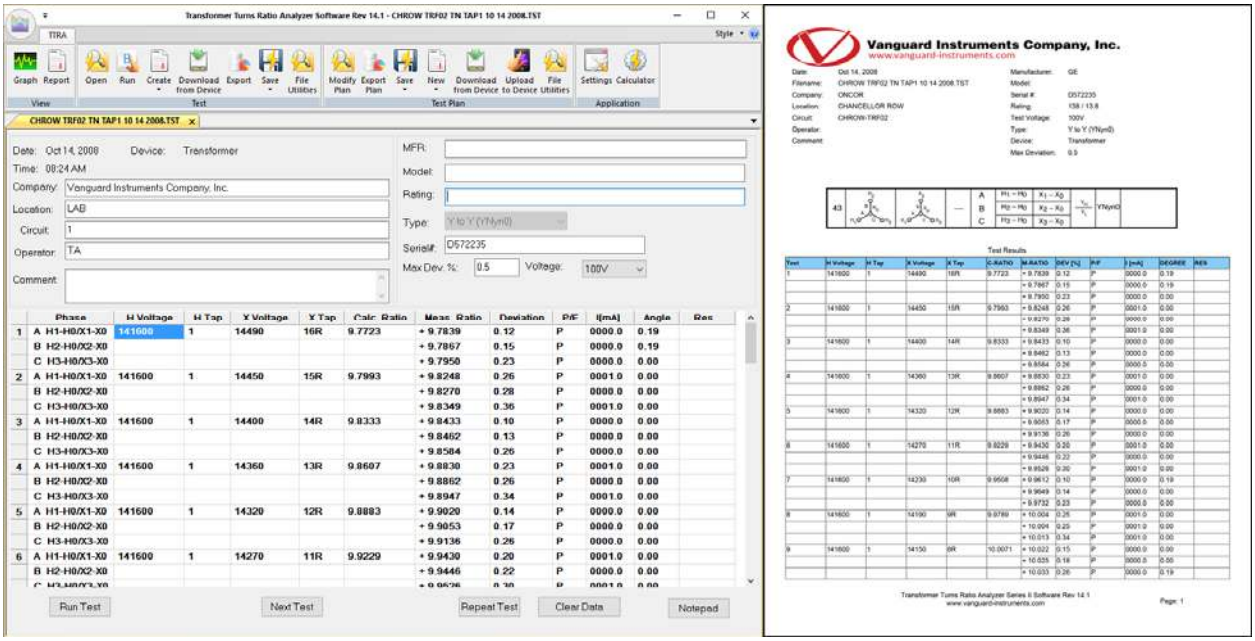
Transformer Turns Ratio Analyzer (TTRA)

VERSION 14.x SOFTWARE MANUAL

For Use with Vanguard's

ATRT-01, ATRT-03, ATRT-03A, and ATRT-03B

Transformer Turns-Ratio Meters



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Revision 6

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CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- The general term “ATRT” used in this manual refers to any of the TTRA compatible Vanguard transformer turns-ratio meters (ATRT-01, ATRT-03, ATRT-03A, ATRT-03B)
- Command ribbon items are referred to as ***Command Ribbon Item***
- Command ribbon sub-items are referred to as *Command Ribbon Sub-item*
- Dialog boxes and their elements (buttons, options, etc.) are referred to as “Dialog Box Element”
- File locations, directories, and filenames are shown as “*C:\folder\filename*”
- Warning messages are indicated as:

Warning message

WARNING

- Important notes are indicated as:

Note details

NOTE

1.0 INTRODUCTION

The Transformer Turns Ratio Analyzer (TTRA) software is a Windows-based PC software application for use with Vanguard's ATRT-01 and ATRT-03 line of transformer turns-ratio testers (ATRT-01, ATRT-03, ATRT-03A, and ATRT-03B). This software allows users to perform the following tasks:

- Test winding turns-ratios of transformers, voltage regulators, and load-tap changers directly from a PC.
- Create test plans for transformers, voltage regulators, and load-tap changers.
    - The test plan can be created on the PC and then transferred to the ATRT.
    - A test plan can be used to quickly test transformers and obtain test results, percentage-error calculation, and Pass/Fail results.
- Export test records in Microsoft Excel, PDF, and XML formats.
- Retrieve test records stored in an ATRT.

1.1 System Requirements

The TTRA software has the following minimum system requirements:

- PC running Microsoft® Windows® XP, Vista, 7, 8, 8.1, or 10
    - Both 32-bit and 64-bit versions of Windows are supported
- 2 Megabytes of hard drive space
- RS-232C (serial) port or a USB to RS-232C (serial) interface

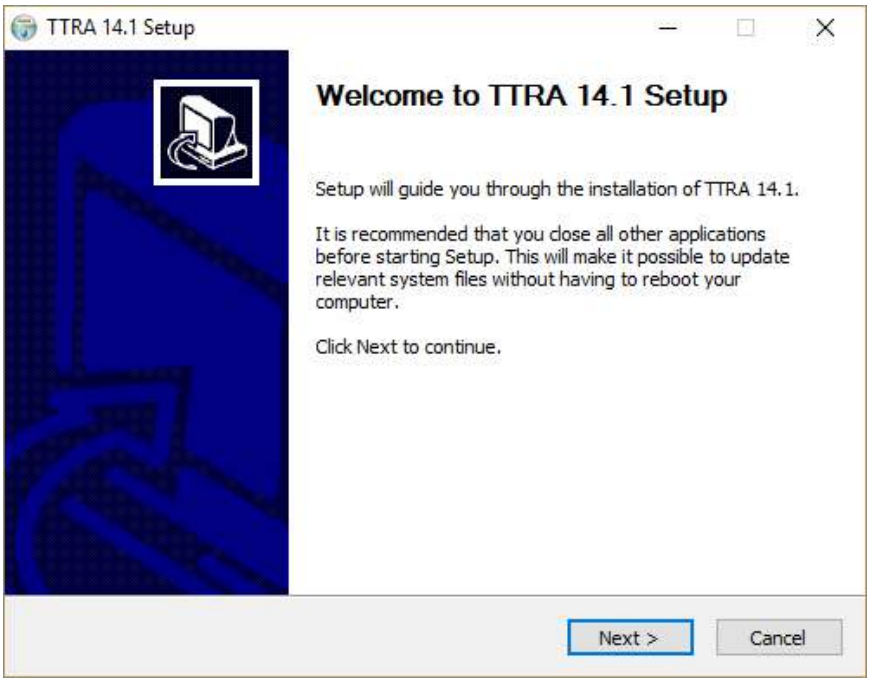
2.0 SOFTWARE INSTALLATION

Follow the steps below to install the TTRA software on your PC.

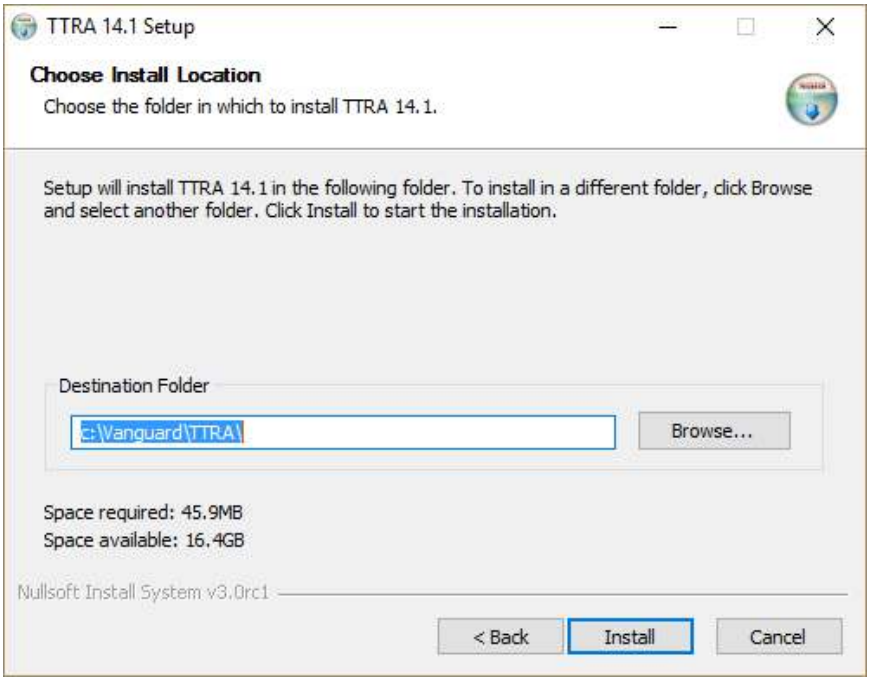
1. If using the Software USB Flash drive that came with your Vanguard ATRT, insert it into an available USB port and then navigate to that drive using Windows Explorer. If you downloaded the software from the Vanguard web site, navigate to the folder where you extracted the installation files.
2. Double click (or single click depending on your Windows Explorer settings) on the "TTRA PC Software Rev 14.x.exe" file to start the installation process. The TTRA installation wizard will appear as shown below:

NOTE

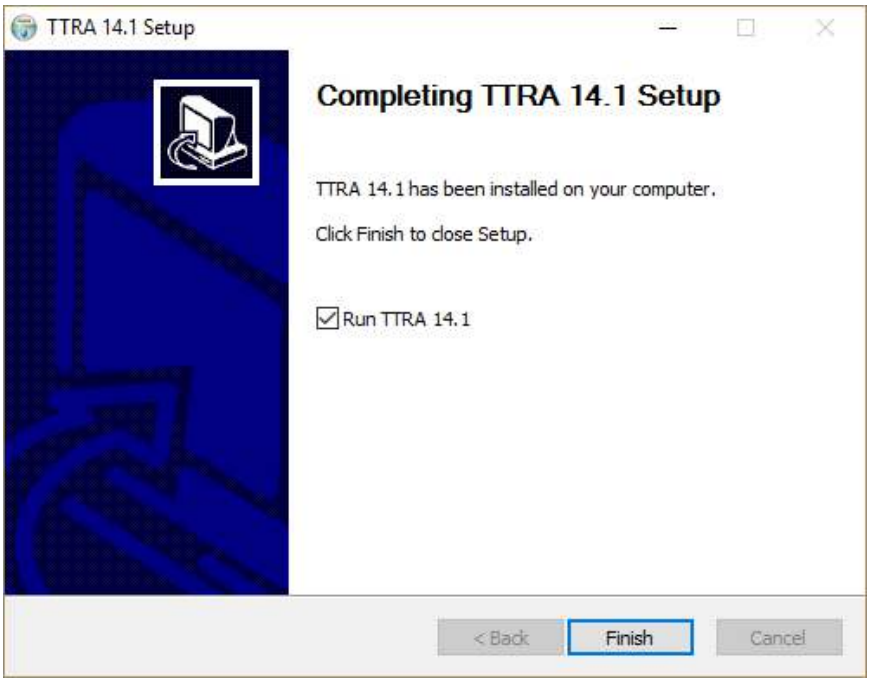
If you have administrative rights on the computer you are using, we highly recommend that you right-click on the "TTRA PC Software Rev 14.x.exe" file and then selecting "Run as administrator". This will ensure that any necessary drivers will be installed correctly.



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\TTRA"*):



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 TTRA 14.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 check box and then click on the "Finish" button.

3.0 STARTING AND CONFIGURING THE TTRA SOFTWARE

3.1 Starting the TTRA Software

The process to launch the TTRA 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 *TTRA* menu item.

Windows 8, 8.1

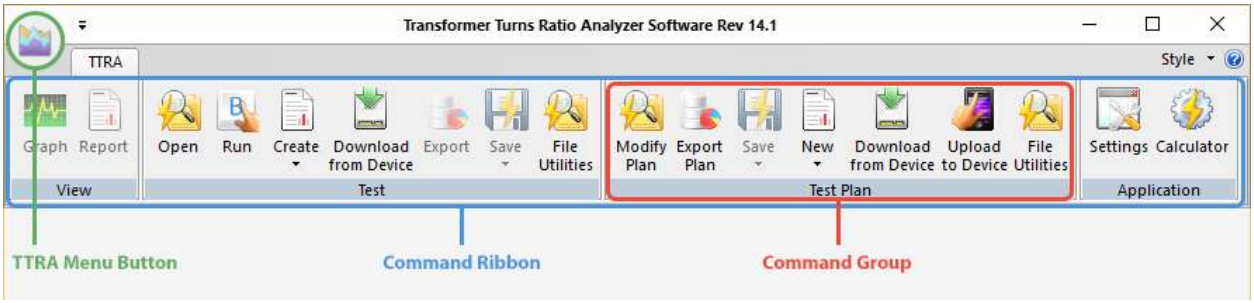
1. Navigate your mouse to the bottom left corner of your screen and click when the "Start" icon appears or simply press the **[Windows]** key on your keyboard.
2. Right click on a blank part of the "Start" screen and then choose *All Apps*.
3. Locate the *TTRA* menu item and click on it.

Windows 10

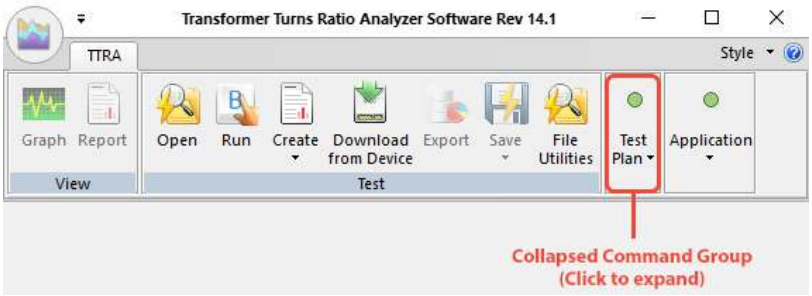
1. Click on the "Start" menu button
2. Click on the *All Apps* menu item.
3. Click on the *Vanguard* menu item.
4. Click on the *TTRA* menu item.

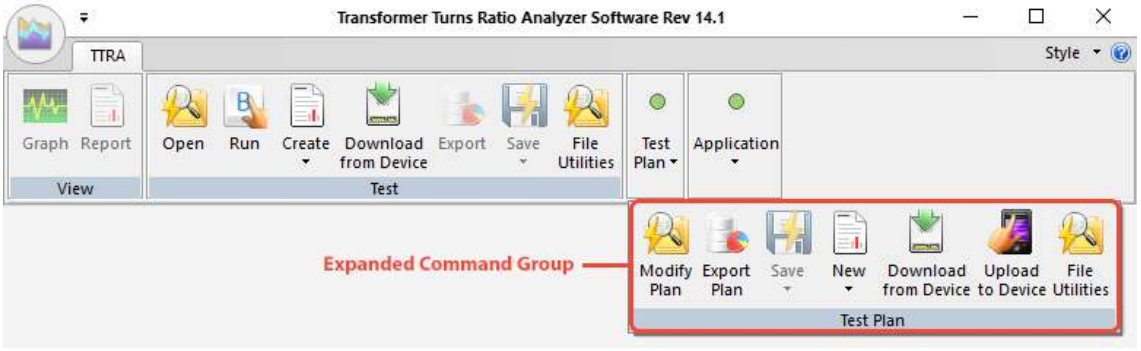
3.2 The TTRA Application Workspace

Older versions of the TTRA software (version 14.0 and lower) used a menu bar and drop-down menus. The current 14.x version of the application uses a command ribbon for faster access to all the functions and features of the TTRA software as shown below:

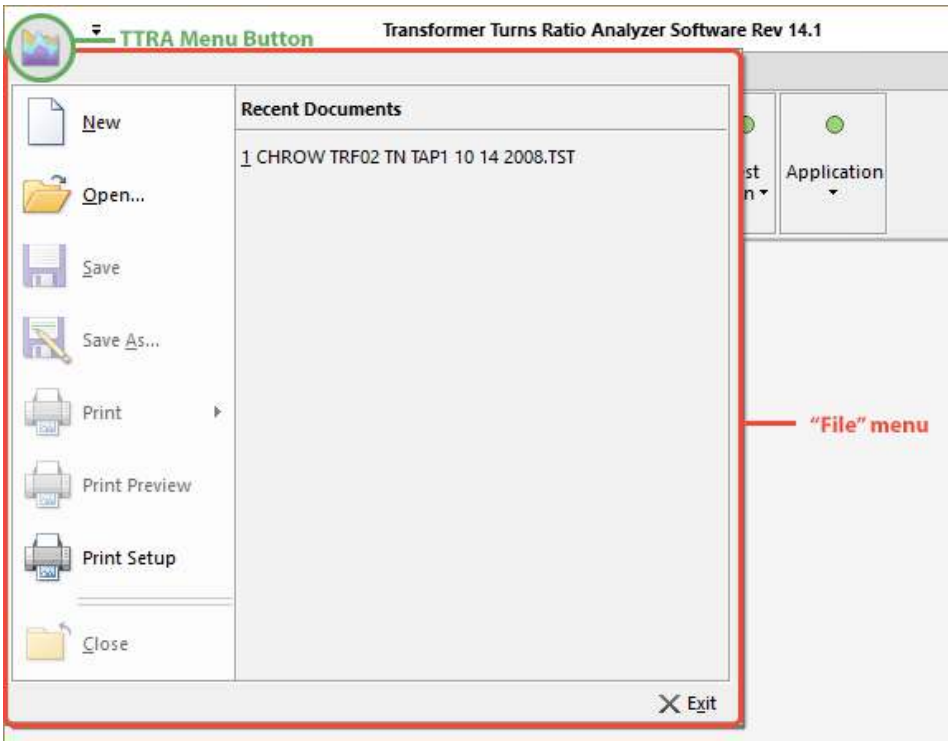


Related commands are grouped together in the command ribbon. If there is not enough space on the screen, some command groups will be collapsed showing only one icon. Click on the command group to view all the commands in that group.





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



3.3 Enabling the ATRT's Computer Interface

To retrieve test records and test plans from an ATRT using the TTRA software, the ATRT must be in Computer Interface Mode. Also, Computer Interface Mode must be enabled when transferring test plans to an ATRT or when performing tests from the TTRA software. To enable the Computer Interface Mode:

1. Make sure the TTRA software is running on the PC and the system settings have been configured correctly (see section 3.2).
2. Connect the ATRT to the PC via the RS-232C port and turn on the power.
3. Once the ATRT has gone through the start-up cycle, the "START-UP" menu will be displayed as shown:

   ```
   1. TEST XFMR 07/07/09
   2. SETUP     07:24:05
   3. CALCULATOR
   4. DIAG  5. QUICK TST
   ```

   Press the **[2]** key (*SETUP*).
4. The following screen will be displayed:

   ```
   1. ENTER XFMR ID
   2. REVIEW RECORD
   3. RESTORE RECORD
   4. NEXT PAGE
   ```

   Press the **[4]** key (*NEXT PAGE*).
5. The following screen will be displayed:

   ```
   1. COMPUTER CONTROL
   2. SET TIME
   3. SET TEST VOLTAGE
   4. TEST PLANS
   ```

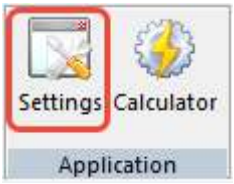
   Press the **[1]** key (*COMPUTER CONTROL*).
6. The following screen will be displayed:

   ```
     COMPUTER ITF MODE
     *** CAUTION! ***
   CABLES MAY HAVE VLTG
     "STOP" TO ABORT
   ```

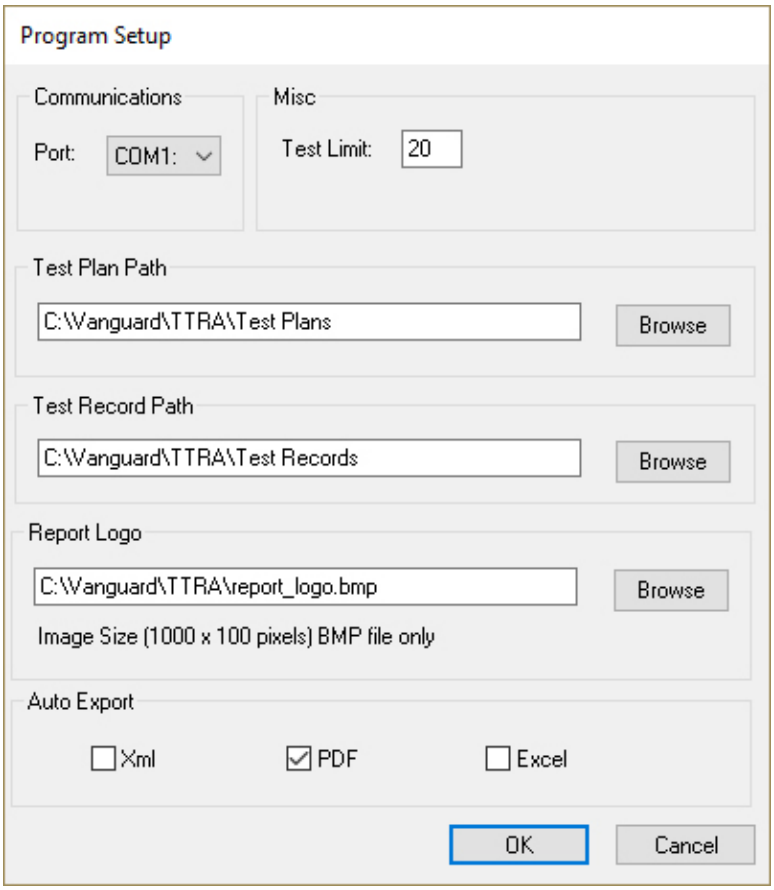
   The ATRT is now in Computer Interface Mode and can be controlled by the TTRA software.

3.4 Configuring Default Application Settings

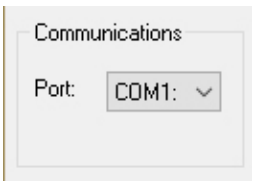
The TTRA's default settings should be configured before attempting to use it for the first time with a Vanguard ATRT. Follow the steps in this section to configure the communication parameters, report and export preferences, and file storage location preferences.



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:



Communications



From the "Communications" section, select the serial port that the ATRT is connected to from the "Port" drop down menu. To find out what serial ports are available on your computer, open

the Windows Control Panel and then open the Device Manager. Any available serial ports will be listed under the "Ports (COM & LPT)" section.

Misc

The "Test Limit" setting defines the number of tests to be used when creating a test plan or when creating a quick test. By default, 20 tests will be created. You can change this value to increase or decrease the number of tests that are created.

Test Plan Path

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.

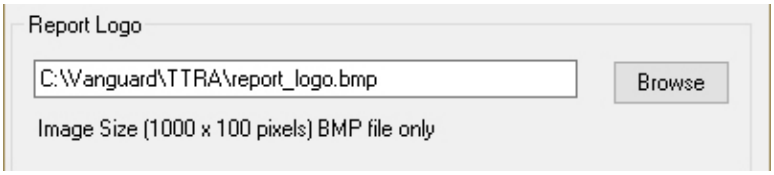
Test Record Path

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.

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.

Report Logo



The TTRA 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.

Auto Export

The TTRA 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

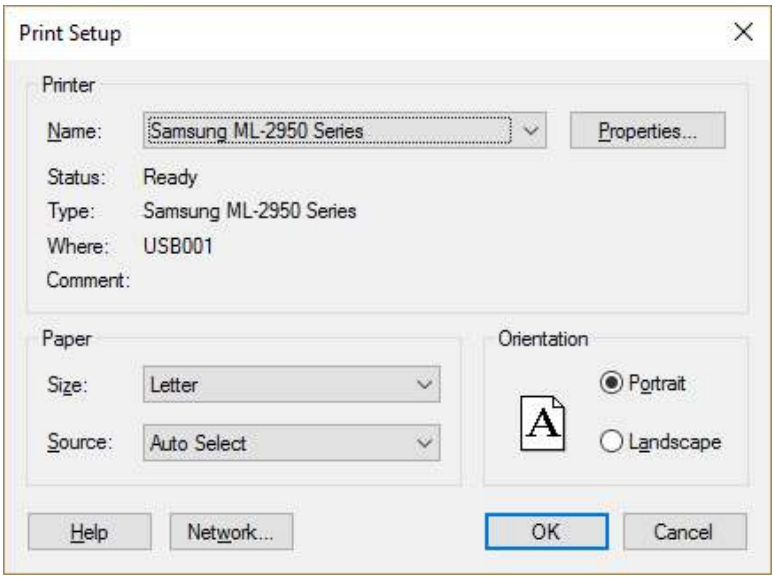
If you have selected one or more auto-export formats, the TTRA software will create a folder with the corresponding format name under the folder where the test record is located. For example, if you had selected the "PDF" export format and your test record was located at "*C:\test records*", the folder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

3.5 Printer Setup

To setup the default printer:

1. Click on the ***TTRA 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 TTRA software can be used to retrieve test records from the ATRT or from the PC hard drive. Once a test record is retrieved, you can change the record header settings, print the test results, change the H Voltage, X Voltage, H Tap, and X Tap values, and save the record to the hard drive.

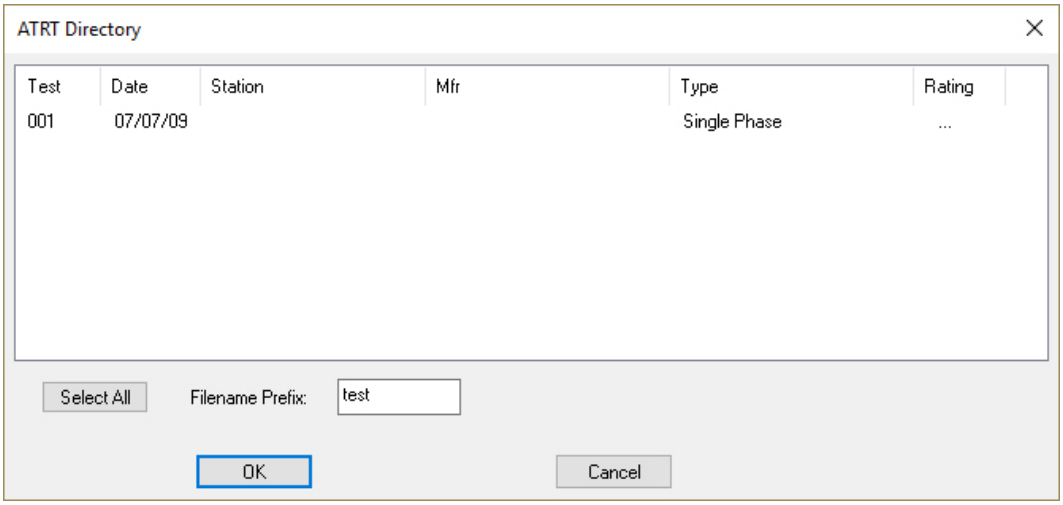
NOTE

If the H Voltage and/or X Voltage values are changed, the TTRA software will automatically re-calculate the calculated ratio and deviation. Make sure to save the test record after making any changes. See section 4.3 for information on saving test records.

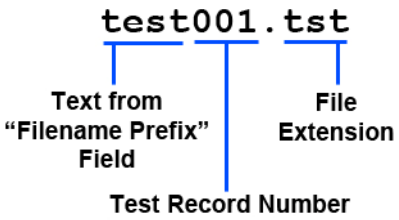
4.1 Retrieving Test Records From an ATRT

To retrieve a test record from an ATRT:

1. Make sure the TTRA software is running. Connect the ATRT to the PC via the RS-232C port and put it in Computer Interface Mode (see section 3.3).
2. Click on the ***Download from Device*** icon from the ***Test*** command group.
3. The following window will be displayed listing a directory of all the test records stored in the ATRT's internal memory:



4. You can select a test 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. To select all of the test records, 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 record on the PC hard drive. When a test record is retrieved from an ATRT and stored on the hard drive, the filename is in the following format:

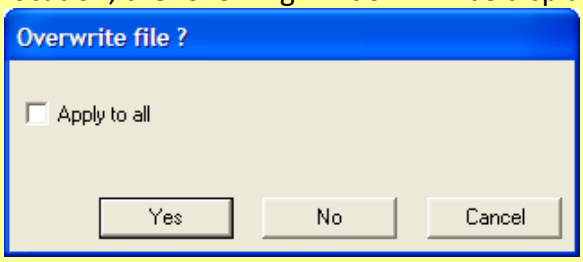


So if you would like the filename to be "*sample_test001.tst*", enter the word *sample_test* in the "Filename Prefix" input field.

6. Click on the "OK" button. The test record will be retrieved from the ATRT and saved on the PC in the default test records directory (see section 3.2 for information on how to change the default test records directory).

NOTE

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

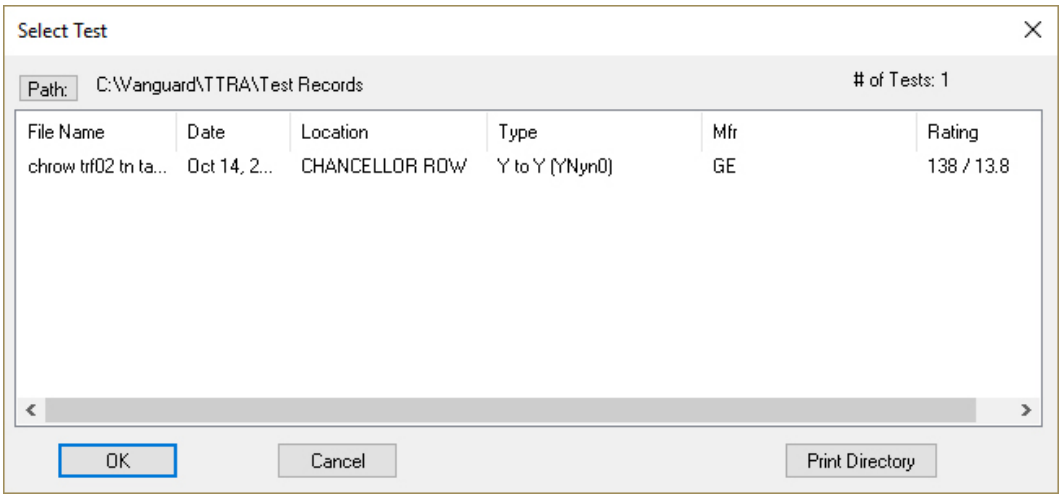


To overwrite the existing file, click on the "Yes" button. If you do not want to overwrite the existing file with the retrieved test record, click on the "No" button and you will be able to enter a different filename for the retrieved test record.

4.2 Recalling a Test Record From the PC Hard Drive

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

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



- The top left section 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 “Path:” button and browse to the folder containing the test records.
- The top right section of the window displays the total number of test records stored in the current directory.
- If you would like to print the current directory listing, click on the “Print Directory” button at the bottom of the window. Select the printer to print to and click on the “OK” button.

2. Click on the filename you would like to retrieve and click the “OK” button. The test record will be loaded and the tabulated test results will be displayed (please see section 4.6 for details).

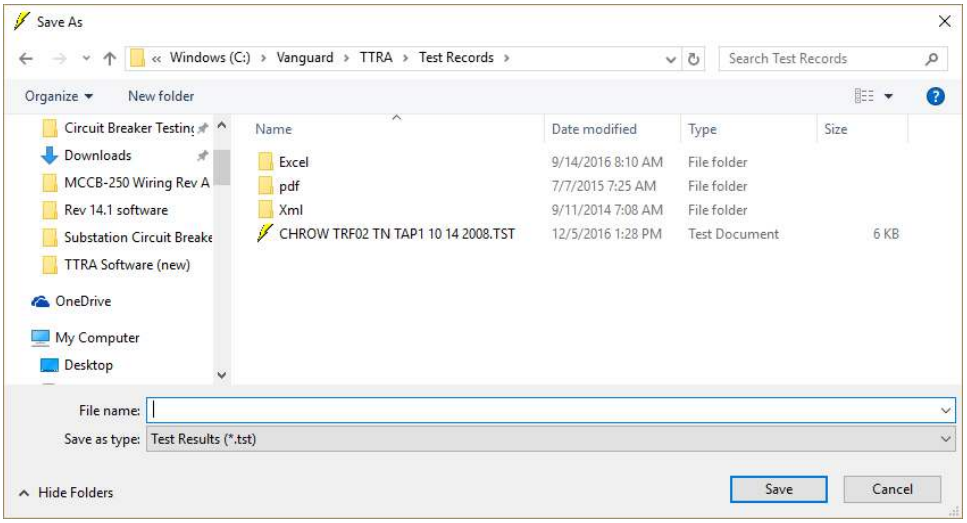
4.3 Saving a Test Record

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 ***Save*** icon from the ***Test*** command group.
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 arrow below the ***Save*** icon from the ***Test*** command group and select the *Save As* option. The following window will be displayed:



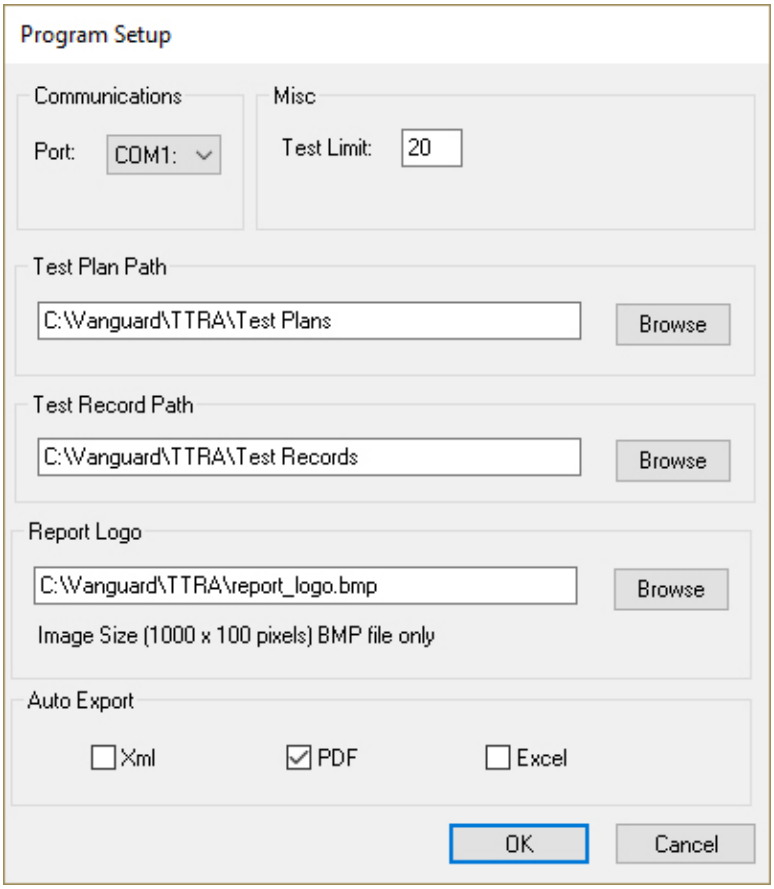
2. Browse to the folder where you would like to save the test record.
3. Enter the filename in the “Filename:” input field.
4. Click on the “Save” button. The test record will be saved with the new filename.

4.4 Moving, Copying, and Deleting Test Records

Test records are stored on your computer in the folder specified in the "Test Record Path" parameter in the TTRA's application settings (please see section 3.4). You can move, copy, or delete the test record files using Windows Explorer. To quickly access your test records folder, click on the ***File Utilities*** icon from the ***Test*** command group. The default location for your test records will be opened in Windows Explorer and you can use standard Windows commands to move, copy, or delete the test records.

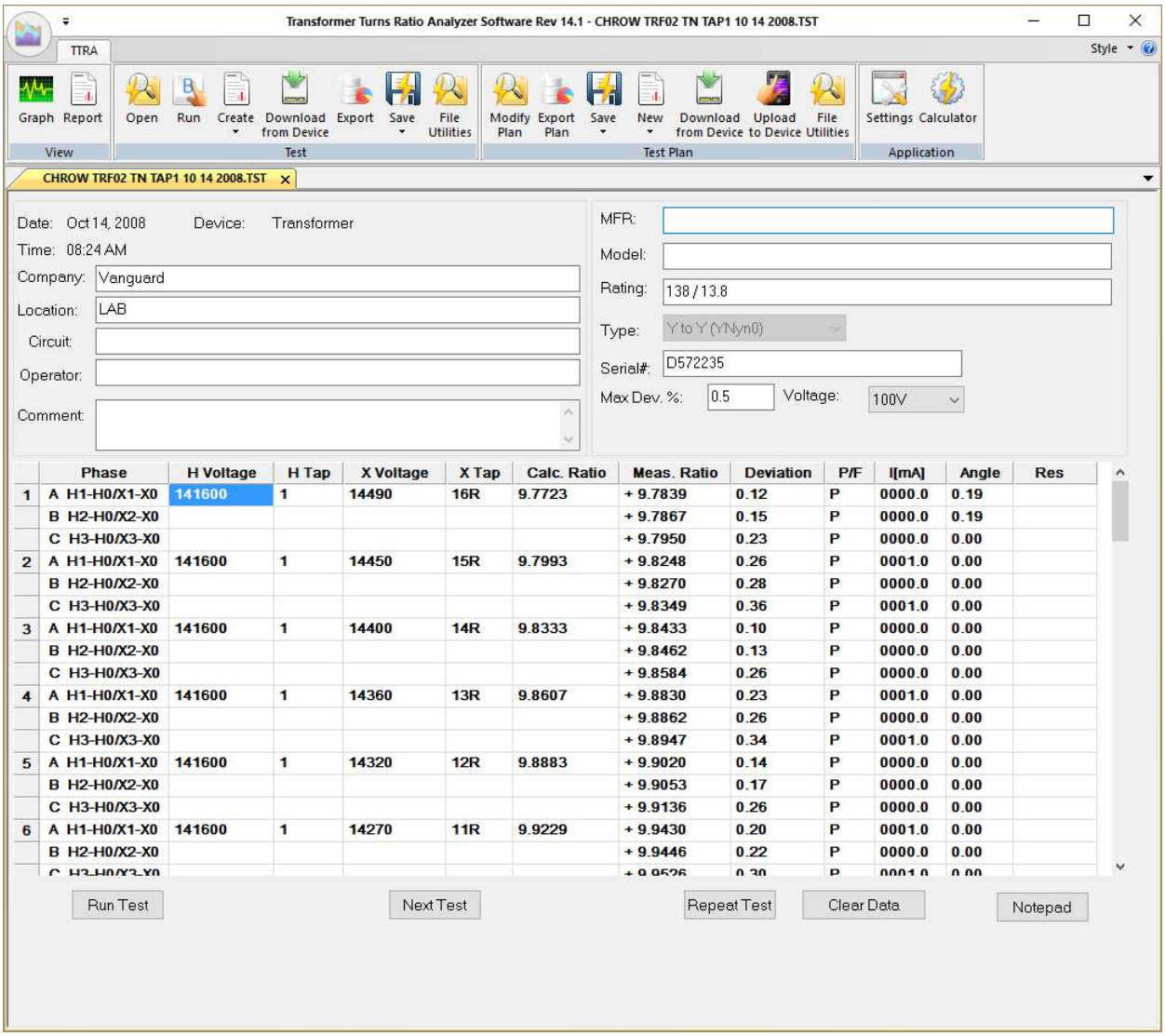
4.5 Exporting Test Records

The TTRA software can automatically export test records in PDF, Excel, and XML formats. You can enable the auto export feature in the Application Settings (please see section 3.4). Once you have enabled auto-exporting to one or more formats, the TTRA software will export your test records upon opening the test record. You can also manually export the test record to the selected formats by clicking on the ***Export*** icon from the ***Test*** command group. Manually exporting the test record can be useful in situations where you have already opened the test record and then decided to change the export formats.



4.6 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:

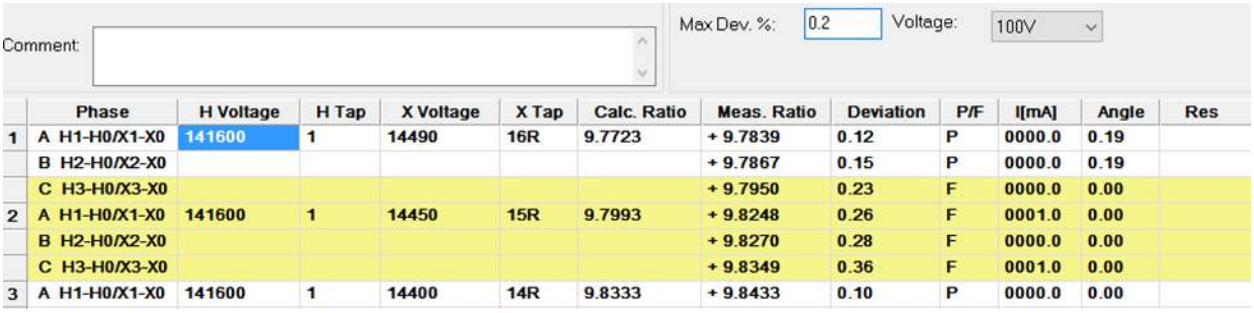


	Phase	H Voltage	H Tap	X Voltage	X Tap	Calc. Ratio	Meas. Ratio	Deviation	P/F	I[mA]	Angle	Res
1	A H1-H0/X1-X0	141600	1	14490	16R	9.7723	+ 9.7839	0.12	P	0000.0	0.19	
	B H2-H0/X2-X0						+ 9.7867	0.15	P	0000.0	0.19	
	C H3-H0/X3-X0						+ 9.7950	0.23	P	0000.0	0.00	
2	A H1-H0/X1-X0	141600	1	14450	15R	9.7993	+ 9.8248	0.26	P	0001.0	0.00	
	B H2-H0/X2-X0						+ 9.8270	0.28	P	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.8349	0.36	P	0001.0	0.00	
3	A H1-H0/X1-X0	141600	1	14400	14R	9.8333	+ 9.8433	0.10	P	0000.0	0.00	
	B H2-H0/X2-X0						+ 9.8462	0.13	P	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.8584	0.26	P	0000.0	0.00	
4	A H1-H0/X1-X0	141600	1	14360	13R	9.8607	+ 9.8830	0.23	P	0001.0	0.00	
	B H2-H0/X2-X0						+ 9.8862	0.26	P	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.8947	0.34	P	0001.0	0.00	
5	A H1-H0/X1-X0	141600	1	14320	12R	9.8883	+ 9.9020	0.14	P	0000.0	0.00	
	B H2-H0/X2-X0						+ 9.9053	0.17	P	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.9136	0.26	P	0000.0	0.00	
6	A H1-H0/X1-X0	141600	1	14270	11R	9.9229	+ 9.9430	0.20	P	0001.0	0.00	
	B H2-H0/X2-X0						+ 9.9446	0.22	P	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.9526	0.30	P	0001.0	0.00	

You can edit the test record header information (such as Company, Location, Circuit, Operator, etc.) by entering data in the corresponding fields at the top of the screen.

You can also edit the H Voltage, H Tap, X Voltage, and X Tap values. If these values are changed, the calculated ratio and deviation will be automatically re-calculated by the TTRA software. Make sure to save the test record after making any changes.

The Max Dev. % value can be edited as well. If this value is changed, any tests that fail based on the new value will be highlighted as shown below:



	Phase	H Voltage	H Tap	X Voltage	X Tap	Calc. Ratio	Meas. Ratio	Deviation	P/F	I[mA]	Angle	Res
1	A H1-H0/X1-X0	141600	1	14490	16R	9.7723	+ 9.7839	0.12	P	0000.0	0.19	
	B H2-H0/X2-X0						+ 9.7867	0.15	P	0000.0	0.19	
	C H3-H0/X3-X0						+ 9.7950	0.23	F	0000.0	0.00	
2	A H1-H0/X1-X0	141600	1	14450	15R	9.7993	+ 9.8248	0.26	F	0001.0	0.00	
	B H2-H0/X2-X0						+ 9.8270	0.28	F	0000.0	0.00	
	C H3-H0/X3-X0						+ 9.8349	0.36	F	0001.0	0.00	
3	A H1-H0/X1-X0	141600	1	14400	14R	9.8333	+ 9.8433	0.10	P	0000.0	0.00	

4.6.1. Printing the Tabulated Test Results

To print the tabulated test results:

1. Click on the ***TTRA Menu Button*** and select the *Print* option.
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. A sample test record printout is shown in Figure 1.

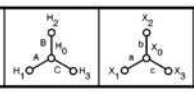
Vanguard Instruments Company, Inc.
www.vanguard-instruments.com

TRANSFORMER TURNS RATIO REPORT

Filename: CHROW TRF02 TN TAP1 10 14 2008.TST Date: Oct 14, 2008 Time: 08:24 AM Page (1/4)

Company: ONCOR
Location: CHANCELLOR ROW
Circuit: CHROW-TRF02
Operator:
Comment:

MFR: GE
Device: Transformer
Type: Y to Y (YNyn0)
Model:
Rating: 138 / 13.8
Serial #: D572235
Max Deviation %: 0.5
Test Voltage: 100V

43		—	A	$H_1 - H_0$	$X_1 - X_0$	$\frac{V_H}{V_L}$	YNyn0	
			B	$H_2 - H_0$	$X_2 - X_0$			
			C	$H_3 - H_0$	$X_3 - X_0$			

TEST	H VOLT	H TAP	X VOLT	X TAP	C-RATIO	M-RATIO	DEV [%]	P/F	I[mA]	DEGREE	RES
1	141600	1	14490	16R	9.7723	A: + 9.7839	0.12	P	0.0	0.19	
						B: + 9.7867	0.15	P	0.0	0.19	
						C: + 9.7950	0.23	P	0.0	0.00	
2	141600	1	14450	15R	9.7993	A: + 9.8248	0.26	P	1.0	0.00	
						B: + 9.8270	0.28	P	0.0	0.00	
						C: + 9.8349	0.36	P	1.0	0.00	
3	141600	1	14400	14R	9.8333	A: + 9.8433	0.10	P	0.0	0.00	
						B: + 9.8462	0.13	P	0.0	0.00	
						C: + 9.8584	0.26	P	0.0	0.00	
4	141600	1	14360	13R	9.8607	A: + 9.8830	0.23	P	1.0	0.00	
						B: + 9.8862	0.26	P	0.0	0.00	
						C: + 9.8947	0.34	P	1.0	0.00	
5	141600	1	14320	12R	9.8883	A: + 9.9020	0.14	P	0.0	0.00	
						B: + 9.9053	0.17	P	0.0	0.00	
						C: + 9.9136	0.26	P	0.0	0.00	
6	141600	1	14270	11R	9.9229	A: + 9.9430	0.20	P	1.0	0.00	
						B: + 9.9446	0.22	P	0.0	0.00	
						C: + 9.9526	0.30	P	1.0	0.00	
7	141600	1	14230	10R	9.9508	A: + 9.9612	0.10	P	0.0	0.19	
						B: + 9.9649	0.14	P	0.0	0.00	
						C: + 9.9732	0.23	P	0.0	0.00	
8	141600	1	14190	9R	9.9789	A: + 10.004	0.25	P	1.0	0.00	
						B: + 10.004	0.25	P	1.0	0.00	
						C: + 10.013	0.34	P	1.0	0.00	
9	141600	1	14150	8R	10.0071	A: + 10.022	0.15	P	0.0	0.00	
						B: + 10.025	0.18	P	0.0	0.00	
						C: + 10.033	0.26	P	0.0	0.19	
10	141600	1	14100	7R	10.0426	A: + 10.064	0.21	P	1.0	0.00	
						B: + 10.065	0.22	P	1.0	0.00	
						C: + 10.075	0.32	P	1.0	0.00	

Figure 1. A Typical Test Record Printout

4.6.2. Displaying the Deviation Graph

The deviation graph is a useful tool for analyzing the transformer ratio deviation. The deviation graph displays the phase A, B, and C turns-ratio deviation of the current test record. The following formula is used to calculate the deviation, or percent difference:

Deviation = **|**[(**Ratio**$_{calculated}$ – **Ratio**$_{measured}$)/ **Ratio**$_{calculated}$] x 100**|**

To display the deviation graph for the loaded test record, click on the ***Graph*** icon from the *View* command group. To view the report again, click on the ***Report*** icon from the *View* command group. A typical deviation graph is shown below in Figure 2.

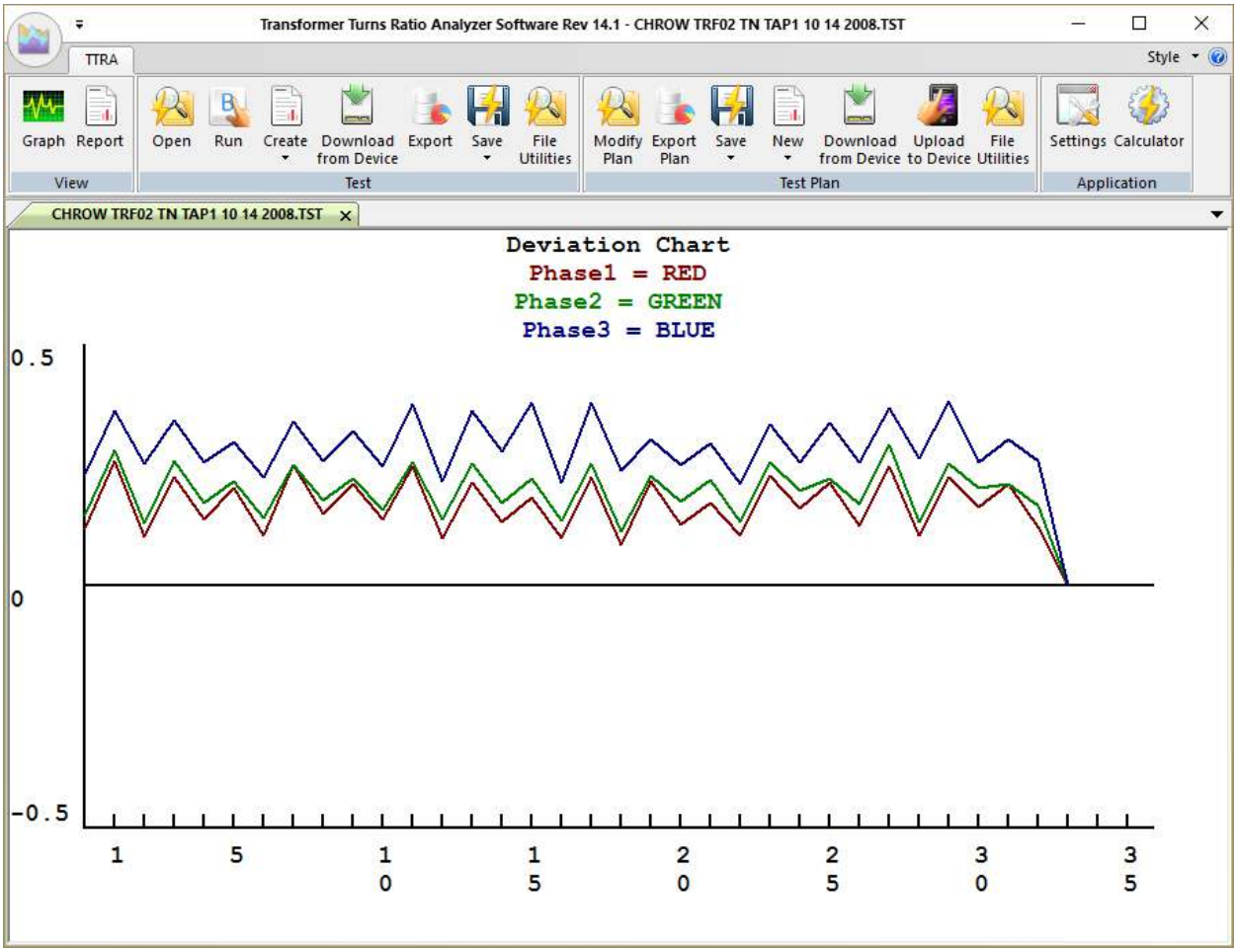


Figure 2. A Typical Deviation Graph

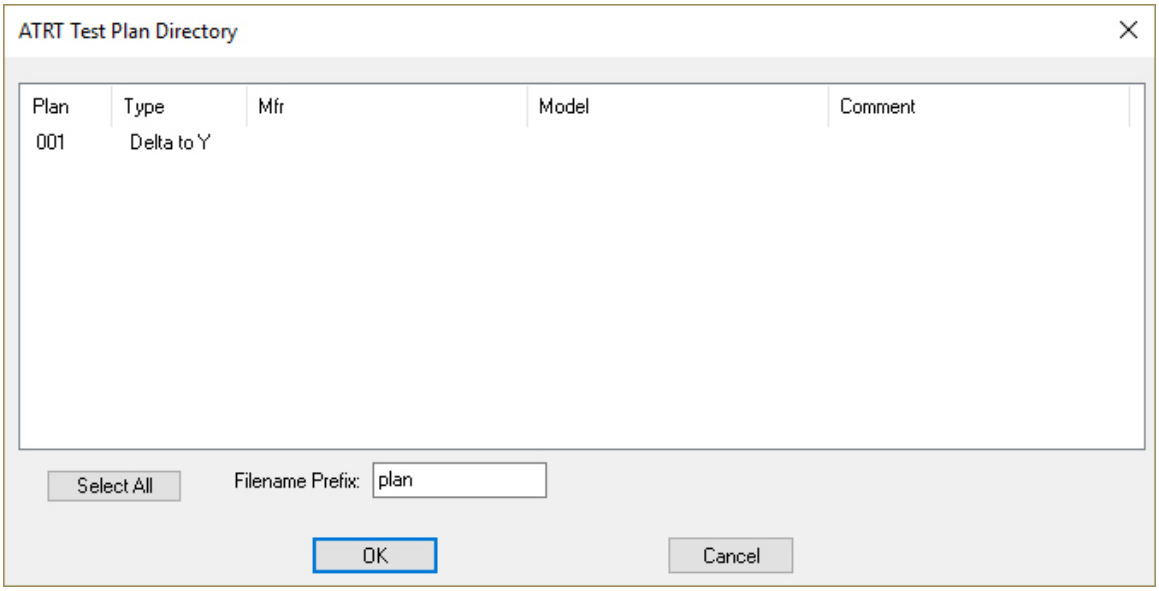
5.0 WORKING WITH TEST PLANS

The TTRA software can be used to create transformer, load tap changer, and voltage regulator test plans on the PC. Test plans can then be run from the PC or transferred to the ATRT to be run from the ATRT (in stand-alone mode). Test plans can also be retrieved from the ATRT using the TTRA software.

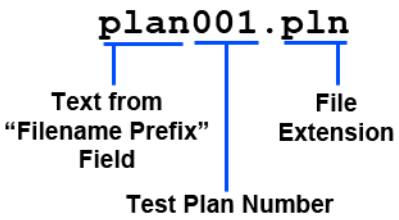
5.1 Retrieving Test Plans From an ATRT

To retrieve a test plan from an ATRT:

1. Make sure the TTRA software is running. Connect the ATRT to the PC via the RS-232C port and put it in Computer Interface Mode (please see section 3.3).
2. Click on the ***Download from Device*** icon in the ***Test Plan*** command group.
3. A window will appear listing a directory of all the test plans stored in the ATRT's memory as shown below:



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 ATRT and stored on the hard drive, the filename is in the following format:



So if you would like the filename to be "*sample_plan001.pln*", enter the word *sample_plan* in the "Filename Prefix" input field.

6. Click on the "OK" button. The test plan will be retrieved from the ATRT and stored on the PC in the default test plans directory (see section 3.4 for information on how to change the default test plan directory).

NOTE

If a test plan file with the same name already exists at the storage location, the file will be over-written with the newly transferred file.

5.2 Recalling a Test Plan From the PC Hard Drive

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

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

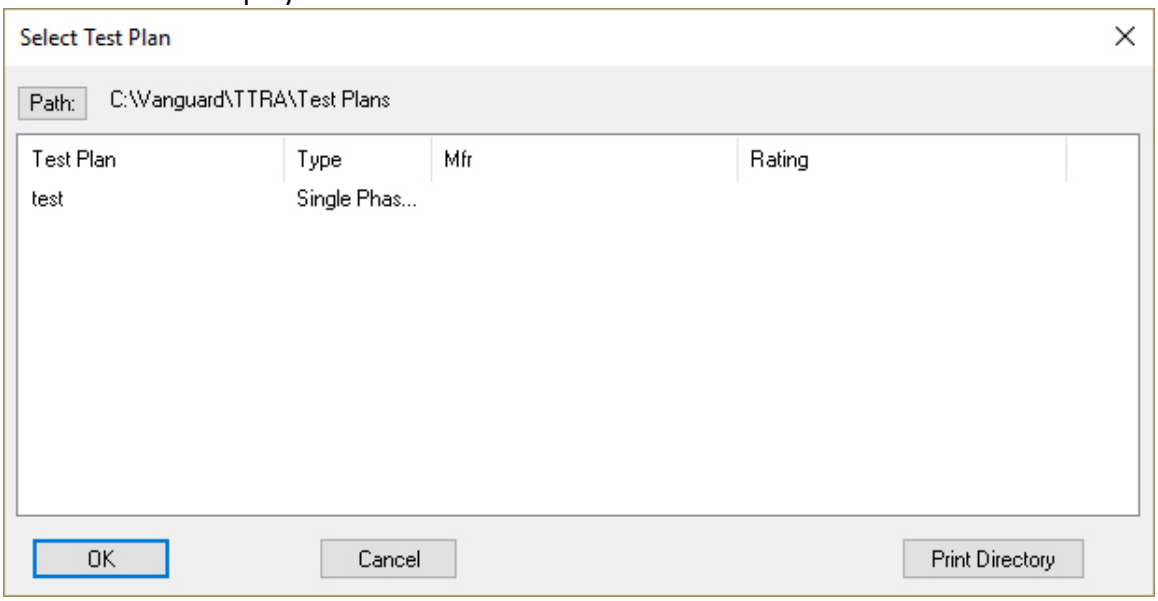
   - The top left section of the window displays the name of the directory where the test plans are being retrieved from. If you wish to retrieve test plans from a different directory, click on the "Path:" button and browse to the folder containing the test plans.
   - If you would like to print the current directory listing, click on the "Print Directory" button at the bottom of the window. Select the printer to print to and click on the "OK" button.

2. Click on the filename you would like to retrieve and click the "OK" button. The test plan will be loaded and the test plan parameters will be displayed. You may change any of the test plan parameters as needed.

5.3 Transferring Test Plans to an ATRT

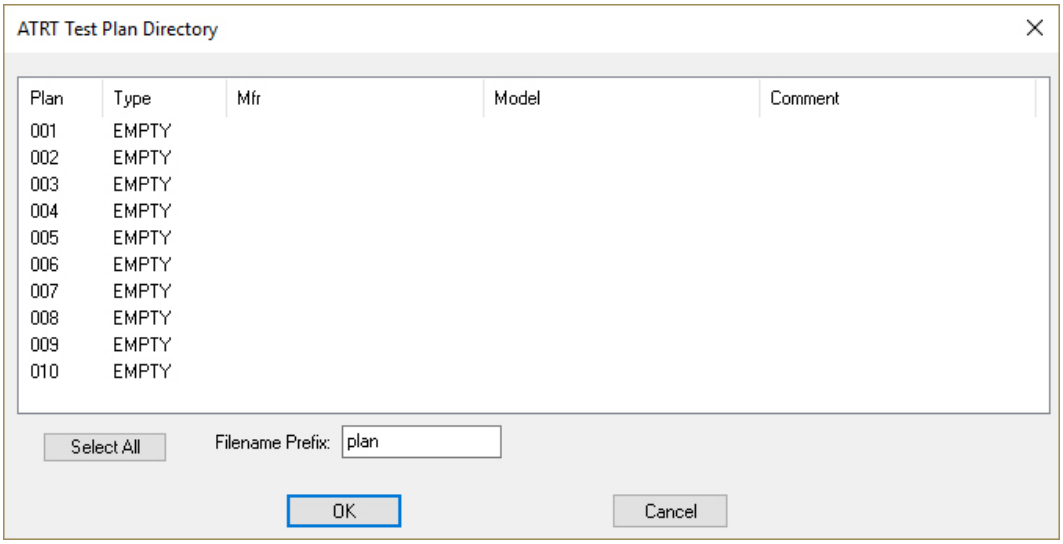
To transfer a test plan from the PC hard drive to an ATRT:

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



- The top left section of the window displays the name of the directory where the test plans are being listed from. If you wish to transfer test plans from a different directory, click on the “Path:” button and browse to the folder containing the test plans.
- If you would like to print the current directory listing, click on the “Print Directory” button at the bottom of the window. Select the printer to print to and click on the “OK” button.

2. Click on the filename you would like to transfer to the ATRT and click on the “OK” button. The following window will be displayed showing a listing of the ATRT’s test plan memory locations and their contents:



3. 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 selected location in the ATRT’s memory.

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.

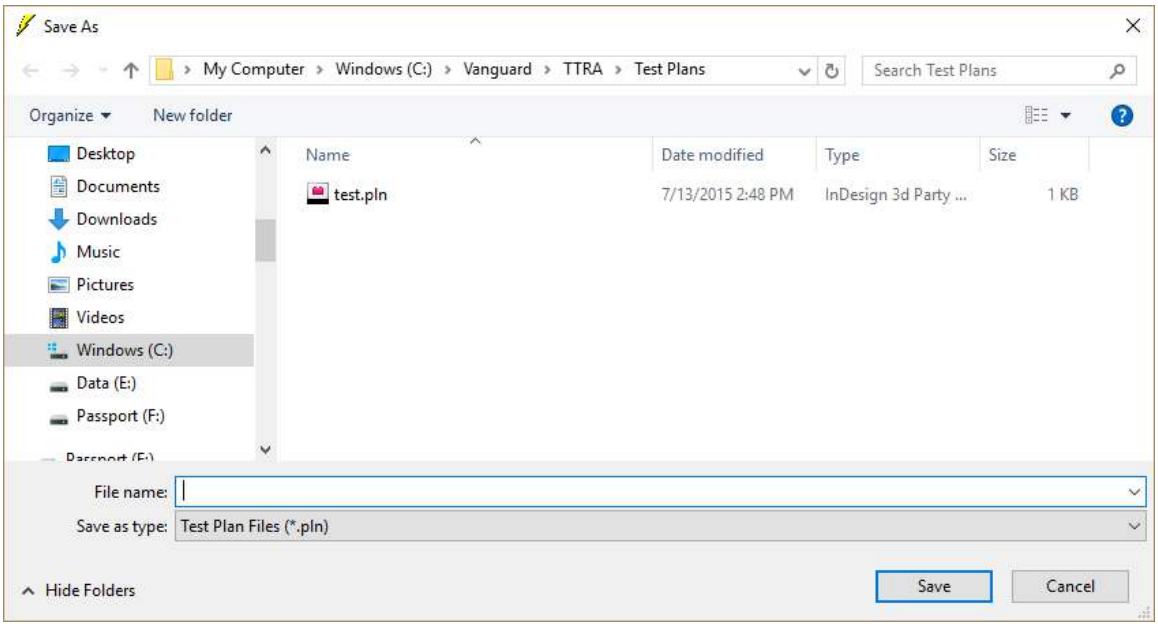
5.4 Saving a Test Plan

5.4.1. Saving a Test Plan With Its Original Filename

1. If changes have been made to the current test plan and you would like to save it with its original filename, click on the ***Save*** icon from the ***Test Plan*** command group.
2. The test plan will be saved with its original filename.

5.4.2. Saving a Test Plan With a Different Filename

1. To save the current test plan with a different filename, click on the arrow below the ***Save*** icon from the ***Test Plan*** command group and then select the *Save As* option. The following window will be displayed:



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

5.5 Moving, Copying, and Deleting Test Plans

Test plans are stored on your computer in the folder specified in the "Test Plan Path" parameter in the TTRA's application settings (please see section 3.4). You can copy, move, or delete the test plan files using Windows Explorer. To quickly access your test plans folder, click on the ***File Utilities*** icon from the ***Test Plan*** command group. The default location for your test plans will be opened in Windows Explorer and you can use standard Windows commands to move, copy, or delete the test plans.

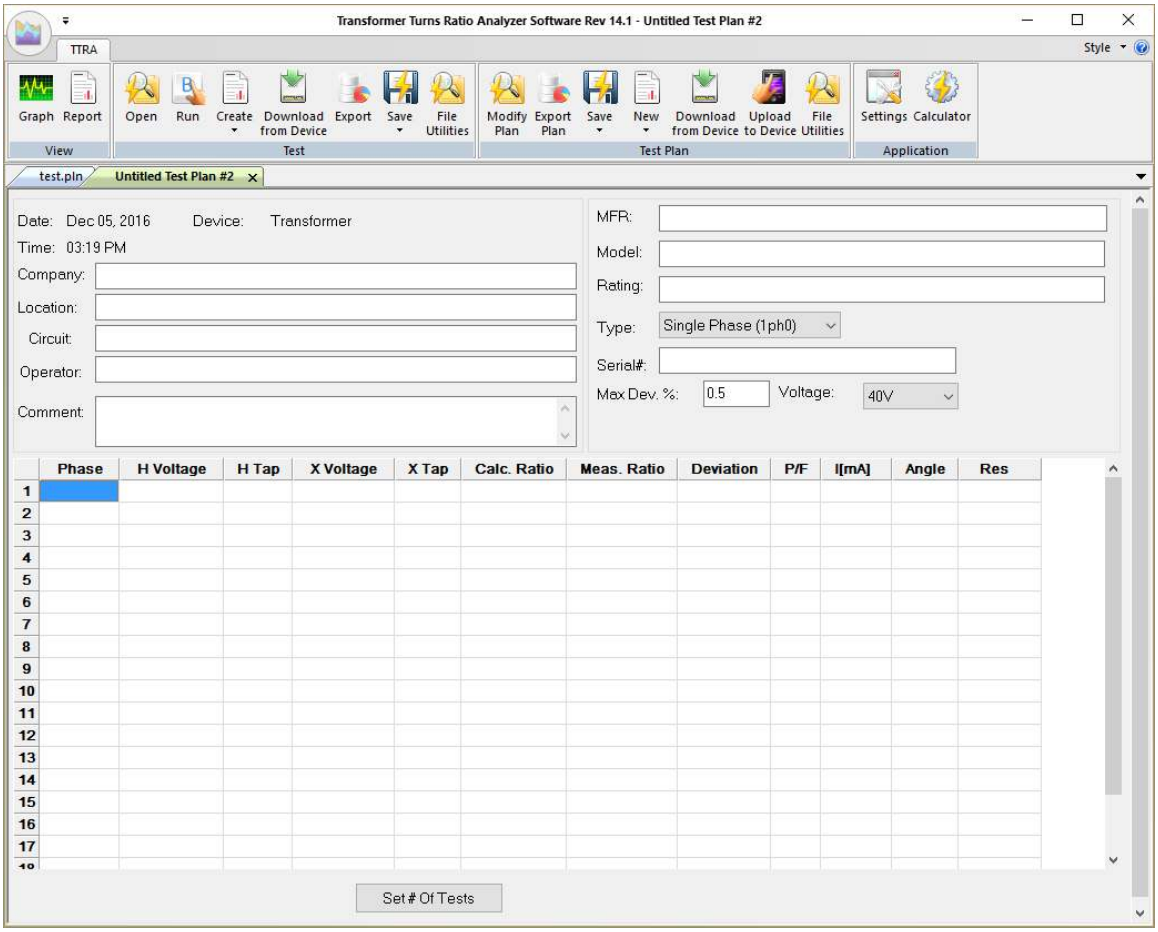
5.6 Creating Test Plans

The TTRA software can be used to create test plans for transformers, load tap changers, and voltage regulators.

5.6.1. Creating a Test Plan for a Transformer

To create a test plan for a transformer:

1. Click on the arrow below the ***New*** icon from the ***Test Plan*** command group and select *Transformer*. An empty test plan will be displayed as shown below:



2. The number of tests created is based on the "Test Limit" value set in the TTRA's application settings. You can over-ride this by clicking on the "Set # Of Tests" button at the bottom of the screen and then entering the number of tests you would like.
3. Enter the header information in the top section. You can use the **[Tab]** key to move from one input area to the next or you can click on the desired input area.
4. Click on the “Type:” drop-down list and select the transformer type.
5. You can set the maximum deviation percentage by clicking in the “Max. Dev. %” input area and typing in the desired value.

NOTE

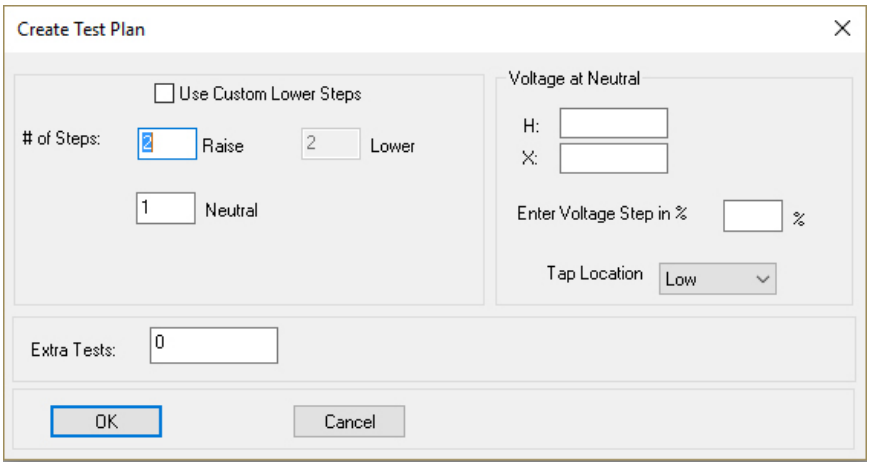
When using a test plan to run the turns-ratio test, the measured turns-ratio is compared against the calculated turns-ratio. The difference (deviation) between the two turns-ratios is calculated as the percentage difference (see section 4.6.2 for the formula). A deviation greater than the preset "Max. Dev. %" will be marked as "F" (Fail) in the "P/F" column.

6. To set the test voltage, click on the "Voltage:" drop-down list and select the desired test voltage (8 Vac, 40 Vac, or 100 Vac).
7. Enter the "H Voltage", "H Tap", "X Voltage", and "X Tap" values for the first row by clicking on each cell and then typing the value. You can also click on a cell, enter the value, and then press the **[TAB]** key to move to the next cell on the right. You can also use the up and down arrow keys to move vertically. Once the "H Voltage" and "X Voltage" values have been entered, the calculated ratio will be displayed in the "Calc. Ratio" column.
8. Once all information has been entered, save the test plan (see section 5.4).

5.6.2. Creating a Test Plan for a Load Tap Changer

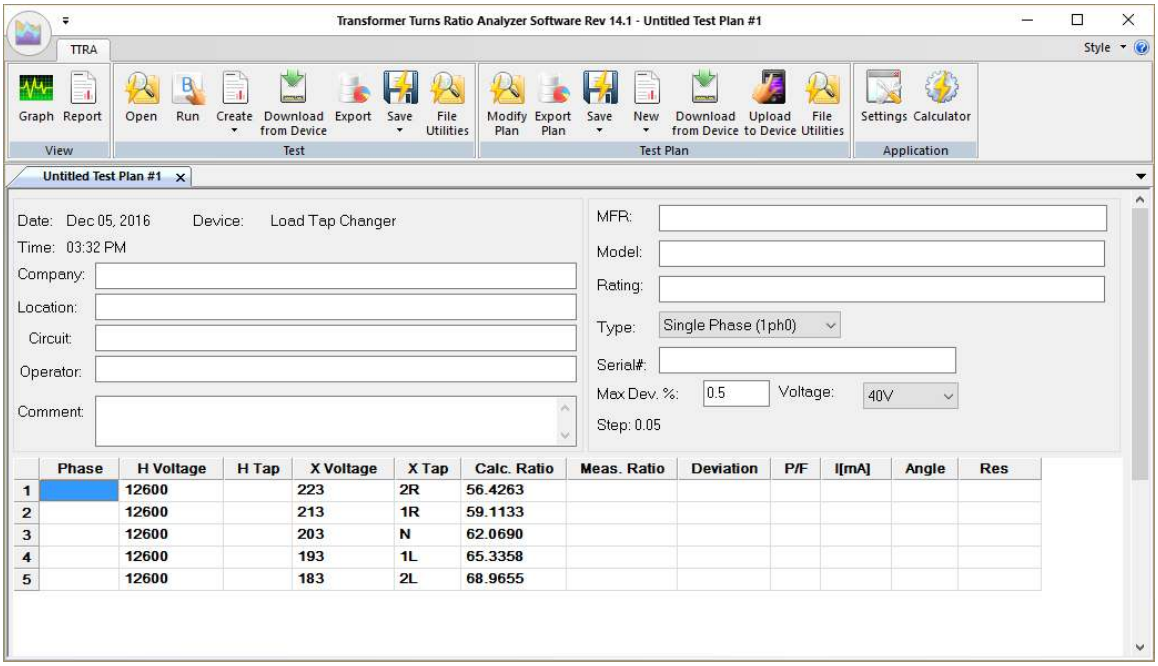
To create a test plan for a load tap changer (LTC):

1. Click on the arrow below the ***New*** icon from the ***Test Plan*** group and select *Load Tap Changer*. The following window will be displayed:



2. If the number of Lower steps is different than the Raise steps, check the "Use Custom Lower Steps" checkbox.
3. Enter the number of Raise steps in the "Raise" input field, and if applicable, the number of Lower steps in the "Lower" input field.
4. Enter the number of Neutral steps in the "Neutral" input field.
5. Enter the H and X voltage values at neutral in the corresponding input fields.
6. Enter the voltage step percentage value in the "Enter Voltage Step in %" input field. This defines the percentage by which each step voltage is raised or lowered.
7. Select the LTC tap location from the corresponding drop-down list. Select “Low” if the LTC taps are located on the low side of the transformer winding or “High” if the LTC taps are located on the high side of the transformer winding.
8. Enter the number of extra tests. This adds extra tests other than the ones automatically generated by the TTRA program. An extra row will be added in the test plan for each extra test.

9. Click on the “OK” button. An untitled test plan with the selected parameters will be created and displayed as shown below:



10. Enter the header information in the corresponding input fields.
11. If you had entered a number other than 0 for additional tests, enter the values for each additional test row (H Voltage, X Voltage, H Tap, and X Tap). You can also modify any of the H Voltage, H Tap, X Voltage, and X Tap values in the other rows by clicking on the corresponding cell and entering the new value.
12. Select the LTC type from the “Type:” drop-down list.
13. Enter the maximum deviation percentage in the “Max Dev. %” input field.
14. Select the test voltage from the “Voltage:” drop-down list.
15. Save the test plan (see section 5.4).

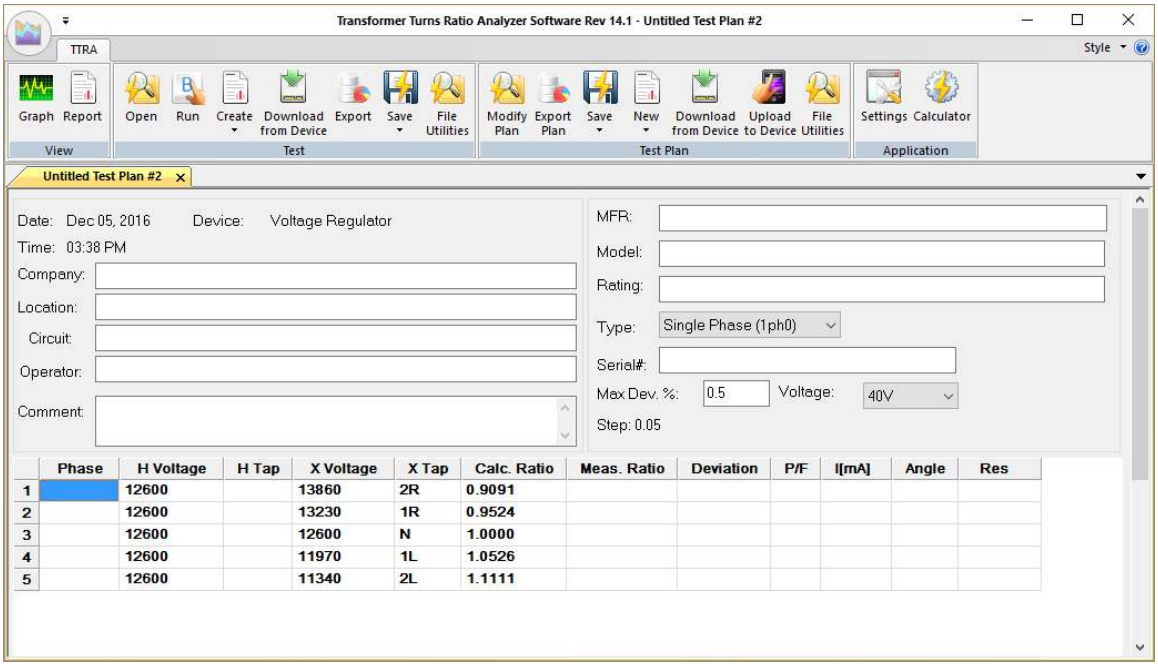
5.6.3. Creating a Test Plan for a Voltage Regulator

To create a test plan for a voltage regulator:

1. Click on the arrow below the ***New*** icon from the ***Test Plan*** command group and select *Voltage Regulator*. The following window will be displayed:

2. If the number of Lower steps is different than the Raise steps, check the "Use Custom Lower Steps" checkbox.
3. Enter the number of Raise steps in the "Raise" input field, and if applicable, the number of Lower steps in the "Lower" input field.
4. Enter the H voltage value at neutral. This is the high side voltage at neutral.
5. Enter the voltage step percentage value in the "Enter Voltage Step in %" input field. This defines the percentage by which each step voltage is raised or lowered.
6. Select the voltage regulator tap location from the corresponding drop-down list. Select “Low” if the voltage regulator taps are located on the low side of the transformer winding. Select “High” if the voltage regulator taps are located on the high side of the transformer winding.

7. Click on the “OK” button. An untitled test plan with the selected parameters will be created and displayed as shown below:



8. Enter the header information in the corresponding input fields.
9. Select the voltage regulator type from the “Type:” drown-down list.
10. Enter the maximum deviation percentage in the “Max Dev. %” input field.
11. Select the test voltage from the “Voltage:” drop-down list.
12. Save the test plan (see section 5.4).

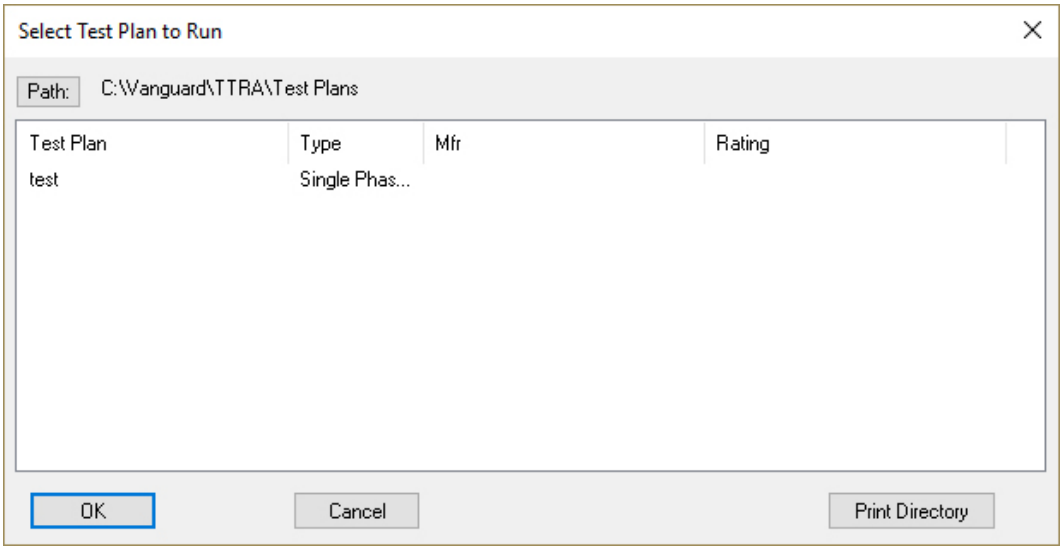
6.0 RUNNING TESTS

The TTRA software can be used to run transformer, load tap changer, and voltage regulator tests directly from the PC. This is especially convenient when used in conjunction with a test plan.

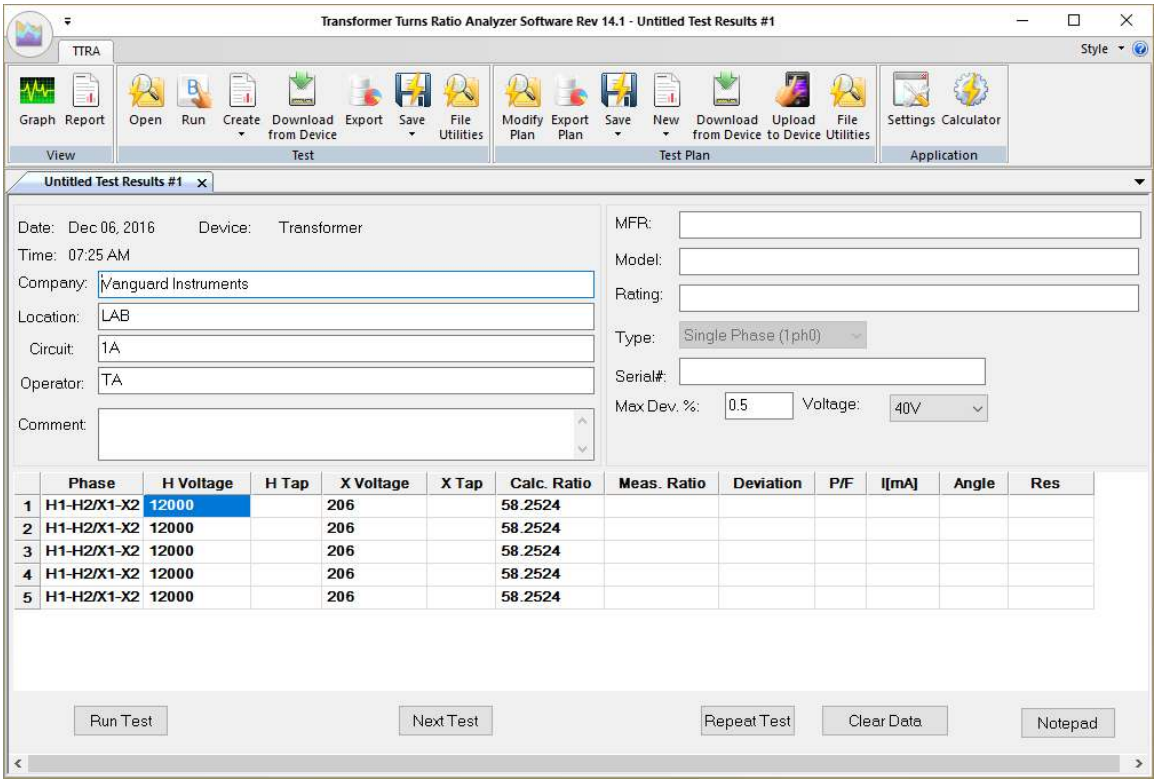
6.1 Running a Transformer Turns Ratio Test Using a Test Plan

Follow the steps below to perform a transformer turns ratio test using a test plan (the same procedure also applies for performing load tap changer and voltage regulator tests):

1. Connect the ATRT to the PC via the RS-232C port and put it in Computer Interface Mode (see section 3.3).
2. Connect the H and X leads per the ATRT's User's Manual.
3. Click on the ***Run*** icon from the ***Test*** command group. The following window will be displayed:

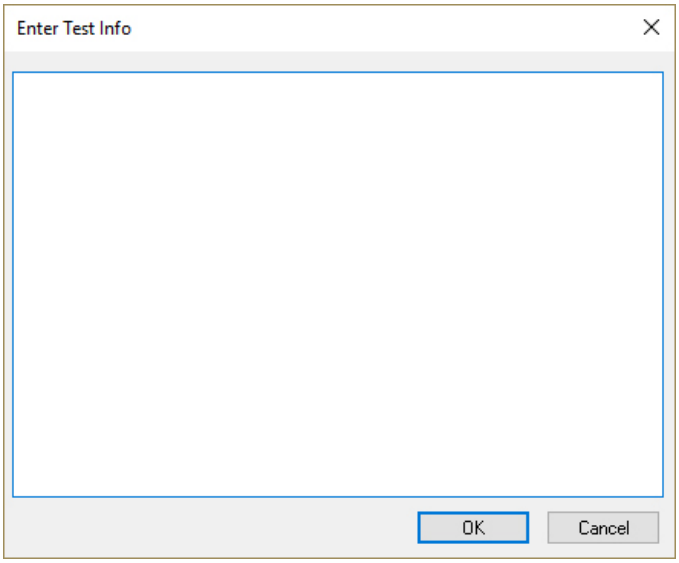


4. If the test plan you would like to use is not in the current directory, click on the “Path:” button at the top of the window and browse to the directory containing the file. Once you have located the test plan to be used, click on the filename, and then click on the “OK” button. The test plan will be loaded and the first test (first data row) will be selected as shown below:



5. To run a test, click on the “Run Test” button at the bottom of the window. The TTRA will initiate the test. Once the test is finished, the measured turns ratio, excitation current, and the phase angle measurement information will be filled in. If the test plan contained the transformer’s nameplate voltages, the “percentage deviation” and “P/F” columns will also be filled in.
6. You can enter the resistor value for each phase reading by clicking on the “Res” cell and entering the value.
7. The header information can also be edited as needed.
8. You can perform the next test by clicking on the “Next Test” button. If you would like to repeat the last test performed, click on the “Repeat Test” button.

9. A notepad is also available for entering any relevant information about the test. To access the notepad, click on the “Notepad” button. The following window will be displayed:



Type your notes and then click on the “OK” button.

10. Save your test record after performing all tests by clicking on the ***Save*** icon from the ***Test*** command group.

6.2 Running a Transformer Test Using the Create Test Option

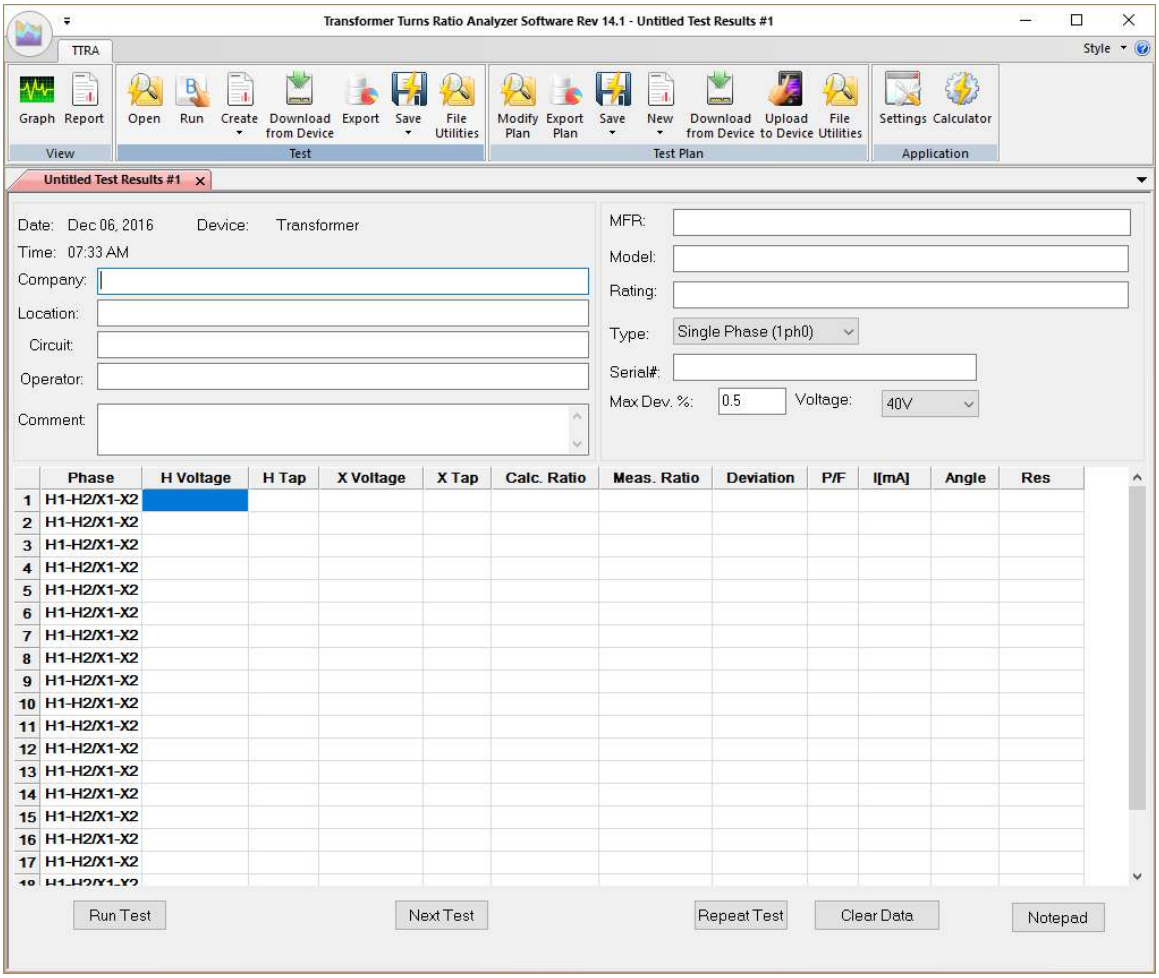
The ***Create*** option from the ***Test*** command group can be used to quickly perform a test without a test plan. To test a transformer using the ***Create*** option:

1. Click on the arrow below the ***Create*** icon from the ***Test*** command group and then select *Transformer*.

NOTE

You can also select *Load Tap Changer* or *Voltage Regulator* to create a Load Tap Changer or Voltage Regulator test respectively. You will then be asked for the relevant parameters for each test. Please see sections 5.6.2 and 5.6.3.

An untitled test plan will be displayed as shown below:



2. Fill in the header information.
3. Select the transformer type from the “Type:” drop-down list.
4. Edit the Max. Dev. % value if necessary.
5. Select the test voltage from the “Voltage:” drop-down list.

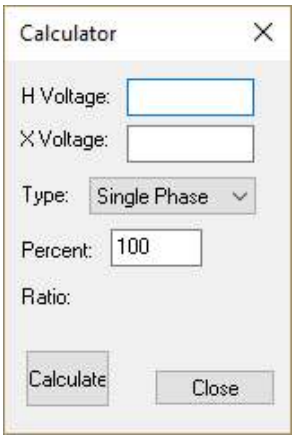
6. Fill in the transformer nameplate voltages. The “Phase” and “Calc. Ratio” fields will be filled in automatically.
7. Click on the “Run Test”, “Next Test” or “Repeat Test” button to test the transformer.
8. Once all tests have been performed, save your test record by clicking on the ***Save*** icon from the ***Test*** command group.

7.0 USING THE TRANSFORMER TURNS RATIO CALCULATOR

The TTRA software features a turns ratio calculator that can be used to quickly calculate the winding turns ratio of a transformer. To use the calculator:

1. Click on the Calculator icon from the Application command group. The calculator window will be displayed as shown below:

   Click on the ***File*** menu and select *Calculator*. The calculator window will be displayed as shown below:



2. Type the H and X voltage values in the corresponding fields.
3. Select the transformer type from the “Type:” drop-down list.
4. If desired, type a percentage value in the “Percent:” input field. This option calculates the turns ratio at the specified percentage of the nameplate voltage. For example, if the H nameplate voltage is 12,000V, the X nameplate voltage is 1200V, the transformer type is single phase, and the percentage value of 80 is used, the turns ratio will be calculated as:

   Ratio = (**V_H** / **V_X**) x (**Percent** / 100)

   = (12,000 / 1200) x (80 / 100)

   = **8.00**

5. Click on the “Calculate” button and the calculated ratio will be displayed to the right of the “Ratio:” label.

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