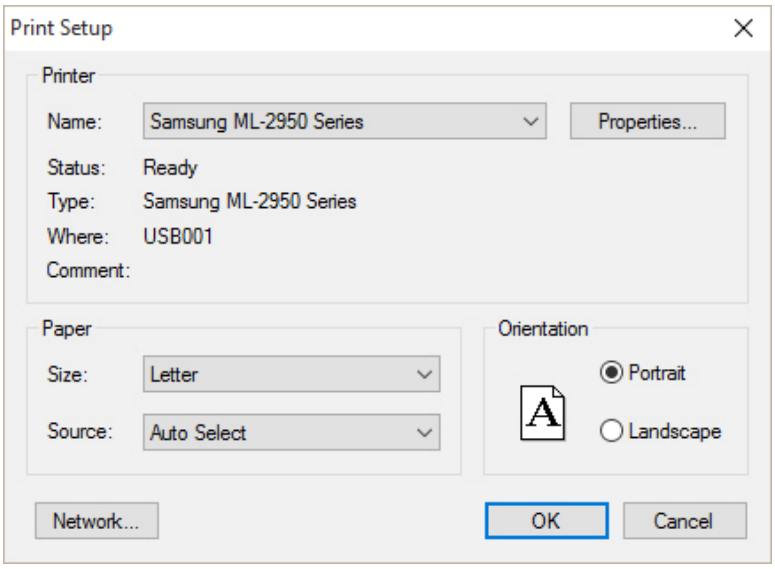
Click on the "OK" button to save any changes you made to the default application settings.

3.4 Printer Setup

To setup the printer:

1. 

   Click on the ***EZCT-2000 Menu Button*** and select *Print Setup…* The following window will be displayed:



2. Select the printer you would like to use from the “Name” drop-down list.
3. Select the appropriate options for the printer.
4. Click on the “OK” button.

4.0 WORKING WITH TEST RECORDS

The EZCT-2000 software can be used to retrieve test records from a CT tester or from the PC hard drive. Once a test record is retrieved, you can change the record header information, print the test results, change the nameplate ratio values, change the knee point marker, change the frequency, add or modify test notes, and save the record to the hard drive.

4.1 Retrieving Test Records From a CT Tester

To retrieve a test record from a CT Tester:

1. Make sure the EZCT-2000 software is running. Connect the CT Tester to the PC (See Appendix A).

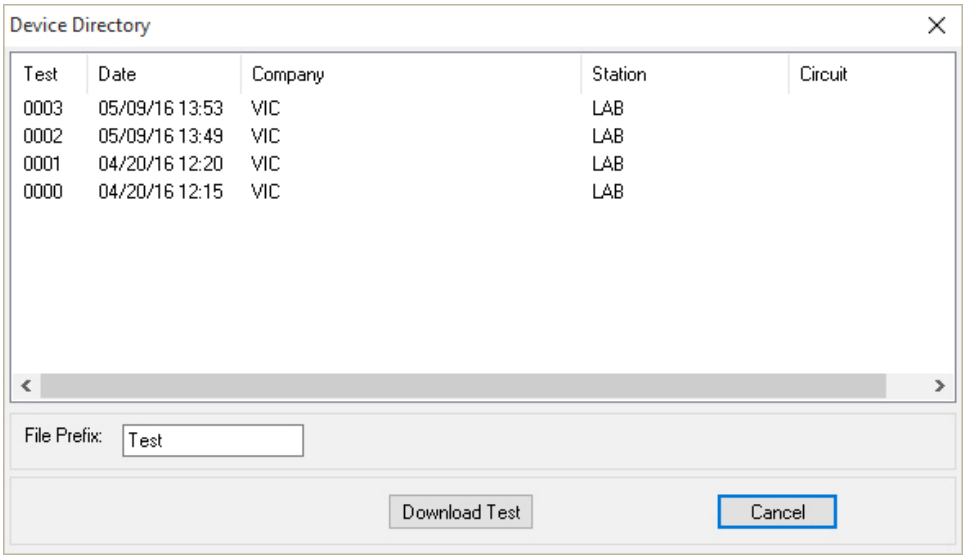
NOTE

When a device is connected and is under PC control, the title bar of the EZCT-2000 software will display the name of the connected device as shown below:

2. 

   Click on the ***Download from Device*** icon from the ***Test*** command group on the command ribbon.

3. The following window will be displayed listing a directory of all the test records stored in the CT tester's internal memory:

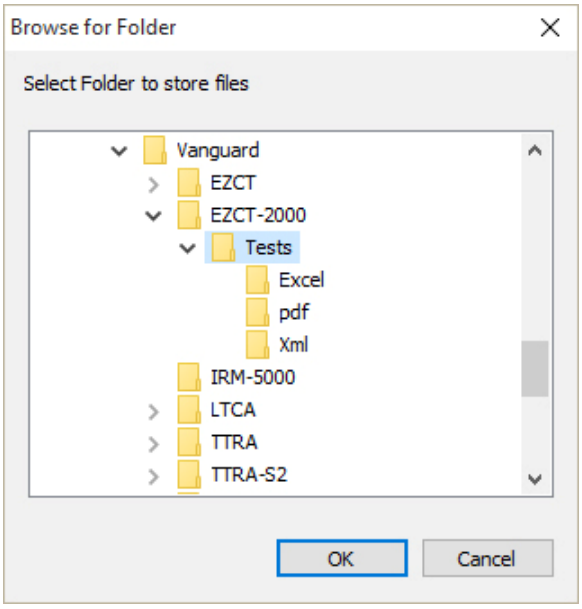


1. You can select a record to be retrieved by clicking on the test record number. The selected record will be highlighted. You may select multiple records by holding down the **[CTRL]** key and clicking on the record numbers. All selected records will be highlighted. You may de-select a selected record by holding down the **[CTRL]** key and clicking on the selected record number a second time.

   The “File Prefix” input field allows you to enter a word that will be used as a prefix for the file name for the stored record on the PC hard drive. When a test record is retrieved from a CT tester and stored on the hard drive, the file name is in the “prefix-date-n.tst-ezct2k” format, where "date" is the month and year the test was performed and “n” is the record number.

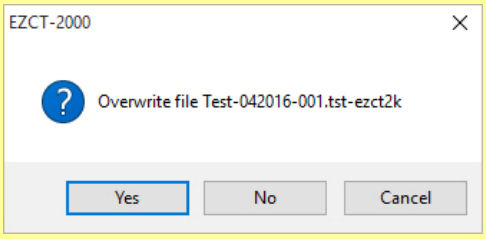
   So if you would like the file name to be “*Substation-date-n.DAT*”, enter the word “Substation” in the “File Prefix” input field.

4. Click on the "Download Test" button to retrieve the selected test records from the connected CT tester. The following window will be displayed (the default test record folder will be selected):



5. Browse to the folder where you would like the test record(s) to be saved and then click on the "OK" button. The selected test record(s) will be retrieved from the CT tester and saved in the selected folder. If you had enabled any of the auto-export options (PDF/Excel/XML), each retrieved test record will also be automatically exported in your preferred format(s) at this time.

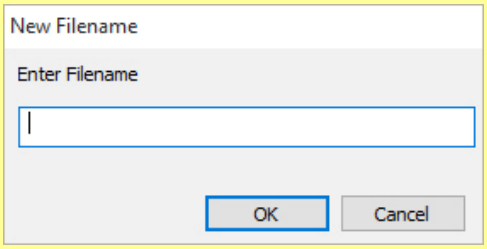
NOTE If a test record file with the same name already exists at the storage location, the following window will be displayed:



To cancel the retrieval process, click on the “Cancel” button.

To overwrite the existing file, click on the “Yes” button.

If you do not want to overwrite the existing file with the retrieved test record, click on the “No” button. The following window will be displayed:



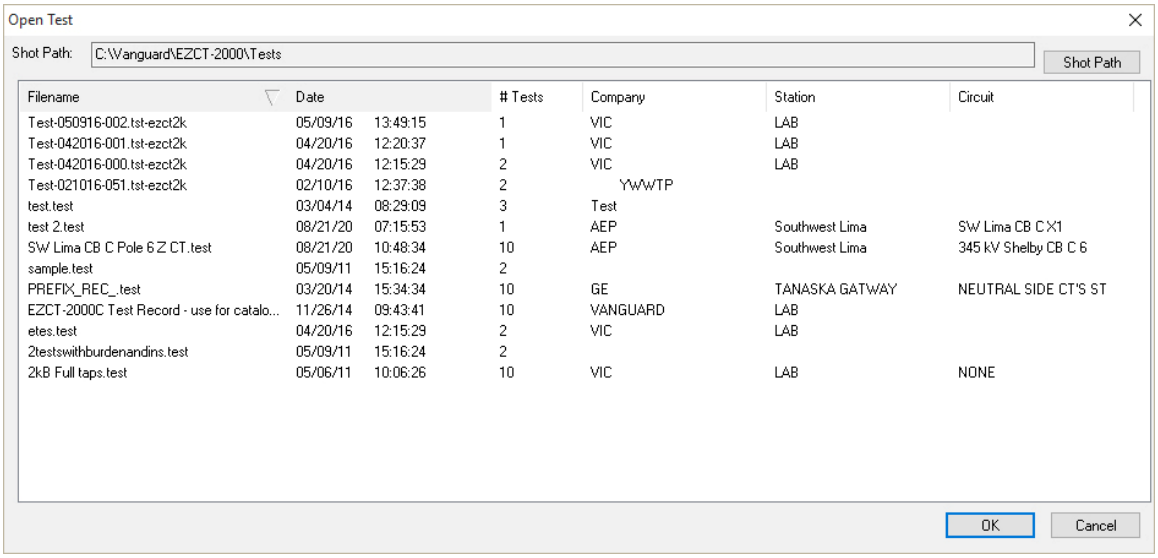
Enter a new file name for the retrieved test record and then click on the “OK” button. The test record will be retrieved from the CT tester and saved with the new file name at the selected location.

4.2 Opening a Test Record From the PC Hard Drive

Test records stored on the PC hard drive can be opened using the steps below:

1. 

   Click on the ***Open*** icon from the ***Test*** command group on the command ribbon. The following window will be displayed:



   - The “Shot Path:” section at the top of the window displays the name of the directory where the test records are being retrieved from. If you wish to retrieve records from a different directory, click on the “Shot Path” button and browse to the folder containing the test records.
   - You can click on a column heading to sort the test records based on the column heading name (filename, date, number of tests, company, station, or circuit). An arrow next to the heading name will indicate whether the list is sorted in ascending or descending order. Click on the heading again to reverse the sort order.

2. Click on the filename you would like to retrieve and click on the “OK” button. The test record will be loaded and the tabulated test results will be displayed (please see section 0 for details).

4.3 Saving a Test Record

4.3.1. Saving a Test Record With Its Original Filename

1. 

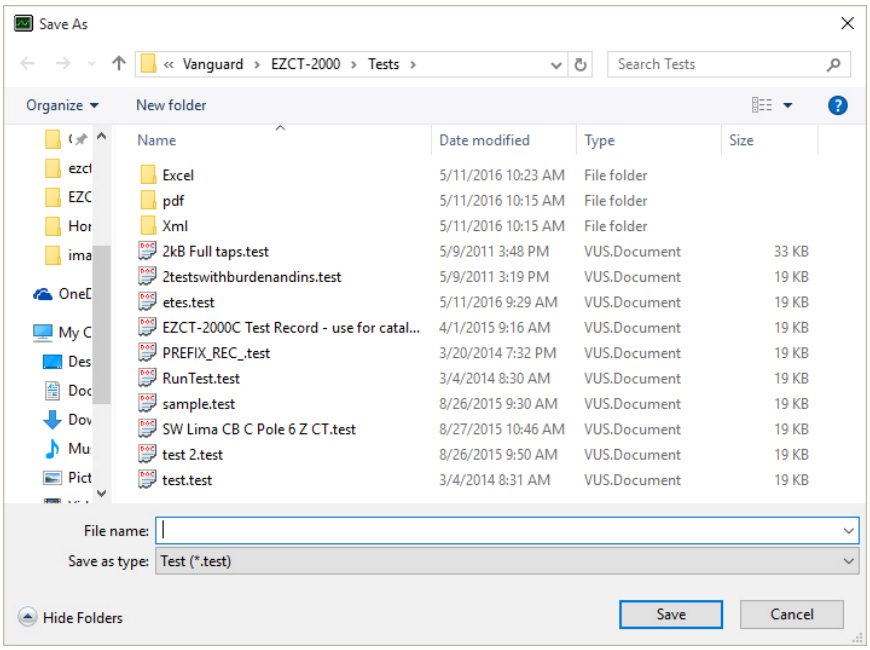
   If changes have been made to the current test record and you would like to save it with its original filename, click on the down arrow below the ***Save*** icon from the ***Test*** command group and then select *Overwrite.*

2. The test record will be saved with its original filename.

4.3.2. Saving a Test Record With a Different Filename

1. 

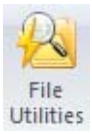
   To save an open test record with a different filename, click on the down arrow below the ***Save*** icon from the ***Test*** command group and then select *Save As*. The following window will be displayed:



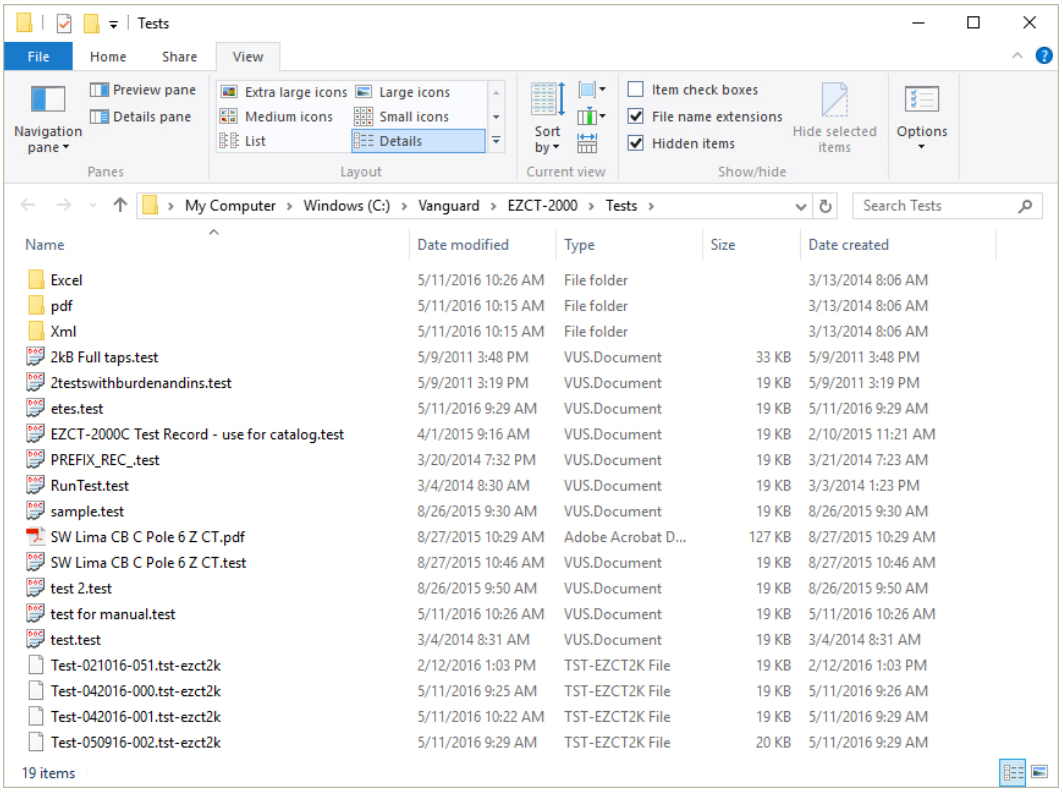
2. Browse to the folder where you would like to save the test record.
3. Enter the filename in the “File name” input field.
4. Click on the “Save” button. The test record will be saved with the new filename.

4.4 Opening the Default Test Records Folder

To quickly access the default test record storage folder in Windows Explorer:

1. 

   Click on the ***File Utilities*** icon from the ***Test*** command group. The default test record storage folder will be opened in Windows Explorer as shown below:



2. You can use standard Windows Explorer commands to copy, move, or delete the test record files.

4.5 Working with Tabulated Test Results

Once a test record has been retrieved (see sections 4.1 and 4.2 for instructions), the record details will be displayed as shown in Figure 1 below:

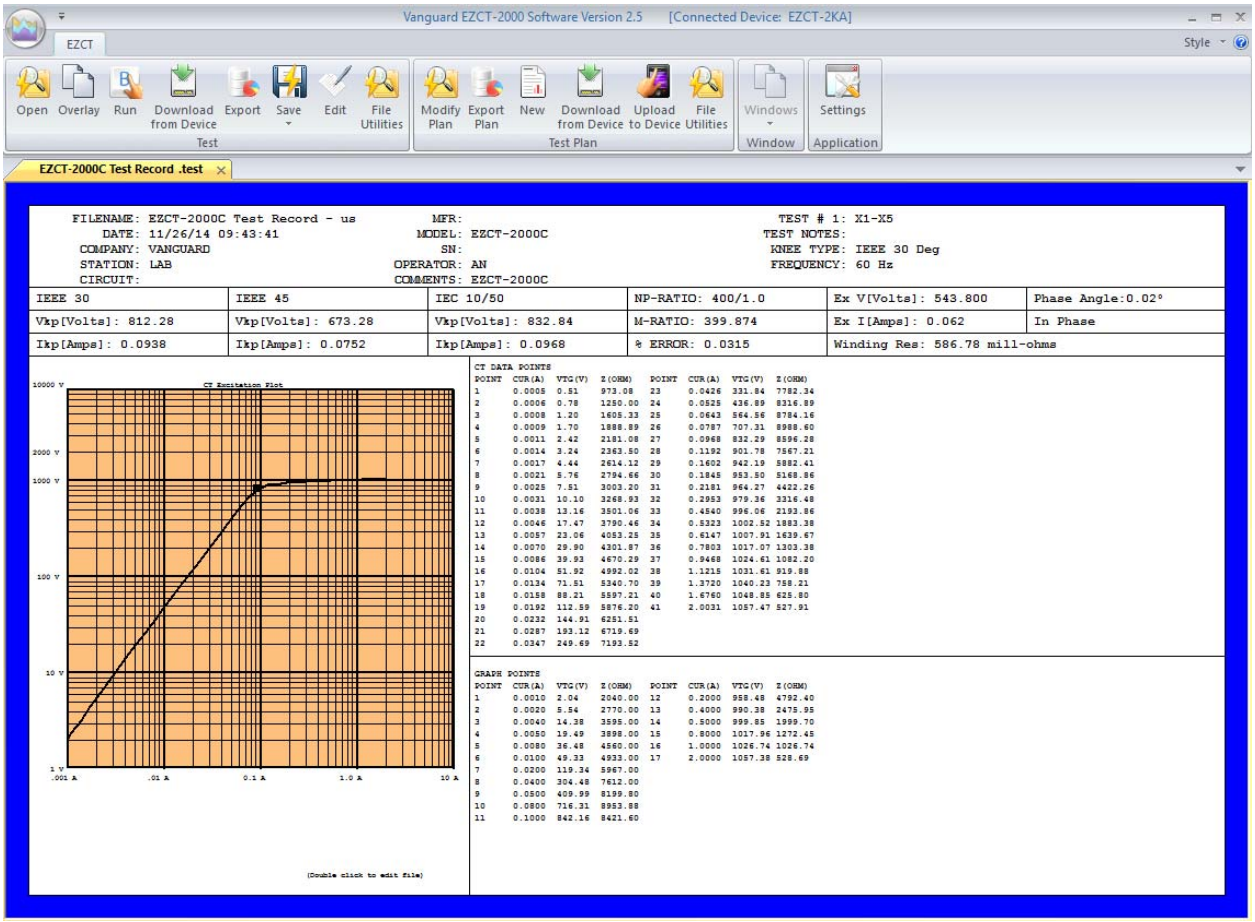
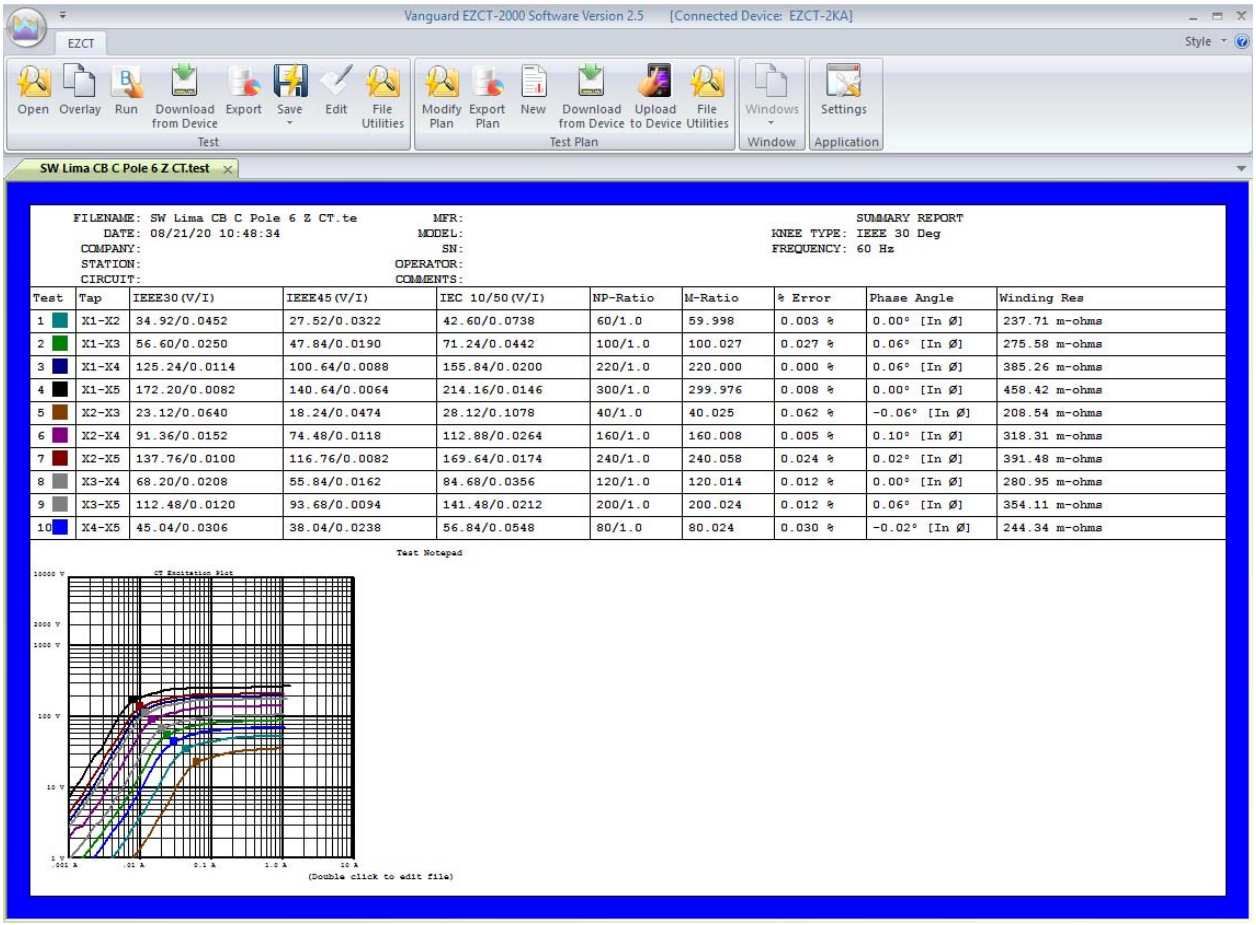


Figure 1. Typical Test Record Page (Excitation Test)

A test record usually consists of multiple pages. Press the **[Page Down]** or **[Page Up]** key to view the next or previous page, respectively. Figure 2 below is an example of a test record page displaying the test summary report:

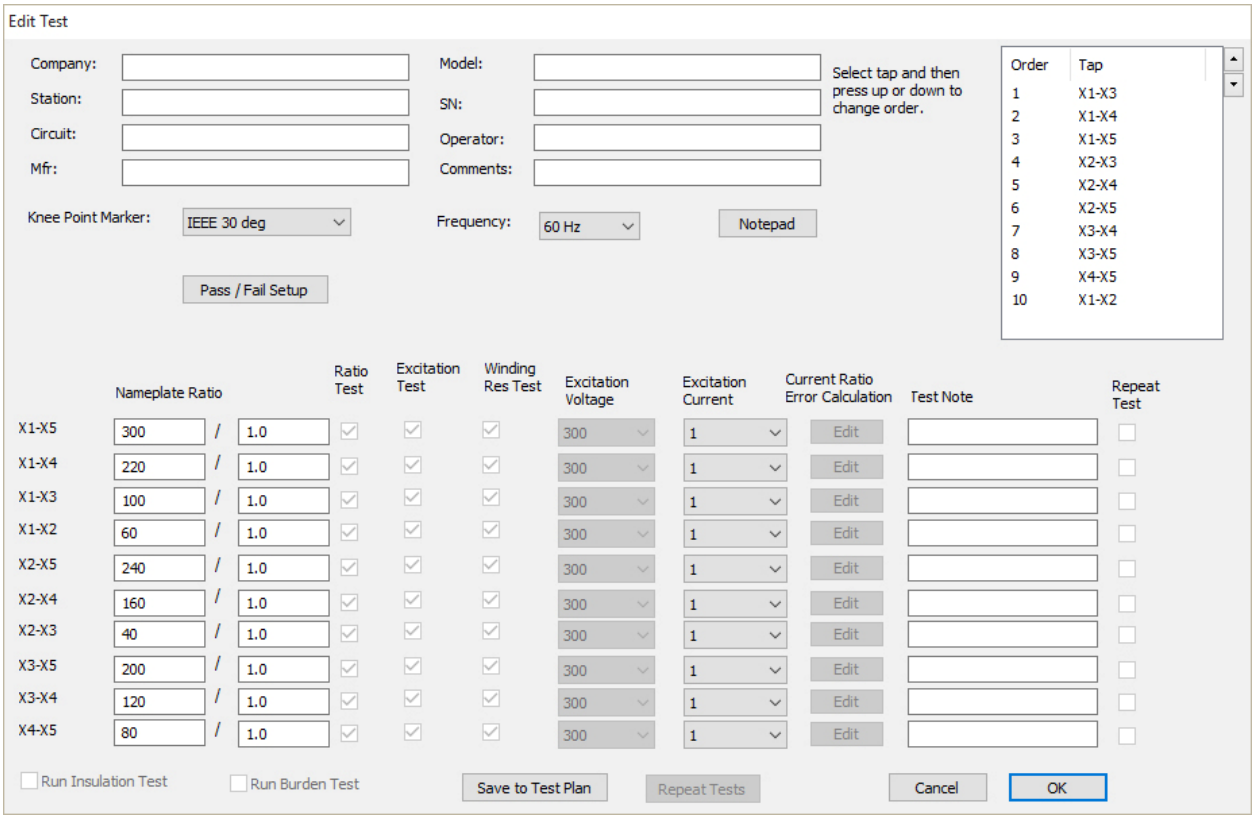


Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	34.92/0.0452	27.52/0.0322	42.60/0.0738	60/1.0	59.998	0.003 %	0.00° [In Ø]	237.71 m-ohms
2	X1-X3	56.60/0.0250	47.84/0.0190	71.24/0.0442	100/1.0	100.027	0.027 %	0.06° [In Ø]	275.58 m-ohms
3	X1-X4	125.24/0.0114	100.64/0.0088	155.84/0.0200	220/1.0	220.000	0.000 %	0.06° [In Ø]	385.26 m-ohms
4	X1-X5	172.20/0.0082	140.64/0.0064	214.16/0.0146	300/1.0	299.976	0.008 %	0.00° [In Ø]	458.42 m-ohms
5	X2-X3	23.12/0.0640	18.24/0.0474	28.12/0.1078	40/1.0	40.025	0.062 %	-0.06° [In Ø]	208.54 m-ohms
6	X2-X4	91.36/0.0152	74.48/0.0118	112.88/0.0264	160/1.0	160.008	0.005 %	0.10° [In Ø]	318.31 m-ohms
7	X2-X5	137.76/0.0100	116.76/0.0082	169.64/0.0174	240/1.0	240.058	0.024 %	0.02° [In Ø]	391.48 m-ohms
8	X3-X4	68.20/0.0208	55.84/0.0162	84.68/0.0356	120/1.0	120.014	0.012 %	0.00° [In Ø]	280.95 m-ohms
9	X3-X5	112.48/0.0120	93.68/0.0094	141.48/0.0212	200/1.0	200.024	0.012 %	0.06° [In Ø]	354.11 m-ohms
10	X4-X5	45.04/0.0306	38.04/0.0238	56.84/0.0548	80/1.0	80.024	0.030 %	-0.02° [In Ø]	244.34 m-ohms

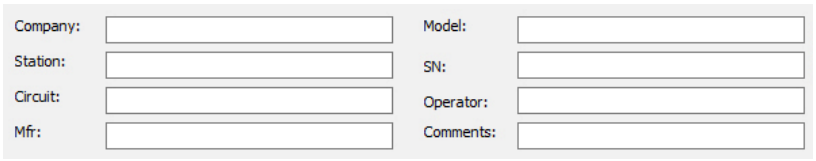
Figure 2. Test Record Page Displaying Summary Report

4.5.1. Editing a Test Record

To edit a test record, double click anywhere on the tabulated test results. The following screen will be displayed:

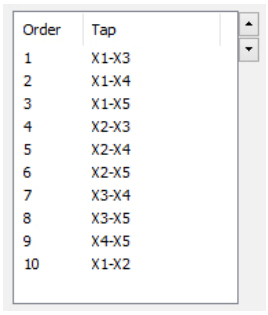


Changing the Test Record Header Information



You can edit the test record header information in the top section of this window. Header information consists of identifying information such as the company, station, circuit, manufacturer, etc.

Changing the Summary Report Tap Order



The top right section of this window displays the tap order for the summary report. If you would like to change the order the taps are displayed on the summary report, click on the tap and then click on either the up or down arrow on the right to move it above or below its current location, respectively.

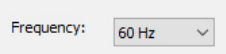
Changing the Knee Point Marker Type

You can change the knee point marker type by clicking on the "Knee Point Marker" dropdown menu.

NOTES

If the knee point marker is changed, the CT Excitation Plot will be updated accordingly to display the selected knee point marker.

Changing the Frequency

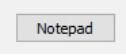


You can change the frequency by clicking on the "Frequency" dropdown menu.

NOTES

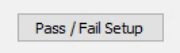
The frequency is for reference only. The CT test is conducted at the supplied line voltage and frequency.

Adding Test Notes

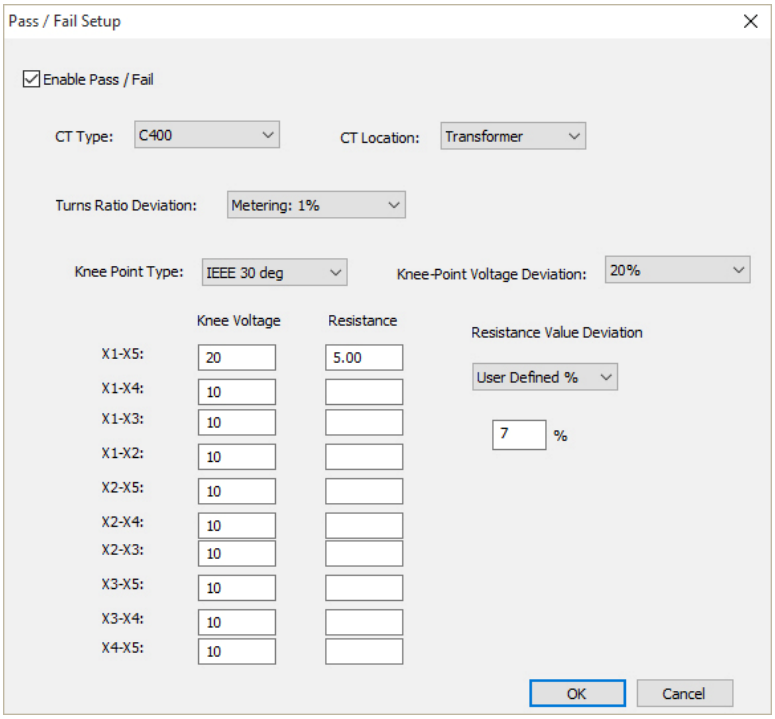


You can add relevant notes for the test record by clicking on the "Notepad" button. Enter your notes in the window that will be displayed and then click on the "OK" button.

Setting Pass/Fail Parameters



The EZCT-2000 software can also generate a Pass/Fail report based on baseline knee voltage and resistance values that can be set for each tap. To enable and configure Pass/Fail parameters, click on the "Pass/Fail Setup" button. The following screen will be displayed:



Check the "Enable Pass/Fail" checkbox to enable the pass/fail feature.

Select the CT type from the "CT Type" dropdown box.

Select the CT location from "CT Location" dropdown box.

Select the turns ratio deviation threshold from the "Turns Ratio Deviation" dropdown box. If you select the "User defined %" option, an entry field will be provided for entering a custom value.

Select the knee-point voltage deviation threshold from the "Knee-Point Voltage Deviation" dropdown menu.

Enter the baseline knee voltage and resistance values for each tap in the fields provided next to each tap label. Select the resistance value deviation threshold from the "Resistance Value Deviation" dropdown menu. If you select the "User defined %" option, an entry field will be provided for entering a custom value.

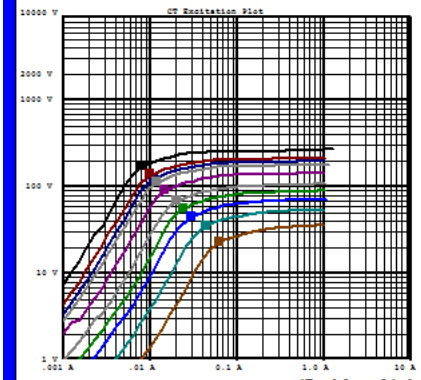
Click on the "OK" button. A new "Pass / Fail Report" page will be added to the report. It will be the second to the last page (See Figure 4). Press the **[Page Down]** key until the "Pass/Fail Report" is displayed. You will notice that in the columns that list the knee point voltage, percent

error, phase angle and winding resistance, the values will be followed by either "[F]" for "Fail" or "[P]" for "Pass".

FILENAME: SW Lima CB C Pole 6 Z CT.te
DATE:
COMPANY:
STATION:
CIRCUIT:
MFR:
MODEL:
SN:
OPERATOR:
COMMENTS:

PASS / FAIL REPORT
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

Test	Tap	IEEE 30	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	34.92 [P]	60/1.0	59.998	0.003 % [P]	0.00° [P]	237.71 m-ohms [P]
2	X1-X3	56.60 [P]	100/1.0	100.027	0.027 % [P]	0.06° [P]	275.58 m-ohms [P]
3	X1-X4	125.24 [P]	220/1.0	220.000	0.000 % [P]	0.06° [P]	385.26 m-ohms [P]
4	X1-X5	172.20 [P]	300/1.0	299.976	0.008 % [P]	0.00° [P]	458.42 m-ohms [P]
5	X2-X3	23.12 [P]	40/1.0	40.025	0.062 % [P]	-0.06° [P]	208.54 m-ohms [P]
6	X2-X4	91.36 [P]	160/1.0	160.008	0.005 % [P]	0.10° [P]	318.31 m-ohms [P]
7	X2-X5	137.76 [P]	240/1.0	240.058	0.024 % [P]	0.02° [P]	391.48 m-ohms [F]
8	X3-X4	68.20 [P]	120/1.0	120.014	0.012 % [P]	0.00° [P]	280.95 m-ohms [P]
9	X3-X5	112.48 [P]	200/1.0	200.024	0.012 % [P]	0.06° [P]	354.11 m-ohms [P]
10	X4-X5	45.04 [P]	80/1.0	80.024	0.030 % [P]	-0.02° [P]	244.34 m-ohms [P]



CT Type: C400
CT Location: Transformer
Turns Ratio Deviation: Metering 1%
Knee-Point Voltage Deviation: 20%
Resistance Value Deviation: User defined: 7.00%

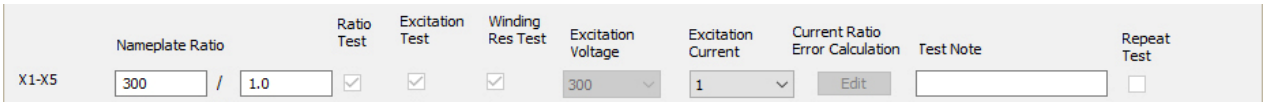
(Double click to edit file)

Figure 3. Sample Pass/Fail Report

Changing Nameplate Ratio Values

You can change any of the nameplate values for the different taps. If the nameplate ratio is changed for a tap connection, the percentage error will be automatically re-calculated and the report will be updated accordingly.

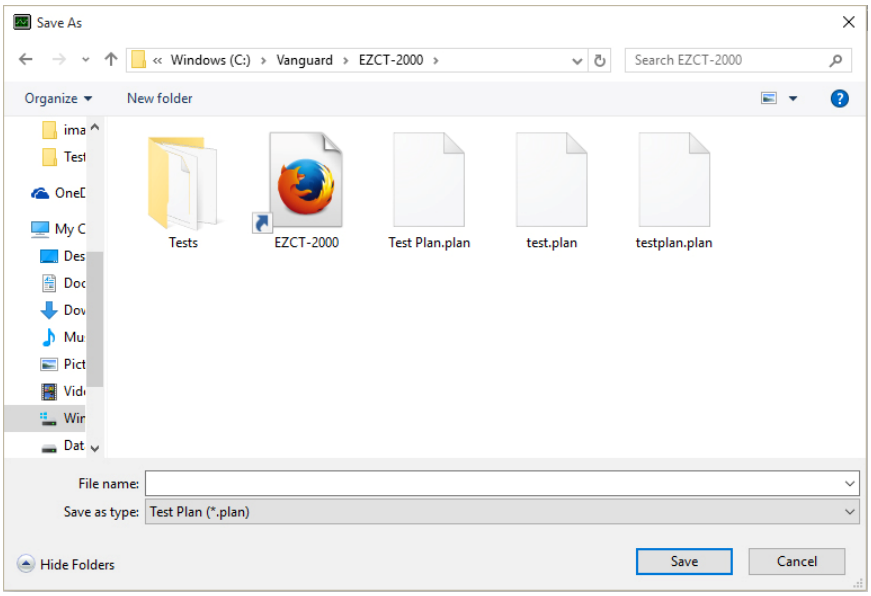
Repeating Tests



If you have a CT tester connected to your computer, you can repeat any of the tests listed. First, click on the "Repeat Test" check box for the tap positions that you would like to repeat the test. Then click on the "Repeat Tests" button at the bottom of the window. The selected tests will be performed and the test record will be updated with the new test results.

Saving the Test Parameters to a Test Plan

You can save the test parameters as a test plan so that it can be used to perform tests in the future by clicking on the "Save to Test Plan" button at the bottom of the screen. The following screen will be displayed:



Navigate to the folder where you would like to save the test plan. Then, enter a file name in the "File name" input field and click on the "Save" button.

Click on the "OK" button after you have made any necessary changes. Also, make sure to save the test record in order to retain any changes.

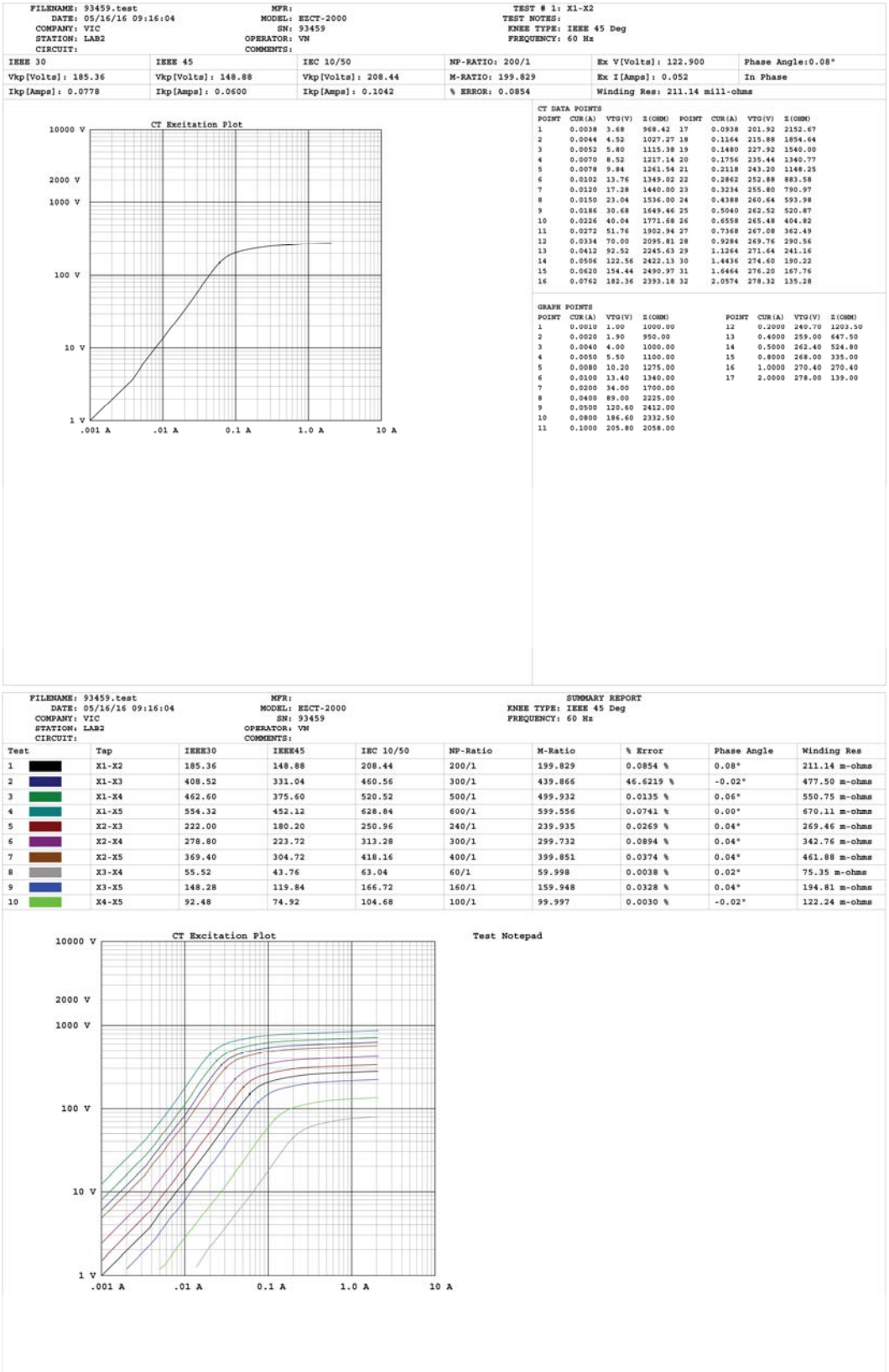
4.5.2. Printing the Tabulated Test Results

To print the tabulated test results:

1. 

   Click on the ***EZCT-2000 Menu Button*** and select the *Print* option. The print dialog box will appear.

2. Select the printer to print to and make any necessary changes to the printer's parameters and then click on the "OK" button. The test results will be printed. Sample test record printouts are shown in Figure 4.



FILENAME: 93459.test
DATE: 05/16/16 09:16:04
COMPANY: VIC
STATION: LAB2
CIRCUIT:
MFR:
MODEL: EZCT-2000
SN: 93459
OPERATOR: VM
COMMENTS:
TEST # 1: X1-X2
TEST NOTES:
KNEE TYPE: IEEE 45 Deg
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 200/1	Ex V[Volts]: 122.900	Phase Angle:0.08°
Vkp[Volts]: 185.36	Vkp[Volts]: 148.88	Vkp[Volts]: 208.44	M-RATIO: 199.829	Ex I[Amps]: 0.052	In Phase
Ikp[Amps]: 0.0778	Ikp[Amps]: 0.0600	Ikp[Amps]: 0.1042	% ERROR: 0.0854	Winding Res: 211.14 mill-ohms	

CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0038	3.68	968.42	17	0.0938	201.92	2152.67
2	0.0044	4.52	1027.27	18	0.1164	215.88	1854.64
3	0.0052	5.80	1115.38	19	0.1480	227.92	1540.00
4	0.0070	8.52	1217.14	20	0.1756	235.44	1340.77
5	0.0078	9.84	1261.54	21	0.2118	243.20	1148.25
6	0.0102	13.76	1349.02	22	0.2862	252.88	883.58
7	0.0120	17.28	1440.00	23	0.3234	255.80	790.97
8	0.0150	23.04	1536.00	24	0.4388	260.64	593.98
9	0.0186	30.68	1649.46	25	0.5040	262.52	520.87
10	0.0226	40.04	1771.68	26	0.6558	265.48	404.82
11	0.0272	51.76	1902.94	27	0.7368	267.08	362.49
12	0.0334	70.00	2095.81	28	0.9284	269.76	290.56
13	0.0412	92.52	2245.63	29	1.1264	271.64	241.16
14	0.0506	122.56	2422.13	30	1.4436	274.60	190.22
15	0.0620	154.44	2490.97	31	1.6464	276.20	167.76
16	0.0762	182.36	2393.18	32	2.0574	278.32	135.28

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	1.00	1000.00	12	0.2000	240.70	1203.50
2	0.0020	1.90	950.00	13	0.4000	259.00	647.50
3	0.0040	4.00	1000.00	14	0.5000	262.40	524.80
4	0.0050	5.50	1100.00	15	0.8000	268.00	335.00
5	0.0080	10.20	1275.00	16	1.0000	270.40	270.40
6	0.0100	13.40	1340.00	17	2.0000	278.00	139.00
7	0.0200	34.00	1700.00				
8	0.0400	89.00	2225.00				
9	0.0500	120.60	2412.00				
10	0.0800	186.60	2332.50				
11	0.1000	205.80	2058.00				

FILENAME: 93459.test
DATE: 05/16/16 09:16:04
COMPANY: VIC
STATION: LAB2
CIRCUIT:
MFR:
MODEL: EZCT-2000
SN: 93459
OPERATOR: VM
COMMENTS:
SUMMARY REPORT
KNEE TYPE: IEEE 45 Deg
FREQUENCY: 60 Hz

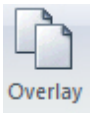
Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	185.36	148.88	208.44	200/1	199.829	0.0854 %	0.08°	211.14 m-ohms
2	X1-X3	408.52	331.04	460.56	300/1	439.866	46.6219 %	-0.02°	477.50 m-ohms
3	X1-X4	462.60	375.60	520.52	500/1	499.932	0.0135 %	0.06°	550.75 m-ohms
4	X1-X5	554.32	452.12	628.84	600/1	599.556	0.0741 %	0.00°	670.11 m-ohms
5	X2-X3	222.00	180.20	250.96	240/1	239.935	0.0269 %	0.04°	269.46 m-ohms
6	X2-X4	278.80	223.72	313.28	300/1	299.732	0.0894 %	0.04°	342.76 m-ohms
7	X2-X5	369.40	304.72	418.16	400/1	399.851	0.0374 %	0.04°	461.88 m-ohms
8	X3-X4	55.52	43.76	63.04	60/1	59.998	0.0038 %	0.02°	75.35 m-ohms
9	X3-X5	148.28	119.84	166.72	160/1	159.948	0.0328 %	0.04°	194.81 m-ohms
10	X4-X5	92.48	74.92	104.68	100/1	99.997	0.0030 %	-0.02°	122.24 m-ohms

Test Notepad

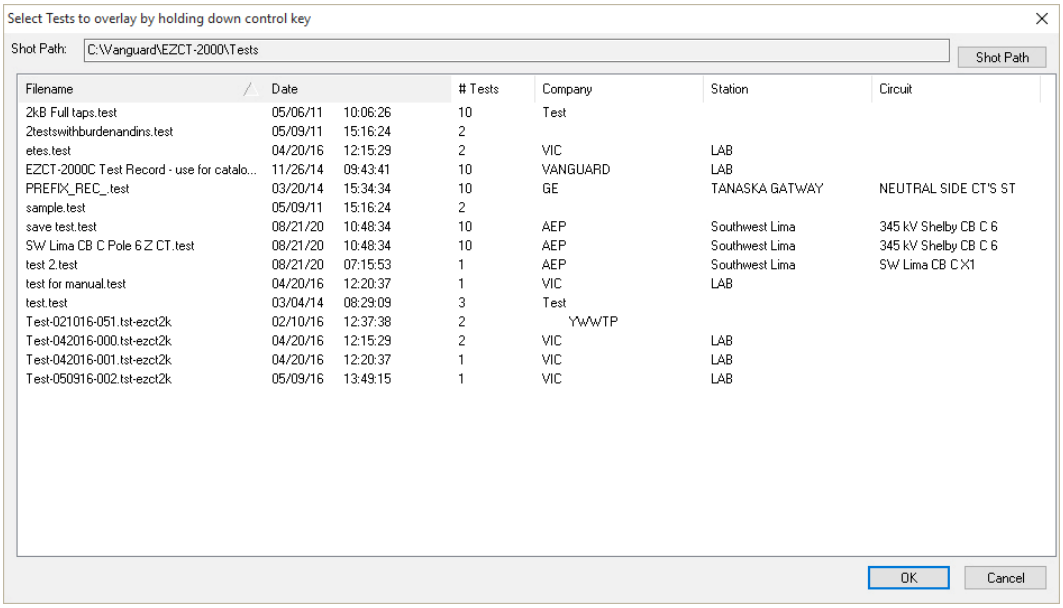
Figure 4. Typical Test Record Printouts (Landscape format)

4.5.3. Overlaying Test Records

You can overlay two test records for further analysis and comparison using the steps below:

1. 

   Click on the ***Overlay*** icon from the ***Test*** command group. The following window will be displayed:



   - The "Shot Path:" section at the top of the window displays the name of the directory where the test records are being retrieved from. If you wish to retrieve records from a different directory, click on the "Shot Path" button and browse to the folder containing the test records.
   - You can click on a column heading to sort the test records based on the column heading name (filename, date, number of tests, company, station, or circuit). An arrow next to the heading name will indicate whether the list is sorted in ascending or descending order. Click on the heading again to reverse the sort order.

2. Click on the first file name that you would like to use. While holding down the **[CTRL]** key, click on the second file name that you would like to overlay. Then click on the "OK" button.
3. Both test records will be retrieved and their test results will be displayed. The graphs will be overlaid and tabulated data will be displayed in two separate sections on the report pages. Press the **[Page Up]** and **[Page Down]** keys to navigate between the report pages.

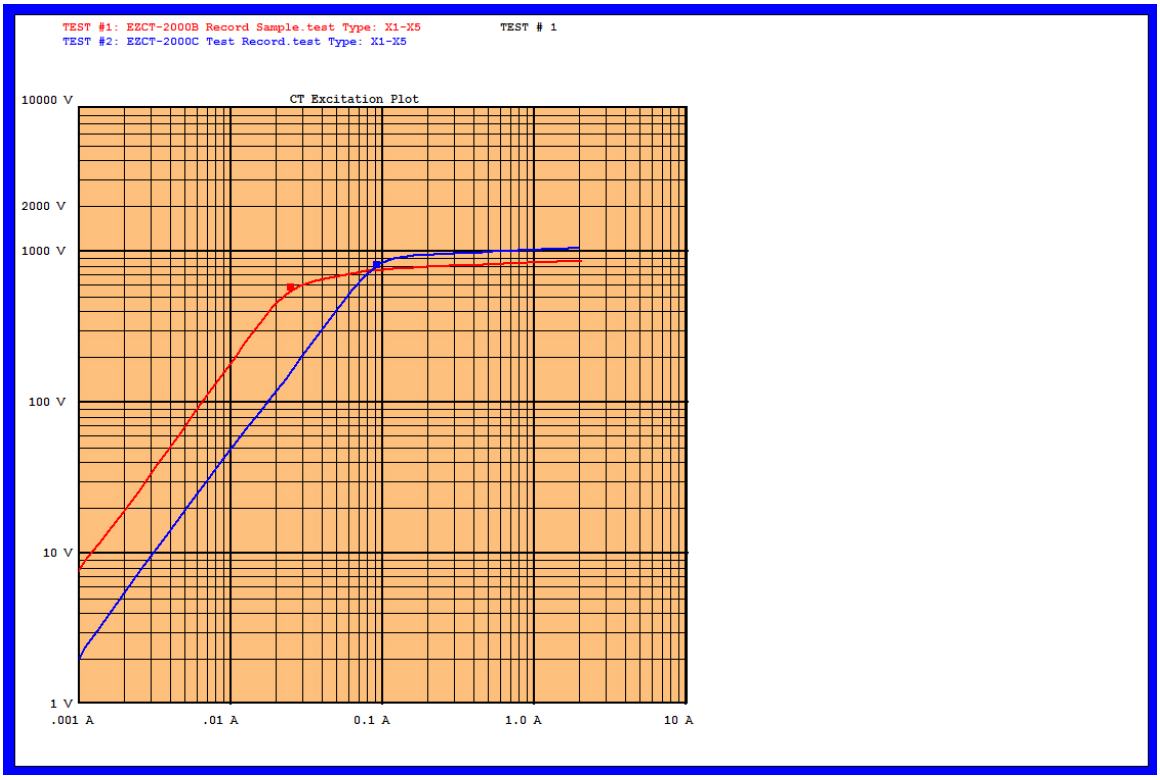


Figure 5. Sample Graph of Overlaid Test Records

FILENAME: EZCT-2000B Record Sample.te
DATE: 05/26/16 11:28:57
COMPANY: VIC
STATION: LAB
CIRCUIT:
MFR: VANGUARD
MODEL: EZCT-2000B
SN: 26183
OPERATOR: AN
COMMENTS: EZCT-2000B
TEST # 1: X1-X5
TEST NOTES: TEST 1
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 600/1.0	Ex V[Volts]: 364.800	Phase Angle:-0.02°
Vkp[Volts]: 573.64	Vkp[Volts]: 459.56	Vkp[Volts]: 640.20	M-RATIO: 599.785	Ex I[Amps]: 0.017	In Phase
Ikp[Amps]: 0.0254	Ikp[Amps]: 0.0200	Ikp[Amps]: 0.0358	% ERROR: 0.0359	Winding Res: 663.22 mill-ohms	

CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0002	0.44	2433.33	17	0.0047	62.99	13374.31	33	0.1171	773.68	6608.88
2	0.0002	1.18	5113.04	18	0.0056	83.18	14774.96	34	0.1604	787.14	4906.75
3	0.0003	1.88	6717.86	19	0.0070	110.78	15916.09	35	0.1960	794.68	4055.51
4	0.0003	3.06	9266.67	20	0.0084	142.68	16985.24	36	0.2320	799.52	3446.52
5	0.0004	2.39	5826.83	21	0.0106	194.63	18448.53	37	0.2755	805.45	2923.69
6	0.0005	3.20	6269.63	22	0.0126	253.59	20141.86	38	0.3377	812.45	2405.54
7	0.0006	4.31	6729.69	23	0.0155	335.96	21731.05	39	0.4595	821.60	1788.18
8	0.0008	5.38	6992.21	24	0.0189	432.34	22826.56	40	0.8127	824.83	1608.83
9	0.0009	6.90	7497.83	25	0.0233	528.17	22629.39	41	0.6306	831.29	1318.19
10	0.0012	9.42	8193.04	26	0.0287	592.24	20657.13	42	0.7527	836.67	1111.62
11	0.0014	11.68	8586.03	27	0.0389	640.70	17831.78	43	0.8050	843.13	931.64
12	0.0017	15.11	9101.81	28	0.0446	675.69	15136.47	44	1.1761	852.29	724.68
13	0.0021	20.06	9782.93	29	0.0523	698.84	13359.64	45	1.4087	857.67	608.85
14	0.0025	25.57	10312.10	30	0.0679	731.15	10771.17	46	1.7183	864.67	503.22
15	0.0032	36.95	11655.52	31	0.0785	746.22	9503.59	47	2.0516	870.59	424.35
16	0.0040	49.80	12481.70	32	0.1018	766.68	7534.22				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	7.78	7780.00	12	0.2000	798.22	3976.10
2	0.0020	19.42	9710.00	13	0.4000	817.13	2042.82
3	0.0040	49.99	12497.50	14	0.5000	824.06	1648.12
4	0.0050	69.35	13870.00	15	0.8000	838.68	1048.35
5	0.0080	133.81	16726.25	16	1.0000	846.34	846.34
6	0.0100	181.33	18133.00	17	2.0000	869.68	434.84
7	0.0200	455.43	22771.50				
8	0.0400	657.04	16426.00				
9	0.0500	691.88	13837.60				
10	0.0800	747.53	9344.13				
11	0.1000	765.13	7651.30				

FILENAME: EZCT-2000C Test
DATE: 05/26/16 11:28:57
COMPANY: VANGUARD
STATION: LAB
CIRCUIT:
MFR: ABB
MODEL: EZCT-2000C
SN:
OPERATOR: AN
COMMENTS: EZCT-2000C
TEST # 1: X1-X5
TEST NOTES:
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 400/1.0	Ex V[Volts]: 543.800	Phase Angle:0.02°
Vkp[Volts]: 812.28	Vkp[Volts]: 673.28	Vkp[Volts]: 832.84	M-RATIO: 399.874	Ex I[Amps]: 0.062	In Phase
Ikp[Amps]: 0.0938	Ikp[Amps]: 0.0752	Ikp[Amps]: 0.0968	% ERROR: 0.0315	Winding Res: 586.78 mill-ohms	

CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0005	0.51	973.08	17	0.0134	71.51	5340.70	33	0.4540	996.06	2193.86
2	0.0006	0.78	1250.00	18	0.0158	88.21	5597.21	34	0.5323	1002.52	1883.38
3	0.0008	1.20	1408.33	19	0.0192	112.89	5876.20	35	0.6147	1007.91	1639.67
4	0.0009	1.70	1888.89	20	0.0232	144.91	6251.51	36	0.7803	1017.07	1303.38
5	0.0011	2.42	2181.08	21	0.0287	193.12	6719.69	37	0.9468	1024.61	1082.20
6	0.0014	3.24	2363.50	22	0.0347	249.69	7193.52	38	1.1215	1031.61	919.88
7	0.0017	4.44	2614.12	23	0.0426	331.84	7782.34	39	1.3720	1040.23	758.21
8	0.0021	5.76	2794.66	24	0.0525	436.89	8316.89	40	1.6760	1048.85	625.80
9	0.0025	7.51	3003.20	25	0.0643	564.56	8784.16	41	2.0031	1057.47	527.91
10	0.0031	10.10	3268.93	26	0.0787	707.31	8988.60				
11	0.0038	13.16	3501.06	27	0.0968	832.29	8596.28				
12	0.0046	17.47	3790.46	28	0.1192	901.78	7567.21				
13	0.0057	23.06	4053.25	29	0.1602	942.19	5882.41				
14	0.0070	29.90	4301.87	30	0.1845	953.80	5168.86				
15	0.0086	39.93	4670.29	31	0.2181	964.27	4422.26				
16	0.0104	51.92	4992.02	32	0.2953	979.36	3316.48				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	2.04	2040.00	12	0.2000	958.48	4792.40
2	0.0020	5.54	2770.00	13	0.4000	990.38	2475.95
3	0.0040	14.38	3595.00	14	0.5000	999.85	1999.70
4	0.0050	19.49	3898.00	15	0.8000	1017.96	1272.45
5	0.0080	36.48	4560.00	16	1.0000	1026.74	1026.74
6	0.0100	49.33	4933.00	17	2.0000	1057.38	528.69
7	0.0200	119.34	5967.00				
8	0.0400	304.48	7612.00				
9	0.0500	409.99	8199.80				
10	0.0800	716.31	8953.88				
11	0.1000	842.16	8421.60				

Figure 6. Sample Tabulated Data from Overlaid Test Records

5.0 WORKING WITH TEST PLANS

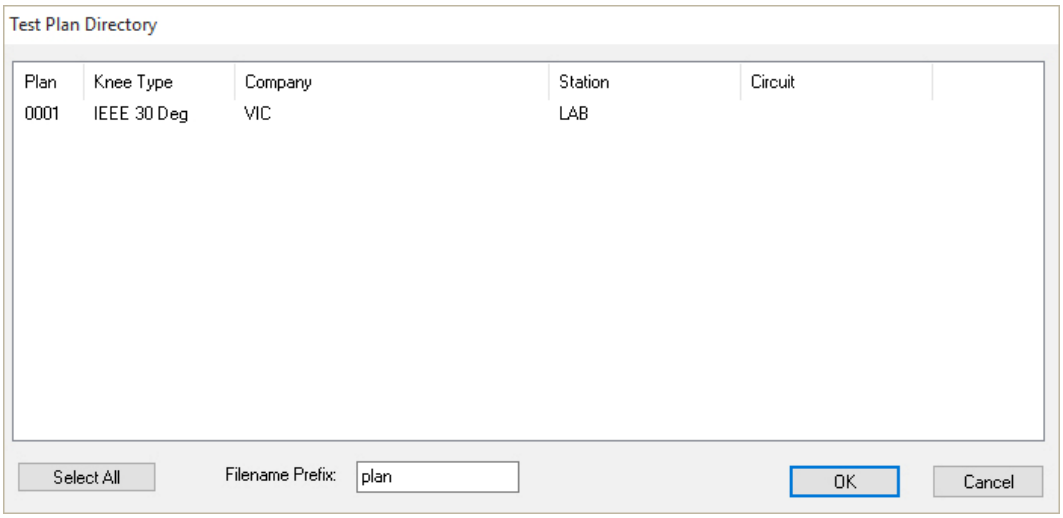
The EZCT-2000 software can be used to create current-transformer test plans. Test plans can then be run from the PC or transferred to the CT Tester to be run from the CT Tester (in stand-alone mode). Test plans can also be retrieved from a CT Tester using the EZCT-2000 software.

5.1 Retrieving Test Plans From a CT Tester

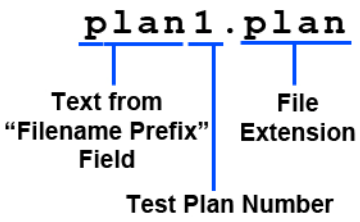
To retrieve a test plan from a CT Tester:

1. Make sure the EZCT-2000 software is running. Connect the CT Tester to the PC.
2. 

   Click the ***Download from Device*** icon from the ***Test Plan*** command group on the command ribbon.
3. The following window will be displayed listing a directory of all the test plans stored in the CT tester's internal memory:

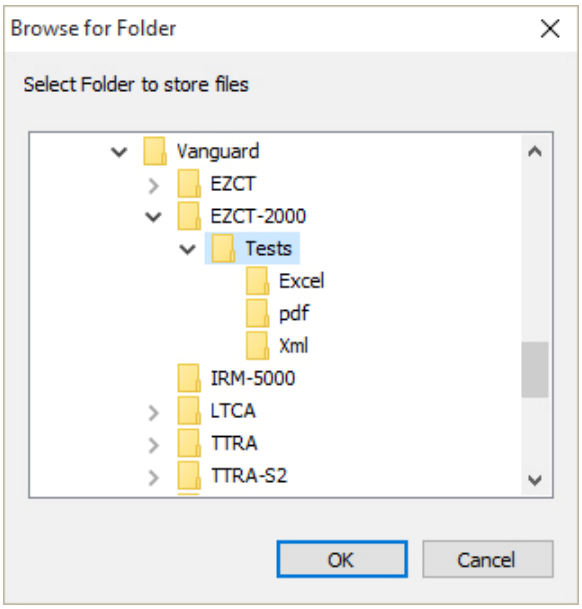


4. You can select a test plan to be retrieved by clicking on the test plan number. The selected test plan will be highlighted. You may select multiple test plans by holding down the **[CTRL]** key and clicking on the test plan numbers. All selected test plans will be highlighted. You may de-select a selected test plan by holding down the **[CTRL]** key and clicking on the selected test plan number a second time. To select all of the test plans, click on the “Select All” button.
5. The “Filename Prefix” input field allows you to enter a word that will be used as part of the filename for the stored test plan on the PC hard drive. When a test plan is retrieved from a CT Tester and stored on the hard drive, the filename is in the following format:



So if you would like the filename to be "*sample_plan1.plan*", enter the word *sample_plan* in the "Filename Prefix" input field.

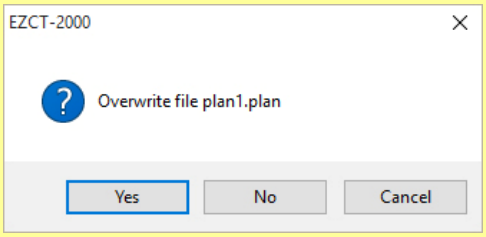
6. Click on the "OK" button. The following window will be displayed:



Navigate to the folder where you would like the retrieved test plan(s) to be saved and then click on the "OK" button. The selected test plan(s) will be retrieved from the CT Tester and stored on the PC in the selected directory.

NOTE

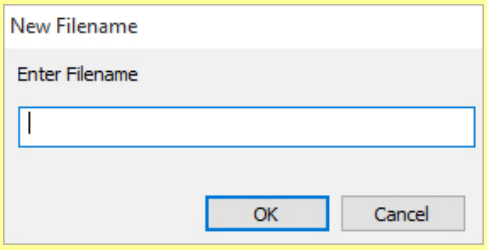
If a test plan file with the same name already exists at the storage location, the following window will be displayed:



Click on the "Cancel" button to cancel the retrieval process.

Click on the "Yes" button if you would like the existing file to be over-written with the new file.

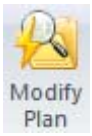
Click on the “No” button if you do not want the existing file to be over-written. The following window will be displayed:



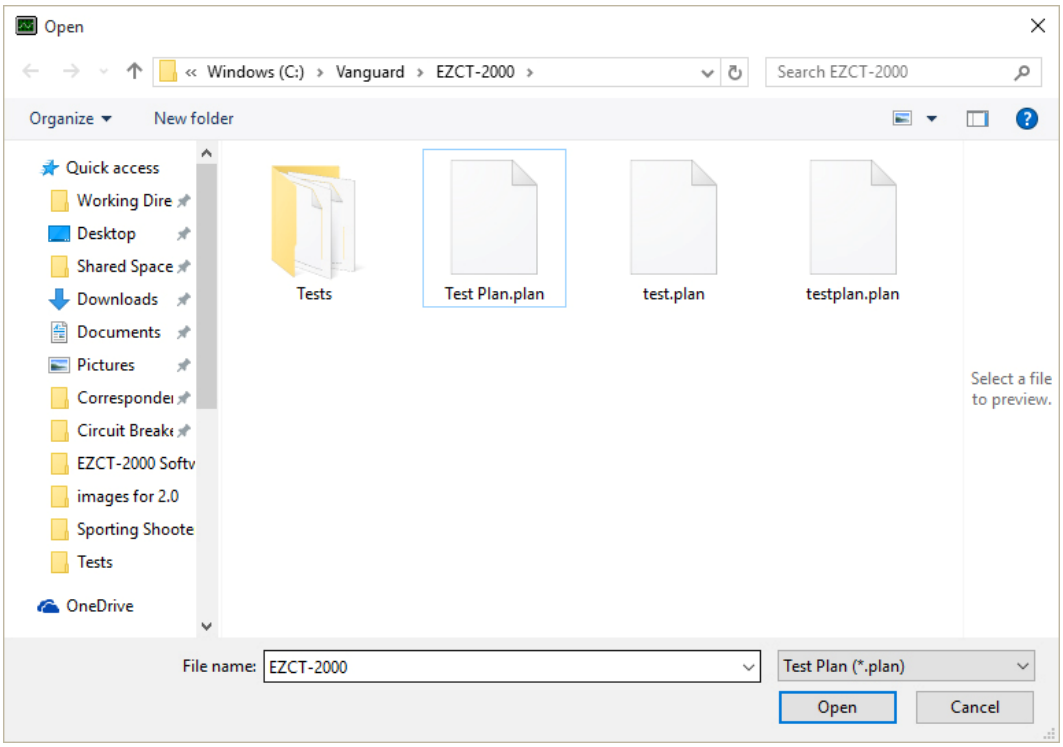
Enter a new file name for the retrieved test plan and then click on the “OK” button. The test plan will be retrieved from the CT Tester and saved with the new file name at the selected location.

5.2 Modifying a Test Plan Stored on the PC

Test plans stored on the PC hard drive can be recalled and modified using the steps below:

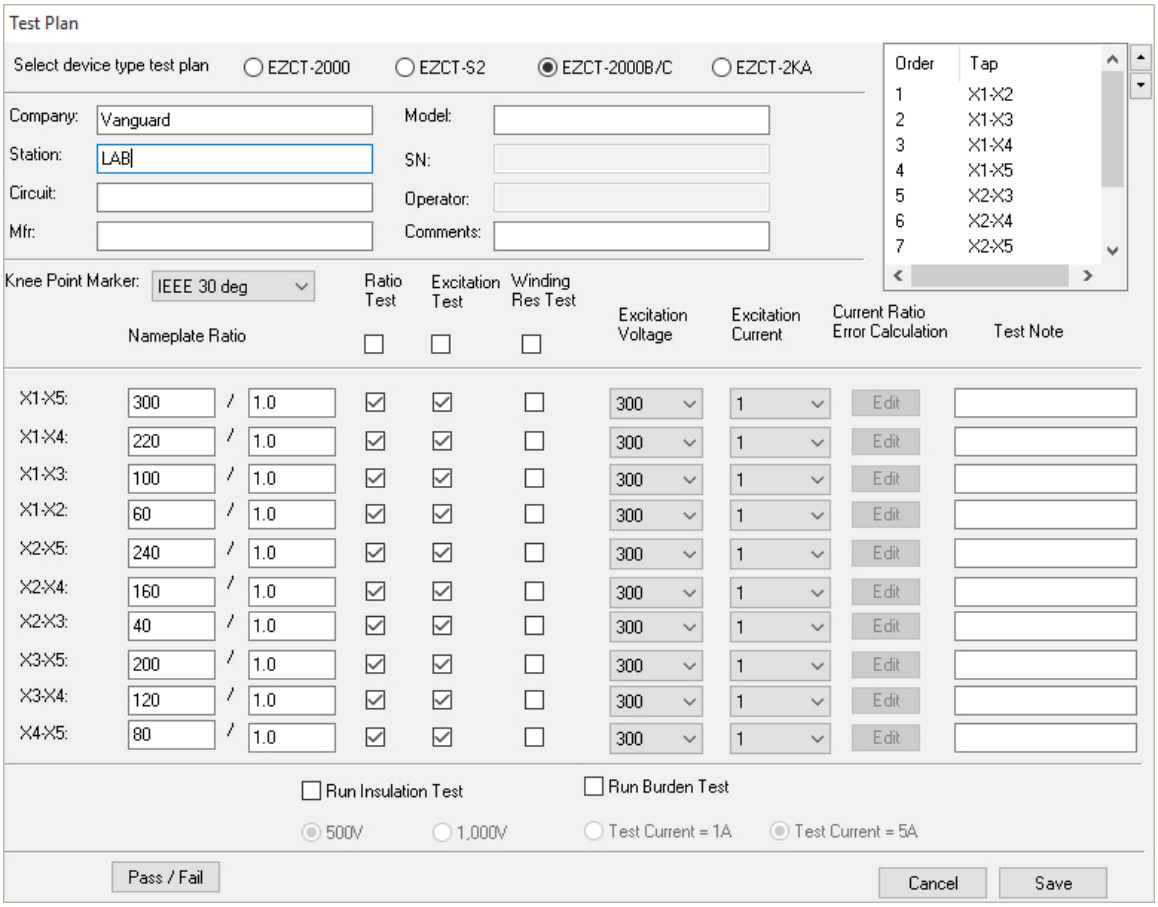
1. 

   Click on the ***Modify Plan*** icon from the ***Test Plan*** group. The following window will be displayed:



2. Browse to the folder containing the test plan that you would like to modify. Click on the file name and then click on the "Open" button.

3. The test plan will be loaded and the test parameters will be displayed as shown below:

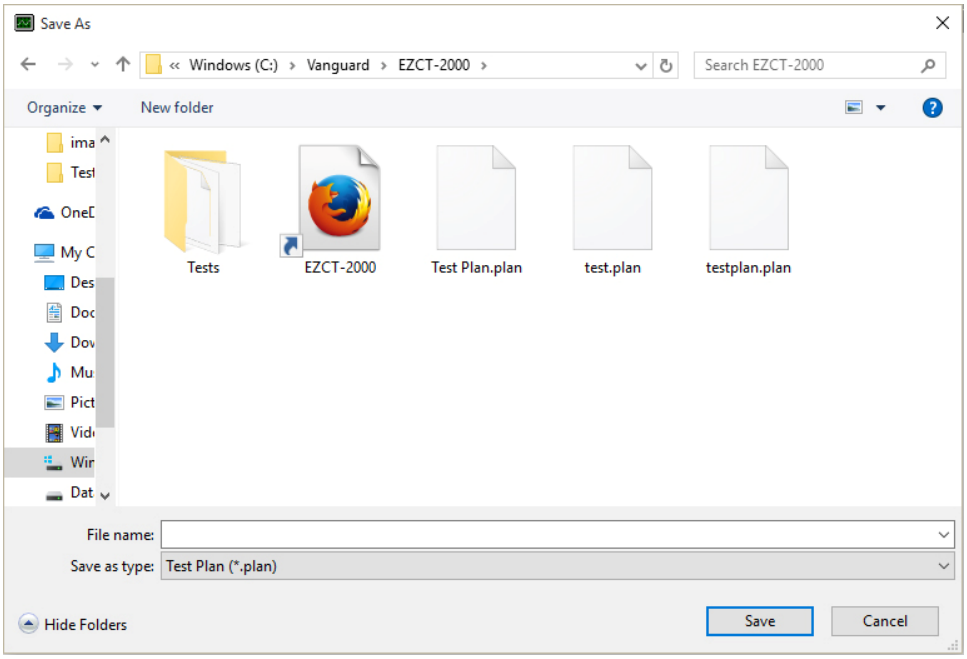


Modify any of the test plan parameters as needed and then click on the “Save” button.

NOTE

Test plan options are available depending on the device selected in the “Select device type test plan” section at the top of the window.

4. The following window will be displayed:



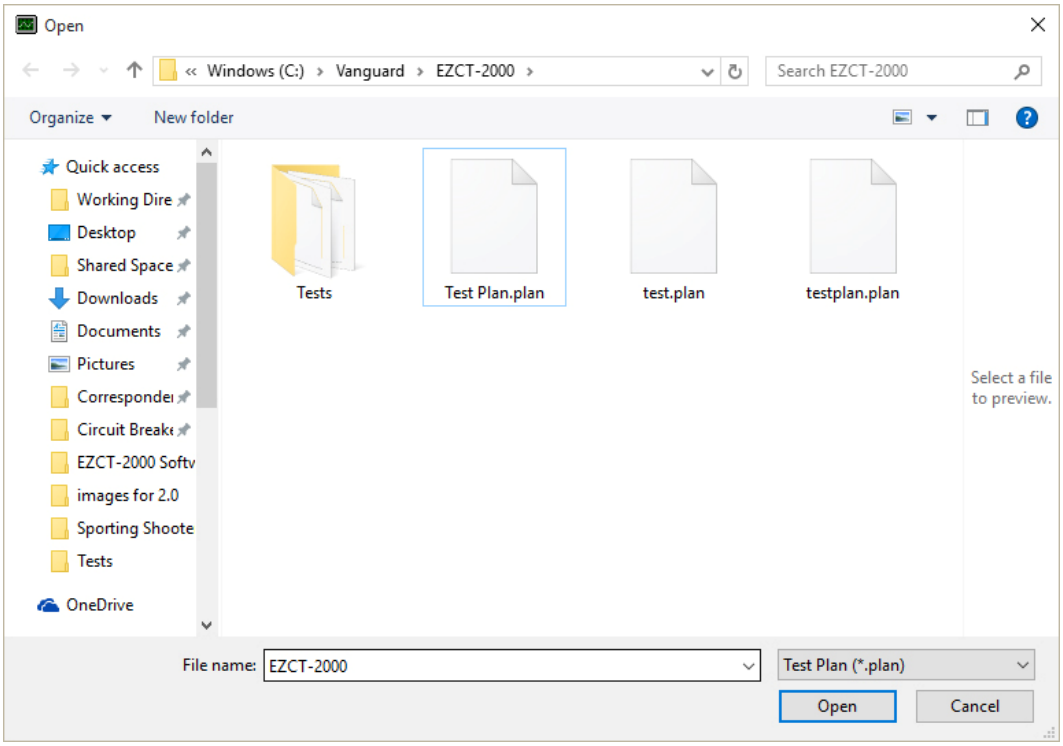
Browse to the folder where you would like to save the modified test plan. Enter a file name in the “File name:” field and click on the “Save” button. The modified test plan will be saved with the new file name. Selecting the same file name will over-write the existing file.

5.3 Transferring Test Plans to a CT Tester

To transfer a test plan from the PC hard drive to a CT Tester:

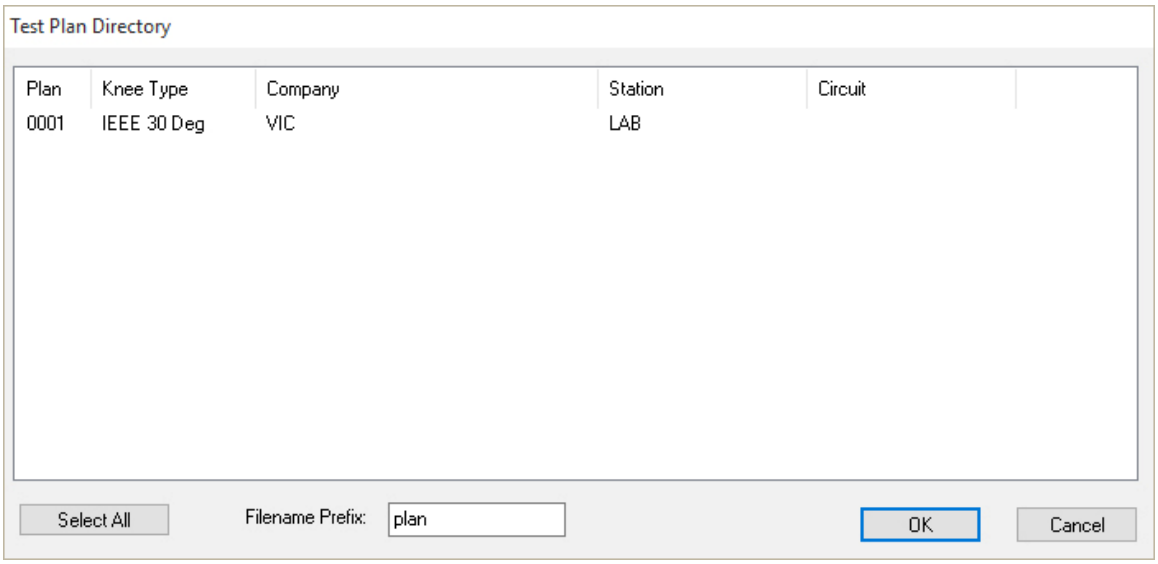
1. 

   Click on the ***Upload to Device*** icon from the ***Test Plan*** command group. The following window will be displayed:



2. Browse to the folder containing the test plan that you would like to transfer to the CT Tester. Once you have located the test plan, click on the file name and then click on the “Open” button.

3. The following window will be displayed showing a listing of the CT Tester's test plan memory locations and their contents:



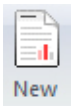
Click on an empty location where you would like the test plan to be transferred to and click on the "OK" button. The test plan will be transferred to the CT Tester and stored in the selected memory location.

NOTE

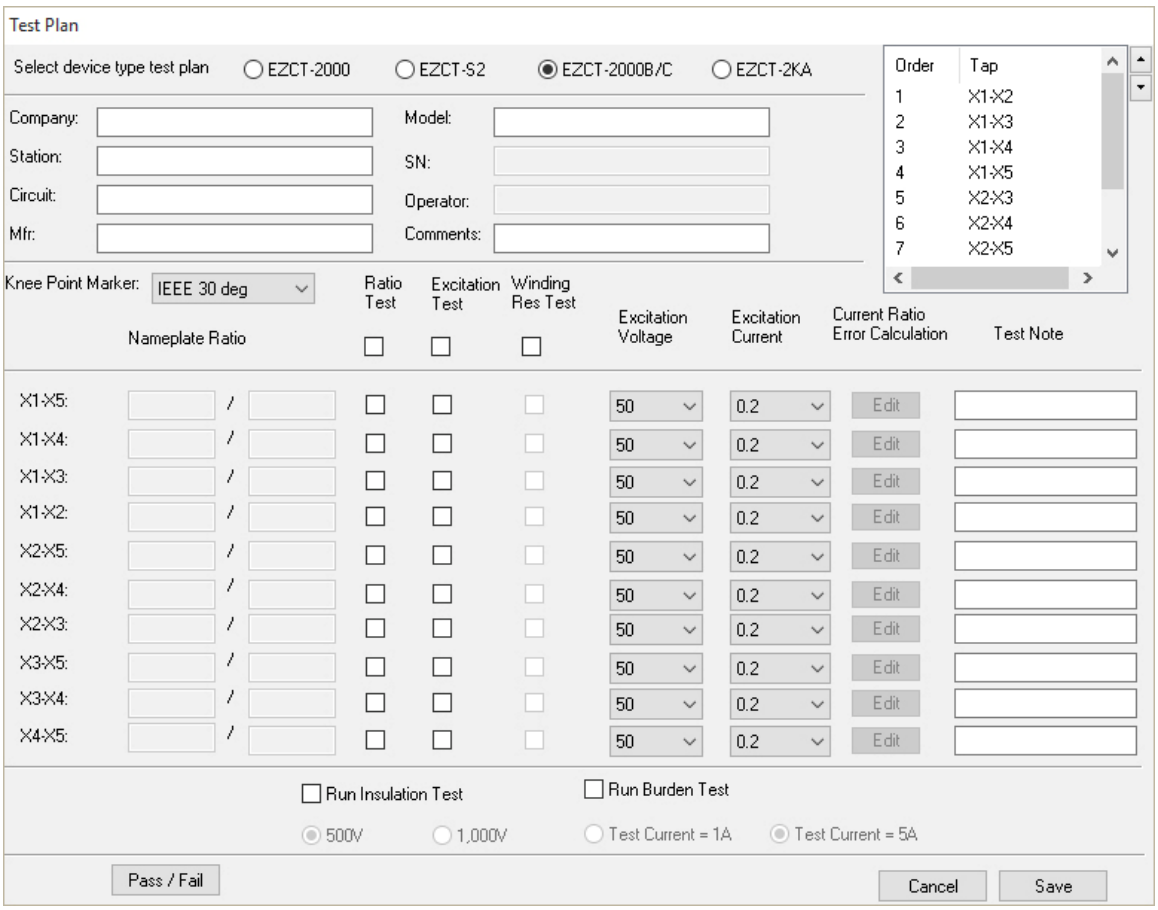
If there are no empty memory locations available, you can select a memory location with data in it, and it will be over-ridden with the transferred test plan.

5.4 Creating Test Plans

To create a test plan:

1. 

   Click on the ***New*** icon from the ***Test Plan*** command group. The following window will be displayed:



2. Select the CT Tester model that the test plan is being created for by clicking on the corresponding radio button in the “Select device type test plan” section at the top of the window. Any options that are not supported by the selected device will be grayed out. Also, the excitation voltage drop-down lists will be updated to only display voltages supported by the selected device.

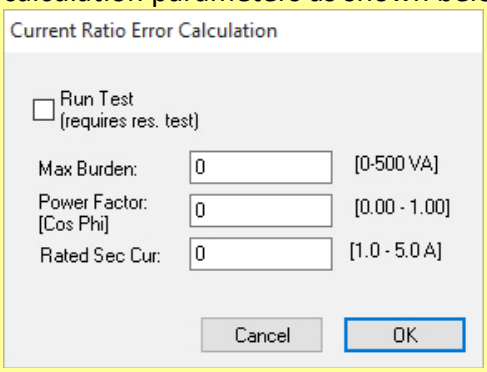
3. Enter the relevant header information at the top of the form (such as Company name, Station name, etc.).

4. The top right corner of the window allows you to re-arrange the tap order. This affects how the taps are listed on the Summary Report page. To re-arrange a tap, click on the tap name and then click on either the up or down arrow on the right to move the tap higher or lower in the list, respectively.

5. Select the knee point marker from the “Knee Point Marker:” drop-down list.
6. For each tap connection you would like to test, click on the check box under each test type that you would like to perform. For example, to perform a ratio test on the X1-X5 tap connection, check the check box under the “Ratio Test” column in the X1-X5 row.

NOTE

The Winding Resistance Test is available for the EZCT-2000/2000A/2000B/2000C/2KA. This option will be activated only if the Excitation Test is checked first.
If you have checked the box under the “Winding Res Test” column, the “Edit” button under the “Current Ratio Error Calculation” box will also become available. Clicking on this button will display the current ratio error calculation parameters as shown below:

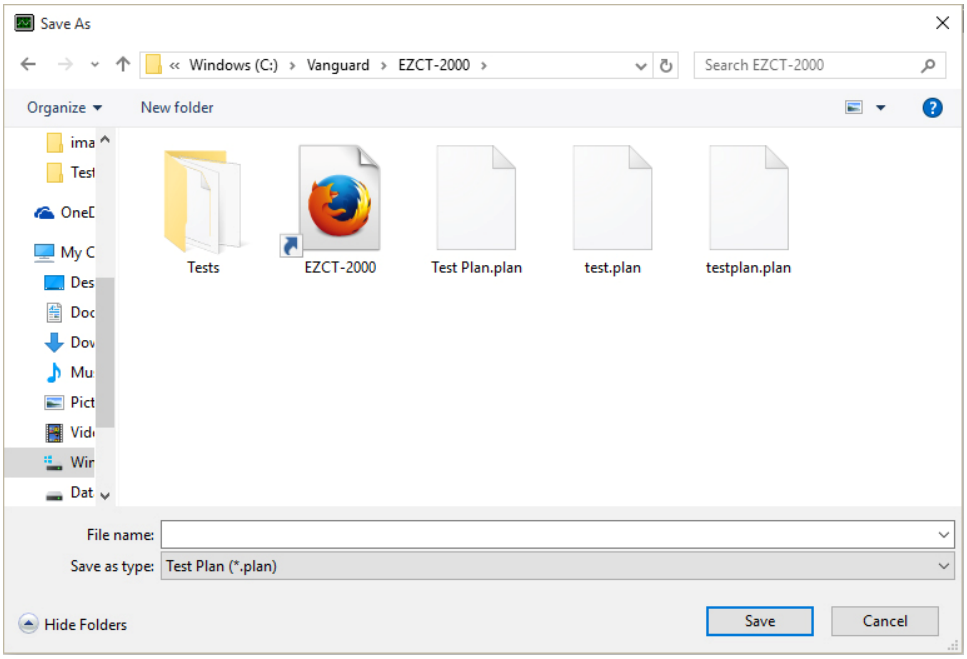


If you would like to run this test, click on the “Run Test” checkbox and then enter the test parameters in the fields below (“Max Burden”, “Power Factor”, and “Rated Sec Cur”). Click on the “OK” button to save the settings.

   a. Once a test has been selected for a tap connection, the “Nameplate Ratio” input fields will be activated. Enter the nameplate ratio values for the tap connection.
   b. Select the excitation voltage from the “Excitation Voltage” drop-down list corresponding to the tap connection.
   c. Select the excitation current from the “Excitation Current” drop-down list corresponding to the tap connection.
   d. Enter any relevant test notes in the corresponding “Test Note” field.

7. EZCT-2000B/2000C only
   a. If you would like to run an insulation test, click on the “Run Insulation Test” check box and then select the insulation test voltage by clicking on the corresponding radio button (500V or 1,000V).
   b. If you would like to run a burden test, click on the “Run Burden Test” check box and then select the burden test current by clicking on the corresponding radio button (1A or 5A).

8. Click on the “Save” button. The following window will be displayed:



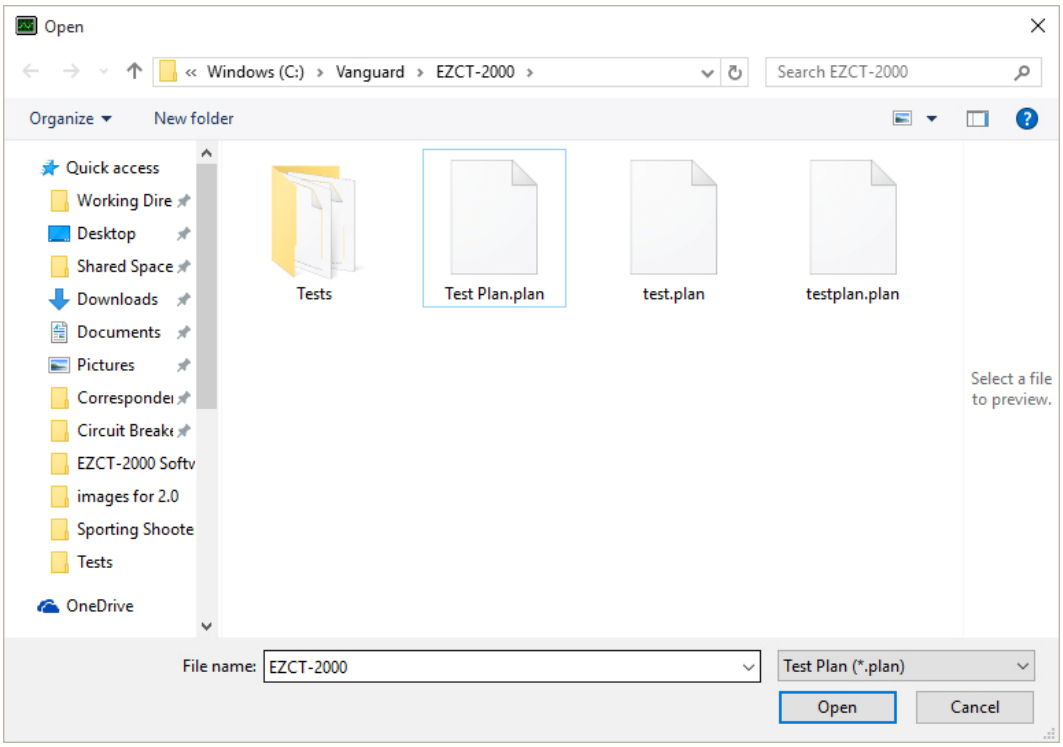
Browse to the location where you would like to save the test plan. Enter a file name in the “File name:” input field and click on the “Save” button. The test plan will be saved in the selected location.

6.0 RUNNING TESTS

The EZCT-2000 software can be used with a test plan to run a current-transformer test directly from the PC. To run a test using the EZCT-2000 software:

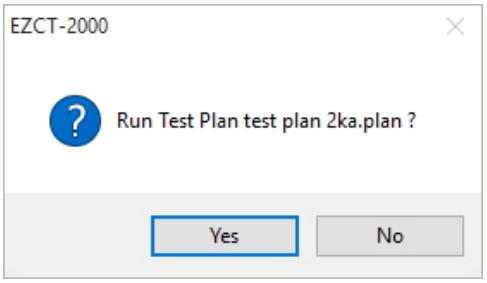
1. Connect the CT Tester to the PC.
2. Make the test connections per the CT Tester's User's Manual.
3. 

   Click on the ***Run*** icon from the ***Test*** command group. The following window will be displayed:



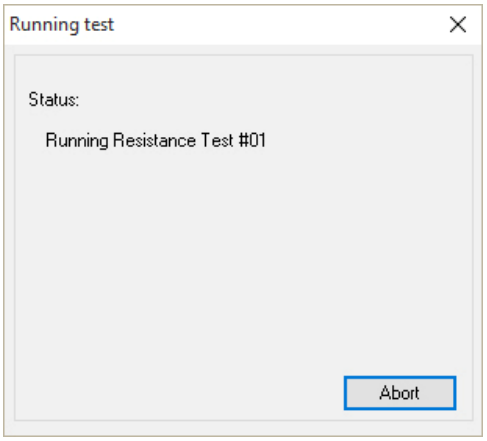
   Browse to the folder containing the test plan that you would like to use. Click on the test plan file name and then click on the "Open" button.

4. The following confirmation window will be displayed:



Click on the “Yes” button.

5. The EZCT-2000 software will start running the tests configured in the test plan. The following window will be displayed showing the status of the current test being performed:



NOTE

You can stop the testing process by clicking on the “Abort” button.

6. When testing has finished, the test results will be displayed. Please see section 4.0 for further information about working with test records.

Appendix A - Connecting Your CT Tester to a PC

The EZCT-2000 software supports the EZCT-S2, EZCT-S2A, EZCT-2000, EZCT-2000A, EZCT-2000B, EZCT-2KA, and the EZCT-2000C current transformer testers. Following is a table that lists the PC interfaces available on each device:

Device	RS-232C	Native USB*	USB to Serial**	Bluetooth
EZCT-S2	**YES**	**YES**	NO	NO
EZCT-S2A	**YES**	**YES**	NO	NO
EZCT-2000	**YES**	**YES**	NO	NO
EZCT-2000A	**YES**	**YES**	NO	NO
EZCT-2000B	**YES**	**YES**	NO	NO
EZCT-2000C	NO	NO	**YES**	**YES**
EZCT-2KA	NO	NO	**YES**	**YES**

* Devices that offer a Native USB interface are connected to a PC's USB port and recognized as a USB device by the PC.

** Devices that offer a USB to serial interface have a USB port on the front panel that is connected to a USB port on the PC. However, the unit uses an internal USB to serial conversion chip and is recognized as an RS-232C device by the PC.

Connecting via RS-232C

1. Connect the unit's RS-232C port to an available RS-232C port on the PC using the provided serial cable.
2. Launch the EZCT-2000 software and then click on the ***Settings*** icon from the ***Application*** command group.
3. In the "Communications" section, check the "Auto Detect" check box and un-check the "Use USB port" check box and then click on the "OK" button.

Connecting via Native USB

1. Connect the unit's USB port to an available USB port on the PC using the provided USB cable.
2. Launch the EZCT-2000 software and then click on the ***Settings*** icon from the ***Application*** command group.
3. In the "Communications" section, un-check the "Auto Detect" check box and check the "Use USB port" check box and then click on the "OK" button.

Connecting via USB to Serial

1. Connect the unit's USB port to an available USB port on the PC using the provided USB cable.
2. Launch the EZCT-2000 software and then click on the ***Settings*** icon from the ***Application*** command group.
3. In the "Communications" section, check the "Auto Detect" check box and un-check the "Use USB port" check box and then click on the "OK" button. Although you are connecting to the unit using a USB cable, it's very important to UN-check the "Use USB port" option since the CT tester is using an internal USB to serial conversion chip.

Connecting via Bluetooth

1. If this is the first time you are connecting to the CT tester, you must first pair the device with your computer. Follow the steps below to pair the device:
    a. Double click on the Bluetooth system tray icon (usually at the bottom right corner of your screen).
    b. Select the "Add a device" or "Add a Bluetooth device" option (this may be different depending on your operating system).
    c. Your computer will search for nearby Bluetooth devices and will detect and list your CT tester. Select your tester and then continue with the process.
    d. Your operating system will ask for a pairing code for the device. Some versions of Windows will ask whether you would like to create a pairing code, enter the device's pairing code, or pair without using a code. Select the "Enter the device's pairing code" option. Then enter the word "default" as the pairing code (without the quotation marks).
    e. Once paired, the CT tester will be listed under your Bluetooth devices.
2. Launch the EZCT-2000 software and then click on the ***Settings*** icon from the ***Application*** command group.
3. In the "Communications" section, check the "Auto Detect" check box and un-check the "Use USB port" check box and then click on the "OK" button.

Vanguard Instruments Company, Inc.

1520 S. Hellman Ave • Ontario, CA 91761 • USA

Phone: 909-923-9390 • Fax: 909-923-9391

www.vanguard-instruments.com

EZCT-2000 Version 2.x Software Manual • Revision 2.0 • May 17, 2016 • TA