HIGHTEST TECHNOLOGY LIMITED

TURA-03 SERIES INSTRUCTION MANUAL

INDEX

DOCUMENTATION PRECEPTS

The following symbols and messages are used throughout this document and are according to ANSI Z535.6 (Product Safety Signs and Labels).

⚠ WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which if not avoided could result in minor or moderate injuries
NOTICE	Indicates information considered important, but not hazard related (e.g. messages relating to property damage)

SYMBOLS USED ON THE FRONT PANEL OF THE DEVICE

The following symbols are used on the front panel of the device.

	Indicates the test cable socket. Follow the instructions while inserting and removing the connector into and out of the socket as explained in section 7 of 'Front Panel Components'.
	Indicates the ground connector.
	Indicates both USB 2.0/1.1 Standard-A, USB 2.0/1.1 Standard-B ports available on the device for communication purposes.
	Indicates Fuse
I/0	Indicates ON/OFF operation
	Indicates 'Back' operation.

IMPORTANT SYMBOLS USED ON THE DISPLAY OF THE DEVICE

Following are some important symbols used on the main menu of the display.

	Indicates the charge status of the built-in battery.
	Indicates the 'Bluetooth' is active on the device.
	Indicates when an external USB is connected to the device.

GENERAL INSTRUCTIONS

NOTICE

This guide applies to the TURA-03, TURA-03 BLUE, TURA-03B and TURA-03B BLUE Turn Ratio Measurement devices (aka TURA-03 Series). The operating procedure is almost the same for the three models, and any differences between these models are clearly described in this manual.

⚠ WARNING

Before turning on the device, please read all instructions and follow the instructions as it works. With the purchase of the device, the user assumes all responsibility for the operation of the device. HIGHTEST Technology Ltd. It assumes no responsibility for the misuse of the device or the compliance of safety precautions.

⚠ CAUTION

All test personnel measuring with the TURA-03 Series must be trained and competent to enter substations and fully understand the requirements for performing the turn ratio tests. All test personnel should stay away from high voltage equipment directly or indirectly during testing.

⚠ WARNING

DO NOT MODIFY THE TEST EQUIPMENT

To avoid the risk of unknown hazards in addition to possible hazards, do not make any modifications to the device and do not use non-original accessories. To ensure that all the safety features of the design are maintained, it is strongly recommended that repairs be made only by HIGHTEST factory service personnel or authorized service. Unauthorized modifications can cause safety hazards and will void the manufacturer's warranty.

WORK SAFETY

Never assume that equipment is safe to handle without using the necessary safety precautions. All procedures must comply with local safety regulations. All equipment must be inspected for damage before use. Damaged equipment must not be used. Avoid testing alone. In the event of an emergency another person's presence may be essential. Make sure that the transformer to be tested is de-energized. Before connecting the test cables to a transformer, ensure that the grounding input of the TURA-03 Series is connected to the ground of the substation. Make sure that the power cord supplied with the device is plugged into a grounded socket.

NOTICE

There is a risk of electric shock if the device is not grounded and/or the power cord is not connected to a grounded socket. It may damage the instrument and/or cause injury to test personnel.

⚠ CAUTION

ENVIRONMENT CRITERIA

TURA-03 Series is designed for both indoor and outdoor operations.

Humidity: Confirm that relative humidity is less than 90% and non-condensing.

Temperature: Confirm that ambient temperature is within the acceptable range as specified in the technical specification.

Altitude: 2000m (6562 ft) to fully safety specifications.

INSTRUMENT CONNECTION AND ACTIVATION

When the internal battery is charged, the HIGHTET device does not need to be connected to a power supply. When the internal battery is not charged the HIGHTET device can be powered by connecting an AC power supply. Do not use non-original power cords.

Input Power Supply: 100-240 V (Permissible deviation: ±15%), 47/63 Hz

Battery: 14.4 V 3.6 Ah

CONNECTING AC POWER SUPPLY

Verify that the AC power supply meets the HIGHTET device input requirements.

NOTICE

CHARGING INTERNAL BATTERY

Once the AC power supply is connected, the integrated battery will automatically begin charging.

⚠ CAUTION

REPLACING INTERNAL BATTERY AND FUSE

Replacing internal battery and fuse should only be performed either by a HIGHTEST technician or authorised personnel of HIGHTEST. Unauthorised modifications can cause safety hazards and will void the manufacturer's warranty. HIGHTEST Technology Ltd. It assumes no responsibility for the misuse of the device or the compliance of safety precautions.

STORAGE, MAINTENANCE & REPAIRS

Do not store the HIGHTEST device outdoors in extreme weather conditions. The storage temperature must comply with the temperature range specified in Section "Technical Data". Repairs and maintenance should only be performed by a HIGHTEST technician or authorised personnel of HIGHTEST.

Features

- Turns Ratio Measurement (Single-phase and three-phase measurement)
- From 0.8 to 50,000 Ratio Measurement
- High Accuracy (0.08 %)
- Ratio Error Measurement
- Excitation Current, Phase Angle, Polarity Measurement
- Automatic vector group detection feature
- Built-in Printer
- Optional Battery (Models: TURA-03B & TURA-03B BLUE)
- Internal Memory, USB Flash Drive
- PC control via USB cable
- Optional Bluetooth control and communication (Models: TURA-03 BLUE & TURA-03B BLUE)
- 7-inch large colour touch display

Technical Specifications

Measurement Parameters	Turns Ratio Measurement, Excitation current, Phase Angle, Polarity, Ratio Error(%), Vector Group Detection, Magnetic Balance		
Ratio Measurement Modes	CT and PT Mode (Single-Phase and Three-Phase)		
Measurement Method	ANSI/IEEE C57.12		
Test Voltages	CT Mode: 1 V and 4 V PT Mode: 1, 4, 10, 40, 100, 250 V		
Ratio Range	0.8 – 50,000		
Accuracy	Mode	Accuracy	Ratio
	CT Mode (1V -4 V)	0.08 % 0.1 %	0.8-399 400-4000
	PT Mode (10 V- 250 V)	0.08 % 0.15 % 0.5 %	0.8-5000 5001-12000 12001-50000
Phase Angle Measurement	0-360 Degree, ±0.2 degree (±1 digit)		
Excitation Current	2 A, 2 % of reading (±1 mA)		
Power Supply	100-240 V, 47/63 Hz		
Battery	14.4 V 3.6 Ah, Optional (Models: TURA-03B & TURA-03B BLUE)		
Memory	Up to 100 records (include up to 25 tap results) Unlimited Storage using an external USB		
Printer	2.28-inch printer		
Communication	USB 2.0/1.1 Standard-A, USB 2.0/1.1 Standard-B, Optional Bluetooth (Models: TURA-03 BLUE & TURA-03B BLUE)		
PC Software	DMP Software		
Display	7-inch colour touch display		
Dimensions	16.7" x 13.4" x 6.8" (424 mm x 340 mm x 173 mm)		
Weight	7.1 kg		
Working & Storage Temperature	Working: -10 °C to +60 °C, Storage: -30 °C to +70 °C		
Protection Class	IP67 (Case Closed)		
Set of Package	TURA-03, Power Cable, Ground Cable, 5m Standard Test Cable Set, 10m Extension Cable Set, Tap Changer Cable Set, USB Cable, Printer Paper (x2), USB flash drive, Instruction Manual (Soft Copy), DMP Software, Cable Bag		
Options	Hard Carrying Case, Bluetooth (refer the ordering info), Battery(refer the ordering info)		
Ordering Information	TURA-03, 250V Three-Phase Transformer Turns Ratio Tester with Built-in Printer		
	TURA-03 BLUE, 250V Three-Phase Transformer Turns Ratio Tester with Built-in Bluetooth & Printer		
	TURA-03B, 250V Three-Phase Transformer Turns Ratio Tester with Built-in Battery & Printer		
	TURA-03B BLUE, 250V Three-Phase Transformer Turns Ratio Tester with Built-in Battery, Bluetooth & Printer		

Scope of Supply

If any of the following content is missing or damaged, please contact your authorized distributor or HighTest Technology Ltd.

Standard Content List

MCS - TURA03-H	5m H Measurement Cable Set for TURA-03
MCS - TURA03-X	5m X Measurement Cable Set for TURA-03
ECS - TURA03-H	10m Extension Cable Set for TURA-03
ECS - TURA03-X	10m Extension Cable Set for TURA-03
PWC-01	1.8m Power Cord with Type F plug
GC-01	2.5m Hightest Standard Ground Cable
USB-01	1.8m USB Cable to connect Hightest devices with PCs
USB-02	USB Flash drive (DMP, Manual, Brochure)
TCS-01	1m Tap changer Cable Set
ECS-TC	4m Extension Cable for Tap Changer Cable Set
PP-57	Thermal Printer Paper
SCB-03	Soft Carry Bag for Cables (TURA-03, WINRES, ARES, CIBRE)

External/Optional Accessories

The following accessories are not included in the standard box contents. Please contact your authorized distributor or HighTest Technology Ltd.

- Hard Carrying Case

Overview

TURA-03 Three Phase transformer turns ratio tester is designed to find the transformer conversion rate automatically and reliably. TURA-03 is capable of high accuracy (up to 0.08%) and a wide range (up to 50000: 1) ratio testing.

TURA-03 is a high precise, fully automatic, microprocessor based three-phase transformer turns ratio meter. HighTest Technology Ltd. has produced TURA-03 after long R&D efforts to make accurate and precise measurements even at higher rates.

TURA-03's 7-inch TFT touch screen provides great convenience to users. TURA-03's advanced communication technologies make it able to control and monitor tests with both wired and wireless means. The results can be saved in the internal memory of the device or to an external memory location. You can create and save templates for frequently using transformer types and perform more rapid tests.

TURA-03 is resistant to impacts and water proof due to its robust case and watertight enclosure. TURA-03 detects connection problems on sides H and X, notify the user by terminating the test in case of short circuit. 1 Vac, 4 Vac, 10 Vac, 40 Vac, 100 Vac and 250 Vac test voltages allow testing different types of transformers.

Transformer Turns Ratio Test Principle

Transformer turns ratio testers are used to test and control, number of turns on the primary side and secondary side of the transformers. Transformer turns ratio testers give the ratio between the primary and the secondary windings instead of giving the winding turns numbers directly.

It is the best method for testing short-circuits windings and incorrect tap changers.

Transformer turns ratio testers measures the voltage from the secondary by applying the desired test voltage to the primary and calculates the primary/secondary wire-winding ratio of the transformer.

The turns ratio and voltage ratios are the same for single-phase transformers. However, the turns ratios and voltage ratios may not be the same for 3-phase transformers.

Application Fields of Transformer Turns Ratio Tester

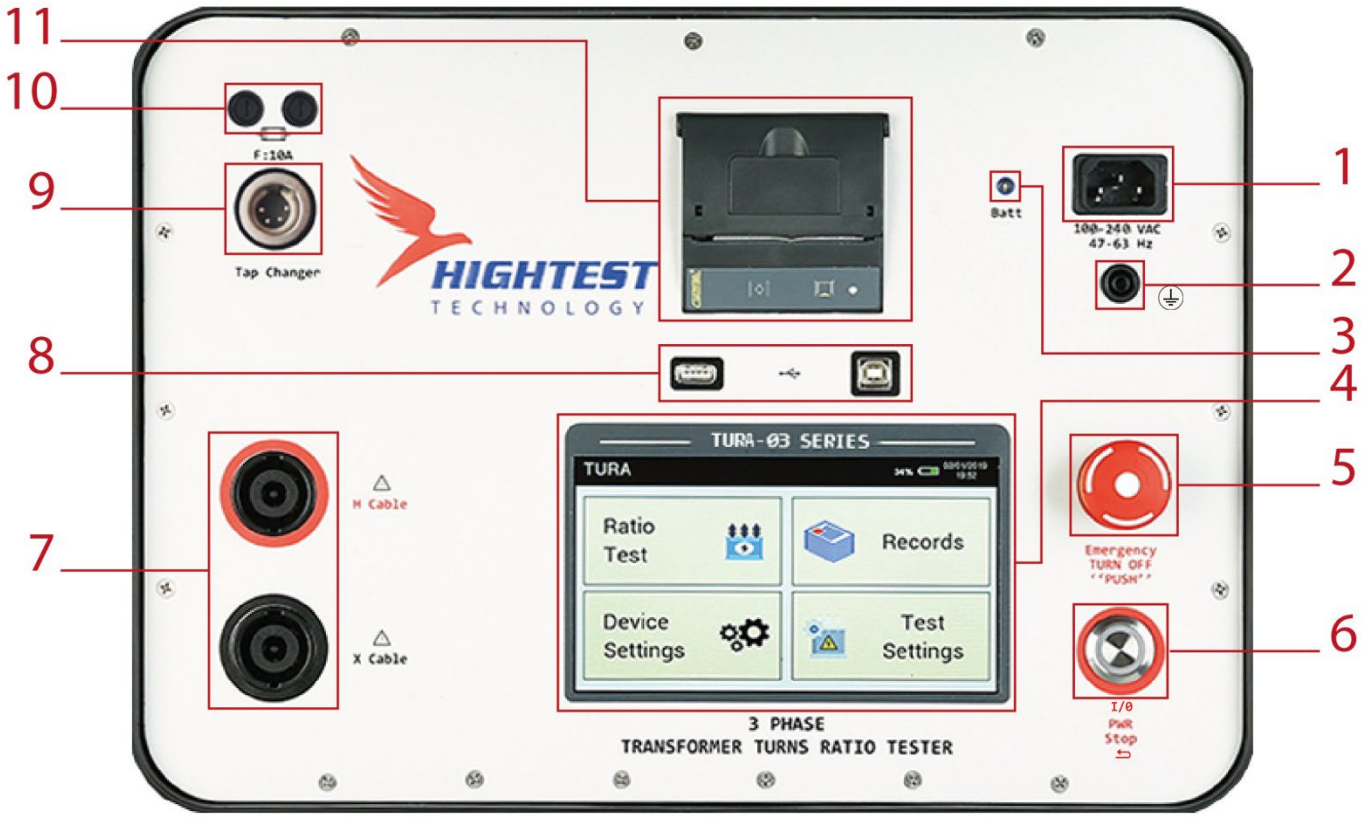
To detect issues such as.

- Short-circuited windings
- Wrong windings
- Defective or incorrect tap settings
- Incorrectly labeled transformers

You can easily find it using TURA-03. Furthermore, the turns ratio test is part of the acceptance tests of the routine preventive maintenance program, which must be carried out at the production stage of the transformers.

Section 1

Front Panel Components



1. Power Connector

- TURA-03 AC power input
- The input voltage should be between 100-240Vac 47/63 Hz.

2. Ground Connector

- Make sure the Ground is connected prior to energising and testing.

3. Charging Indication LED

- LED flashes while the device is under charging.
- If the device is fully charged, the indicator LED stops flashing and stays light up continuously.

4. Display

- 7-inch Resistive Touch TFT Display great convenience to users.
- It allows TURA-03 to show all measurement results on a single screen.
- Visibility in daylight and low light levels
- Able to adjust brightness level.

5. Emergency Stop Button

Push the emergency button while testing to stop the ongoing test in an emergency situation. In addition to designated 'Emergency Button', TURA-03's power button will also function as 'Emergency Stop'.

6. Power Button

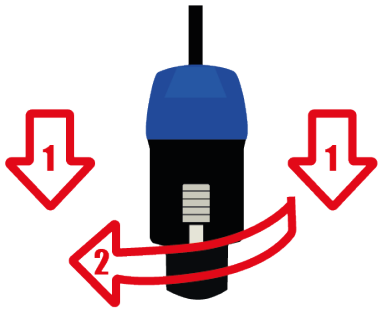
Power Button has some specific tasks apart from the intended purpose.

- To turn ON the device.
- Pressing the power button for 2 seconds while the device is ON will switch off the device automatically. (Display status is negligible.)
- You can switch the device OFF by a single press on the power button while the device is on the main page.
- Can be used as "**Back**" button on pages other than the home page.
- Can also be used as an "**Emergency Stop**" while performing the test.

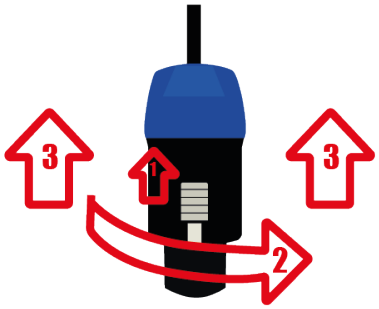
7. H & X Cable Connector

To connect the test cables to TURA-03. Make sure the test cable is properly connected before starting the test.

- Snap the test cable into place and turn it clockwise slightly. Check the latch is locked.



- To remove the test cable, hold the latch UP slightly, turn it counterclockwise and pull it out.



8. USB Connection Port

There are two USB ports available on TURA-03.

- USB 2.0/1.1 Standard-A, to connect external USB flash drive to save the test results and to update software.
- USB 2.0/1.1 Standard-B, to control TURA-03 via computer. The cable to be used should not be longer than 1 meter.

9. Tap Changer Output

TURA-03 comes with built-in Tap Changer Control unit. Users can control Tap changer with menu available on display while performing test. No need for addition remote control for tap changing. You can easily set tap changer contact time or wait time with the available on-screen settings.

10. Fuse

To provide overcurrent protection for electrical circuit of TURA-03.

11. Printer

TURA-03 comes with 2.28-inch built-in printer which allows the operator to print the measurement results. If the paper is empty, lift the printer cover up to load new paper roll and close the cover.

Section 2

Operating Instructions

1. Instructions

- Unlock the enclosure tabs on the front side of the case to open the lid.
- Connect the test cables according to the instructions described above.
- Always; connect the test cables marked **"H"** to the higher winding side of the transformer and the cables marked **"X"** to the lower winding side of the transformer.
- Switch ON the device by pressing the power button of the device.
- Apply the procedures described as below and introduce the test parameters to the instrument.
- Finally, you can test by pressing **"Test"** tab, save the test results in the device memory or print them.

2. Current Transformer Test

- Voltage and current transformers have reverse test connection configurations.
- When testing current transformers with TURA-03, the cables "**H**" must be connected to the "**S**" terminal of the current transformer and the "**X**" cables must be connected to each other through the current transformer.

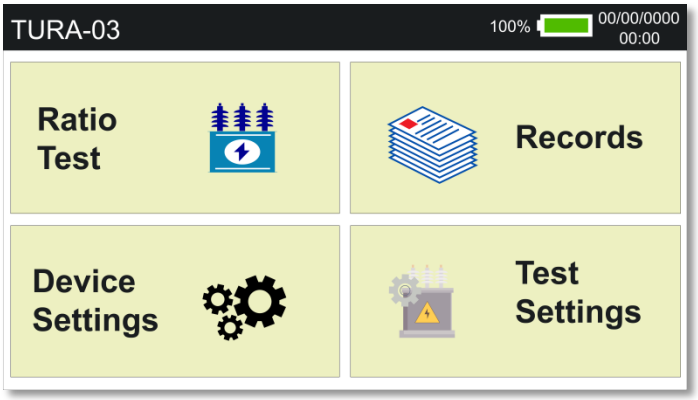
3. Three Phase Transformer Test

- Turns ratio test on three phase transformers is based on the principle of single phase measurement.
- To understand the configuration, it is necessary to know the phase relations and the vector diagram.
- TURA-03's large display shows all measurement results on a single screen.

Section 3

Display Introductions

Home Page



- To perform single-phase or multi-phase testing.
- To access test records.
- To alter device settings.
- To add test settings and create test templates.
- Displays the date and time information.
- Indicates the current date and time
- Indicates when Bluetooth is active.
- Indicates when the USB memory is inserted. If it is green, the automatic recording option is active.
- Indicates the battery level and status
- Critical battery warning. If the battery is at/below 15%, the display shows the warning. If the battery is at critical level, no test can be performed.

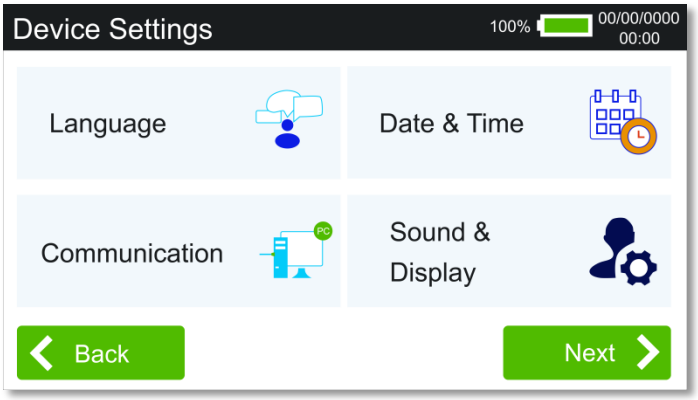
1. Device Settings

In this menu the device setting can be altered. Device settings consist of 2 pages. You can use the '**Next**'/ '**Back**' tabs to navigate through the pages. You can make the following settings under this menu:

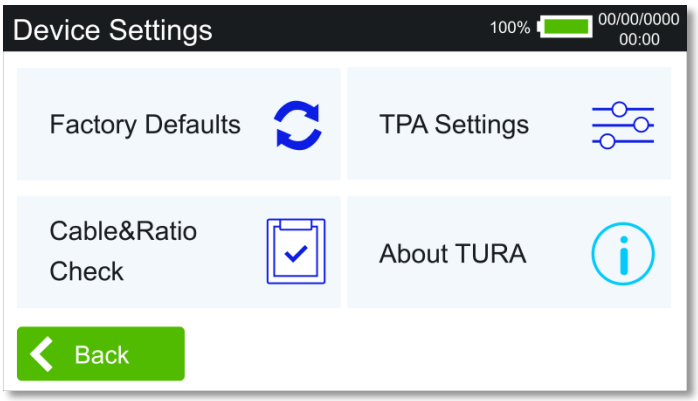
1. Language Settings
2. Date and Time Settings
3. Communication Settings
4. Audio and Display Settings
5. Factory Defaults
6. Tap Changer Settings
7. Cable and Ratio Check

8. About TURA

Following is the page 1 of '**Device Settings**'



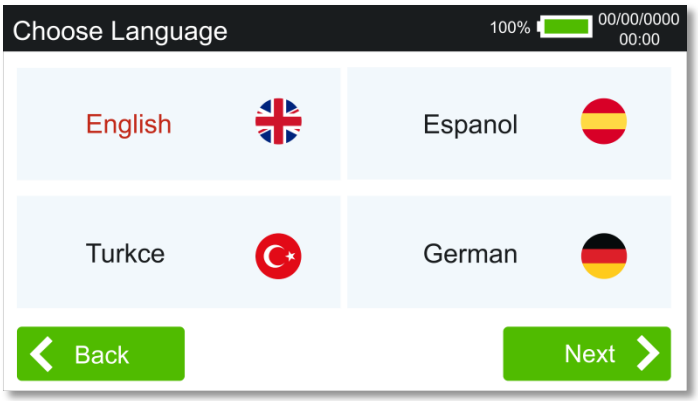
Press the '**Next**' tab to navigate to the page 2 of '**Device Settings**'



1.1 Language Settings

TURA-03 series supports multiple languages including EN, ES, TR, DE and FR. (Portuguese and many more will be added soon)

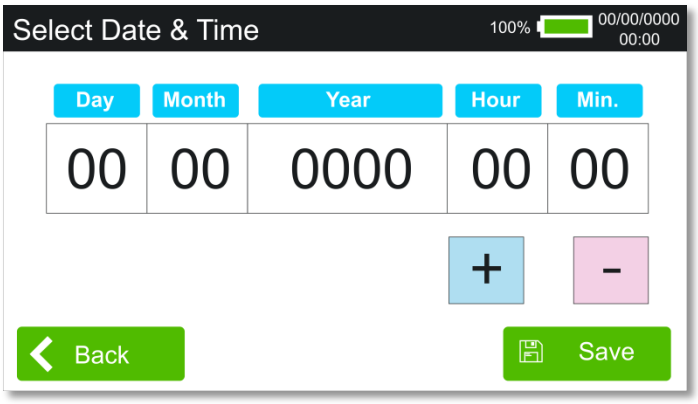
- Press the '**Language**' tab to choose the desired language for changing the default language of the device.
- The active language is marked in red.
- Exit the menu by using the '**Back**' tab.



1.2 Date and Time Settings

TURA-03 has a high accuracy real time clock.

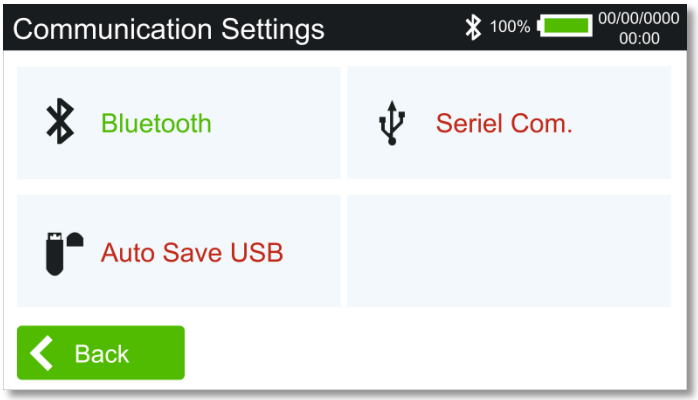
- Press '**Date & Time**' tab in the '**Device Settings**' menu to change date or time.
- Choose the parameter to be changed and then use '+/-' tabs to alter it.
- Press '**Save**' after making the necessary changes.



1.3 Communication Settings

TURA-03 has multiple communication options.

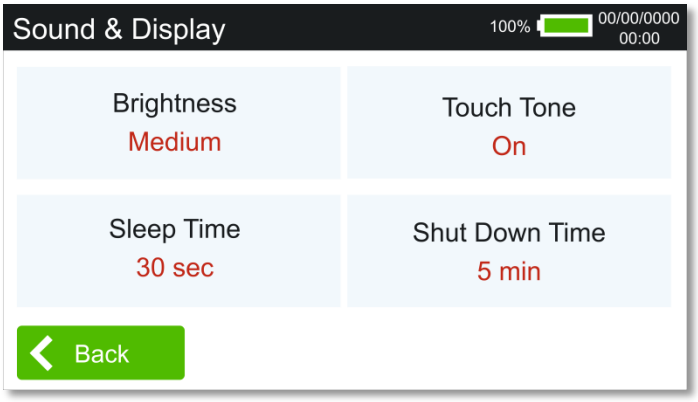
- To control TURA-03 via Bluetooth, activate Bluetooth broadcasting by pressing '**Bluetooth**' tab.
- To control TURA-03 via PC Software, activate connection by pressing '**Serial Com.**' tab.
- TURA-03 cannot be controlled simultaneously by Serial Communication and Bluetooth. Either one of these two options can be activated at a time.
- The USB connection is activated by pressing the '**USB Storage**' tab to automatically store the test results on the USB memory.
- The chosen option is highlighted in Green.



1.4 Sound and Display Setting

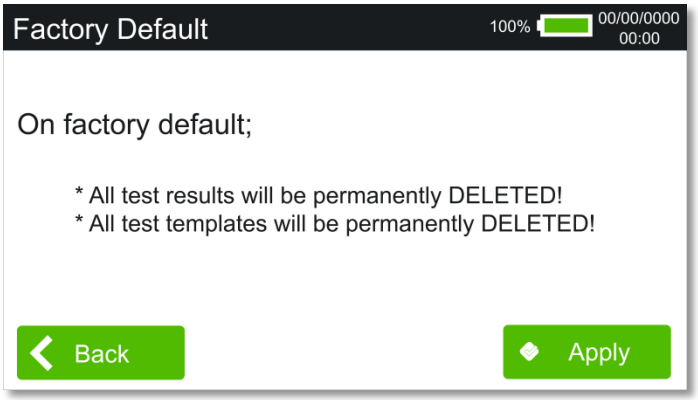
To change Sound and Display settings.

- **Brightness**: The brightness of the display can be set to high, medium and low. Keep the screen brightness to a minimum for longer battery life.
- **Touch Tone**: To turn ON/OFF the touchpad sound.
- **Sleep time**: To set the '**Sleep Time**' to automatically turn off the Display after a certain seconds/minutes of inactivity. To turn it on again, press the Power button.
- **Shut Down time**: To set a time to automatically turn OFF the device after a certain seconds/minutes of inactivity.



1.5 Factory Default

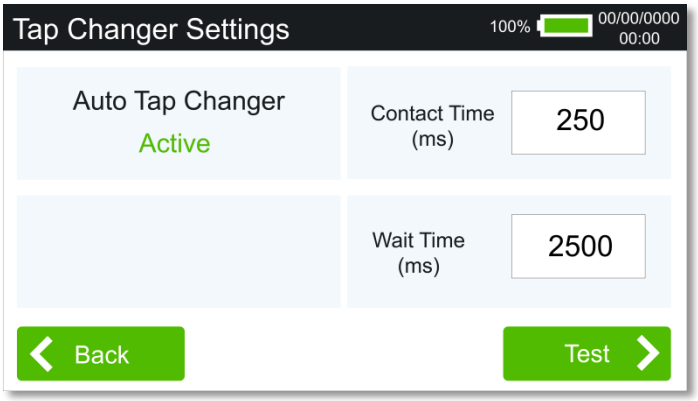
To reset the device to factory default settings. All the saved test results and templates will be permanently deleted.



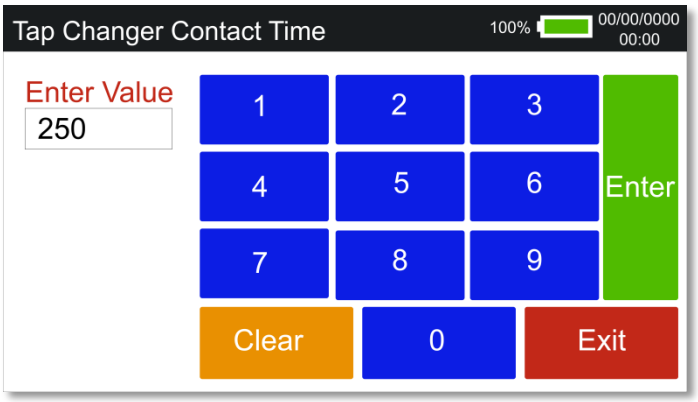
1.6 Tap Changer Settings

To set Tap changer contact time and wait time;

- The Auto Tap Changer option must be activated to use the '**Automatic Tap Changer**'
- '**Contact Time**' is the pulse duration for the automatic tap changer.
- '**Wait Time**' is the waiting time after automatic tap is changed.

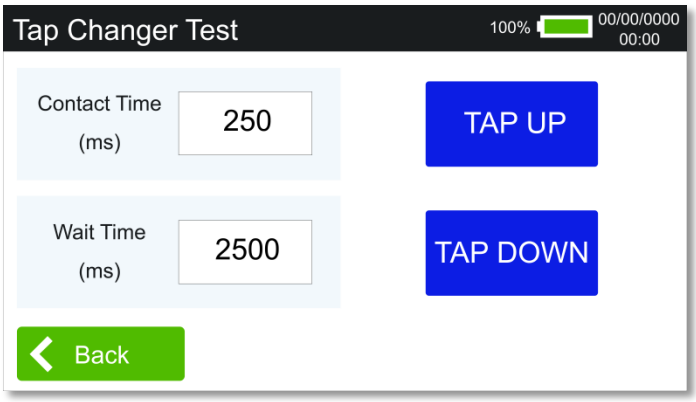


To set the contact time, tap on the space provided to enter '**Contact Time**'. Then the following window will open. Press '**Enter**' to save the value and return to the previous page.



And to set the wait time, tap on the space provided to enter '**Wait Time**'. Then the following window will open. Press '**Enter**' to save the value and return to the previous page.

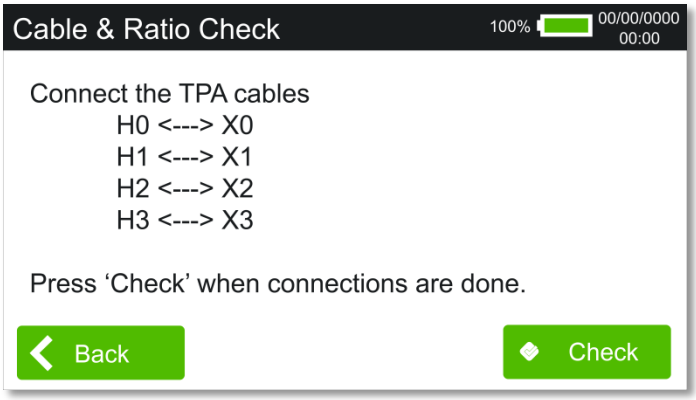
Also when you press '**Test**', the following window will open where you can set the contact time and wait time for tap changer and check it by pressing '**TAP UP**' or '**TAP DOWN**'.



1.7 Cable and Ratio Check

TURA-03 Series shows the cable connections between TURA and transformer to be tested which indeed helps the operator to check whether the connections are done properly.

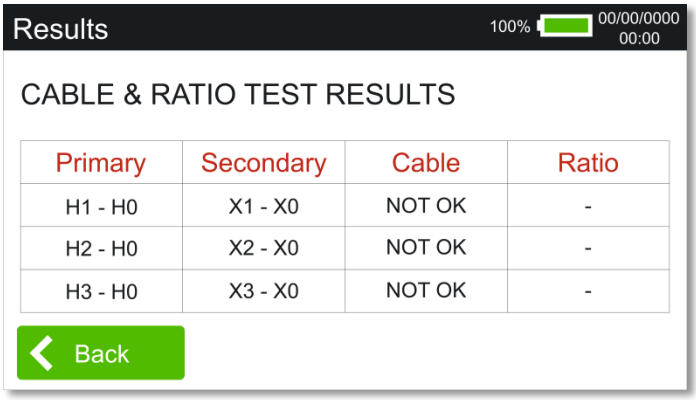
Following page shows how to make connections of TURA-03.



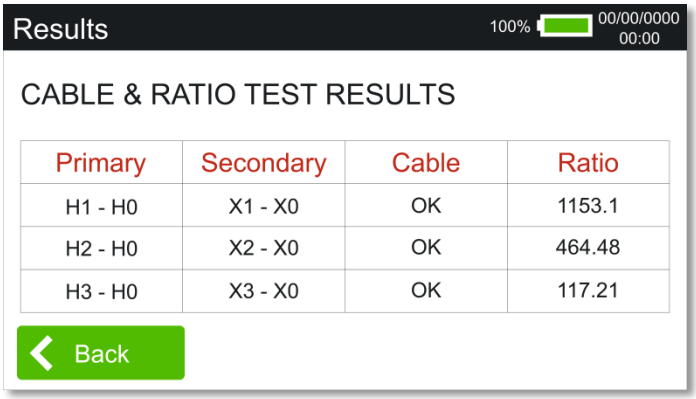
After making the connections, you can check by pressing '**Check**'.

CAUTION!

During the test, you can press 'Emergency Stop' button on the front panel or you can touch on the 'Screen' or simply press the 'Power Button' in an emergency situation. The test will be cancelled immediately.



If it shows **NOT OK**, you must check the connection once again and should perform it again.

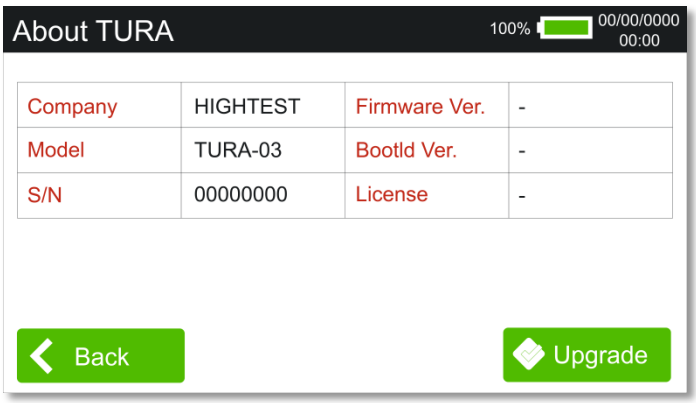


If it says **OK** then you can proceed to Ratio checks.

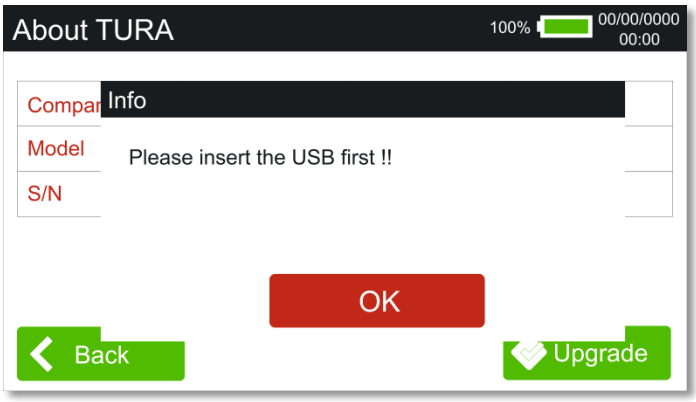
1.8 About TURA

Information about TURA-03 is available.

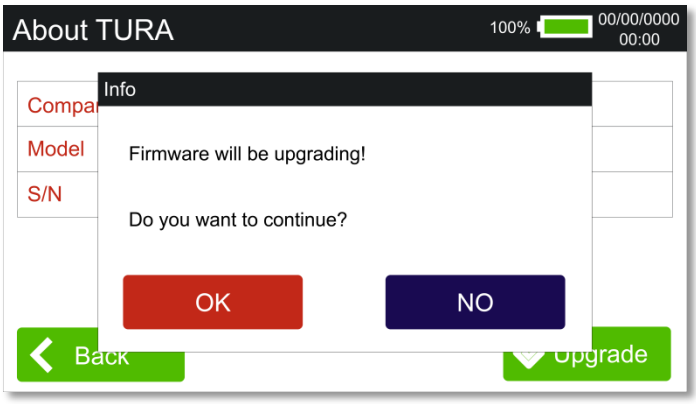
Download the latest version of software from www.hightest.co.uk for software update and by using a USB, you can update the device by pressing 'Upgrade' tab.



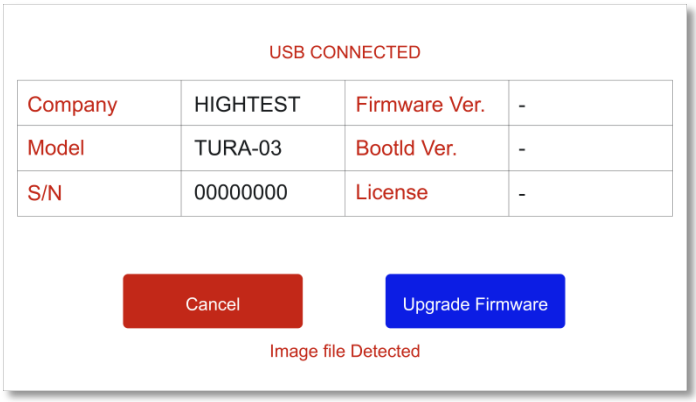
If the USB is not connected, the following pop-up will appear on the screen.

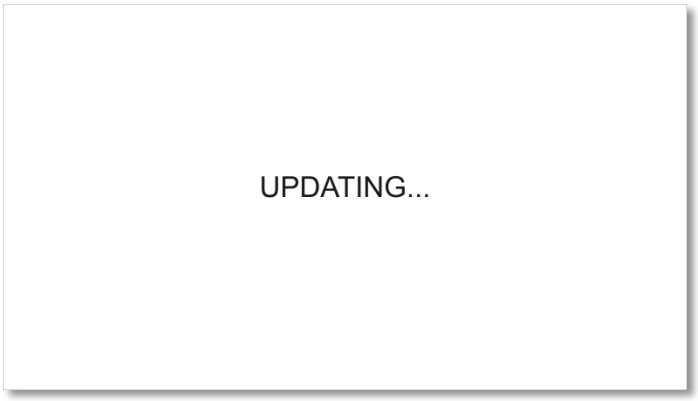


After connecting the USB and pressing the '**Upgrade**' tab the following window appears. Press '**Ok**' to continue the upgrading process.



Then the following screen will appear and press '**Update Firmware'** tab to update the TURA's firmware.



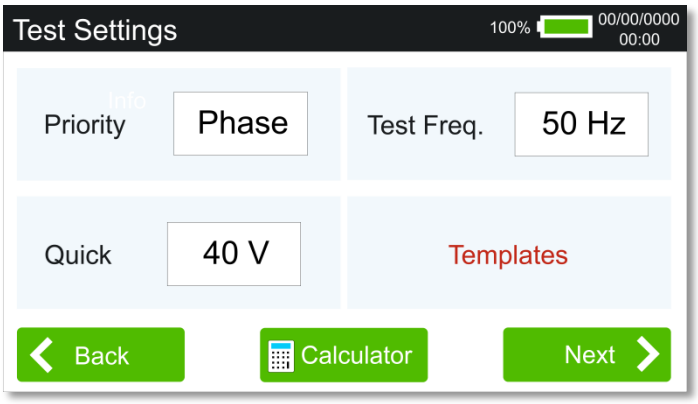


2. Test Settings

Available on the '**Home Page**' to make necessary settings related to the test to be performed. Test settings consist of 4 pages and you can use the '**Next**'/'**Back**' tabs to navigate through the pages. You can make the following settings under this menu:

- Priority Settings
- Test Frequency Settings
- Quick Test Menu
- Calculator
- Templates
- Comparator Settings
- User Info
- Transformer Info

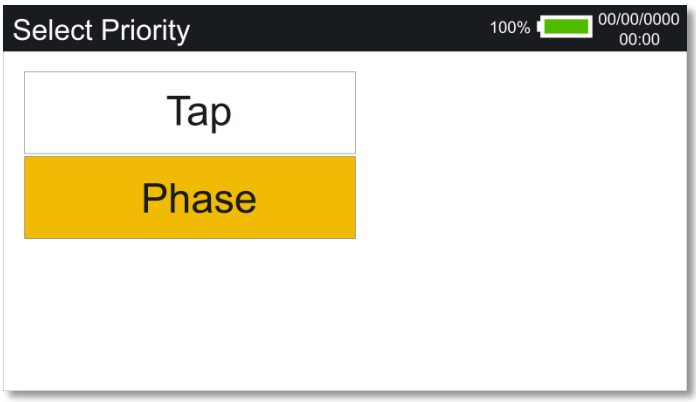
You can see details of first page of the device settings below



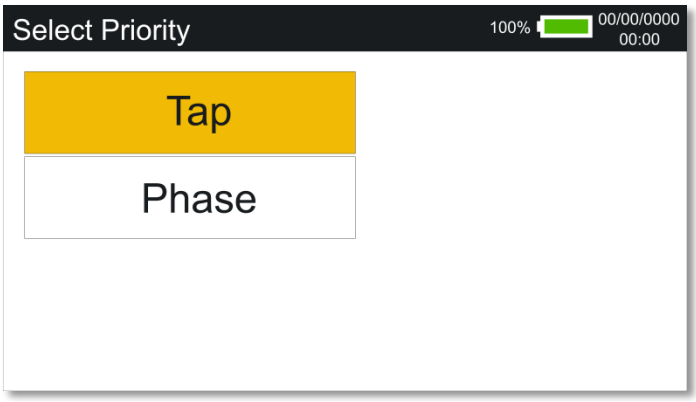
2.1 Priority Settings

In this menu; the test priority is selected. Three phase transformers with multiple taps can be tested according to tap or phase priority

If the '**Phase**' option is active: First, it performs tests for all phases of tap 1. So L1, L2 and L3 are tested and the tap is changed to 2. By continuing this sequence L1, L2 and L3 are tested for the last tap and the test ends.

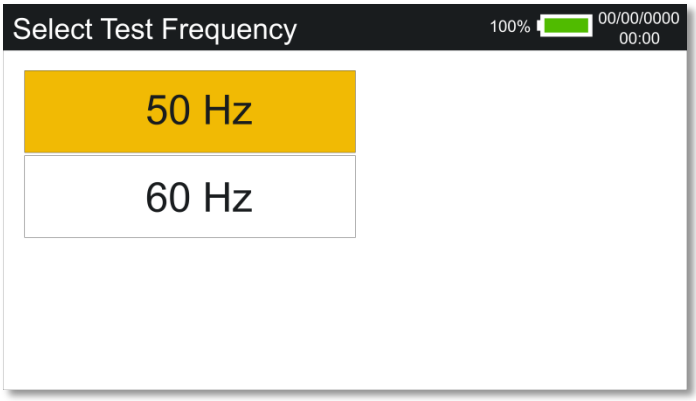


If the '**Tap**' option is active: First, the L1 phase of the 1st tap is measured and then followed by L1 phase of the 2nd tap. After completing the tests for L1, it performs the tests of L2 phase from 1st tap to the last stage. Finally, it carries out the tests of the L3 phase from the 1st tap to the last stage.



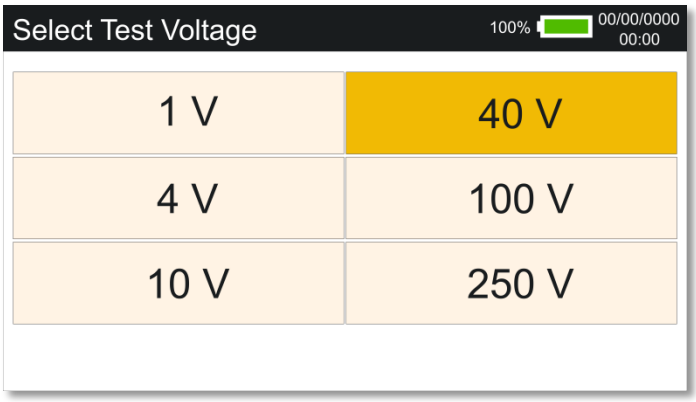
2.2 Test Frequency Settings

Test frequency is selectable; either **50 Hz** or **60 Hz** according to the user's preference.



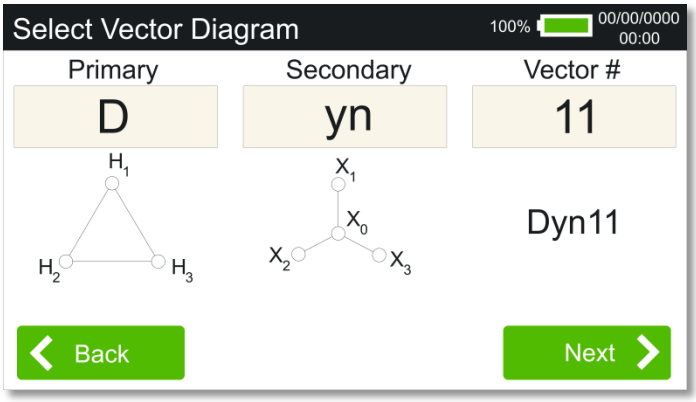
2.3 Quick Test Menu

To choose the test voltage for quick test. Test voltage is selectable from the following menu according to the user's preference. Users can choose from the following values; 1 V, 4 V, 10 V, 40 V, 100 V and 250 V.



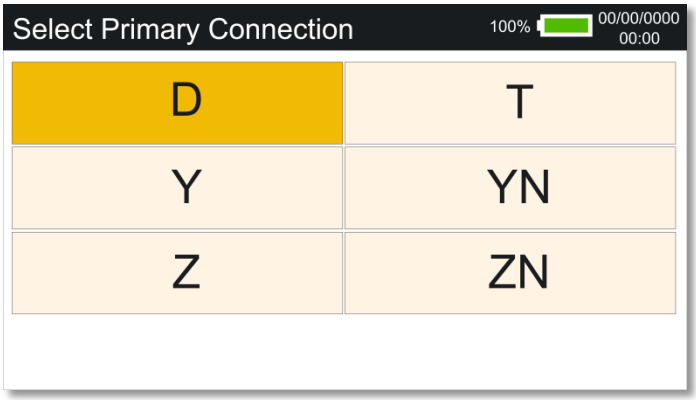
2.4 Calculator

To calculate the Turns Ratio and Voltage Ratios of different transformer groups. When you press the '**Calculator**' tab, the following page will open.

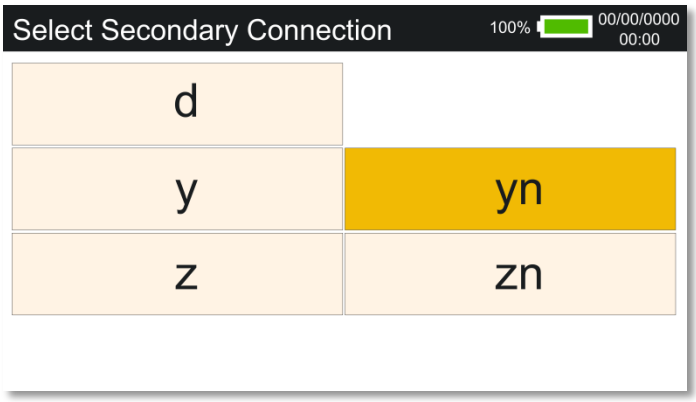


Click on the respective tab to choose **primary** and **secondary** configuration. Initially, select the vector group and then press '**Next**'.

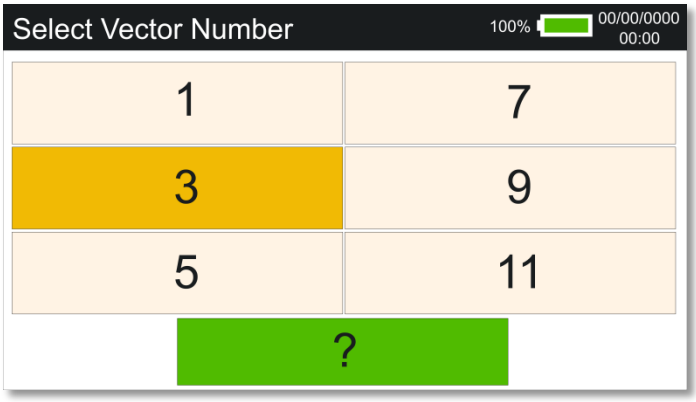
For Primary configuration; Selection is made by pressing on the desired tab. Once the selection has been made, the page will automatically return to the previous page



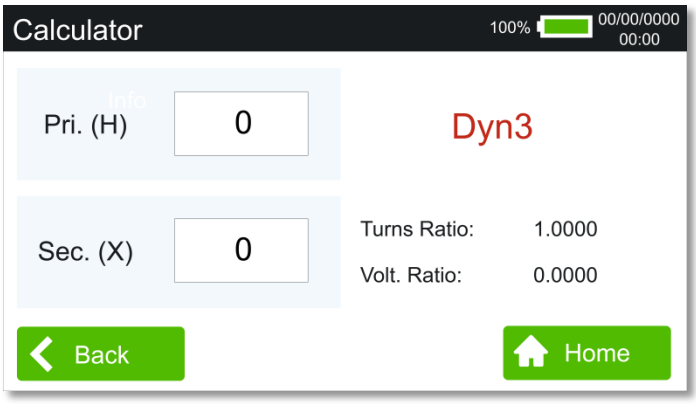
For secondary configuration; Selection is made by pressing on the desired tab. Once the selection has been made, the page will automatically return to the previous page



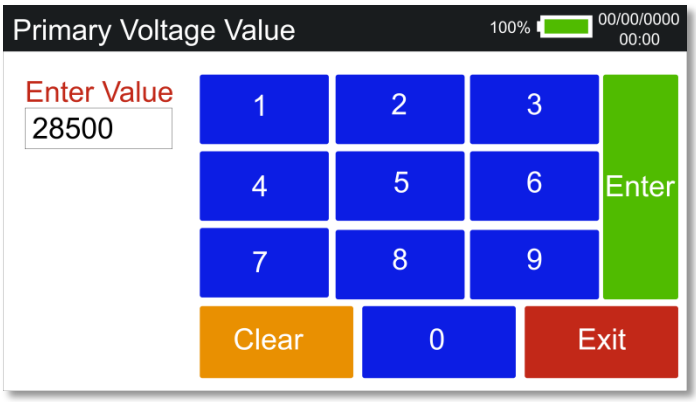
Then enter the vector number.



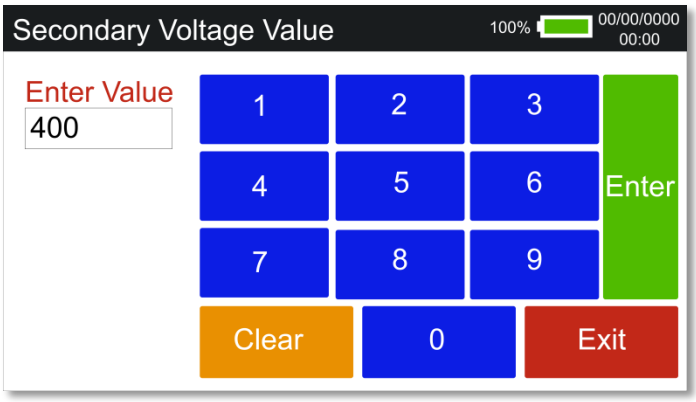
The actual ratio can be calculated by entering the primary and secondary values.



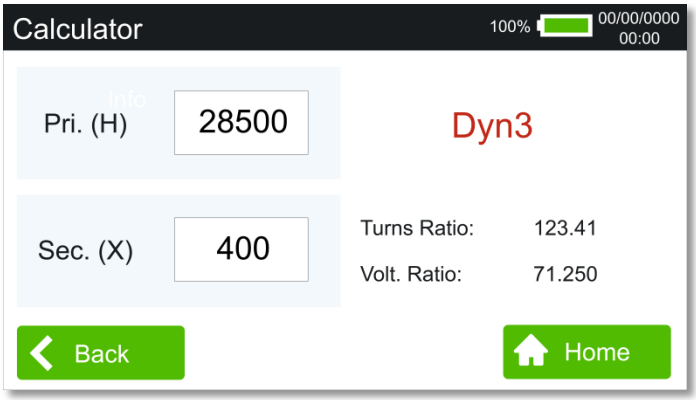
By pressing on the corresponding tabs you can enter primary and secondary voltage values of the transformer and calculate it. By using the '**Pri (H)**' tab you can enter Primary Voltage using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.



By using the '**Sec (X)**' tab you can enter Secondary Voltage using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.

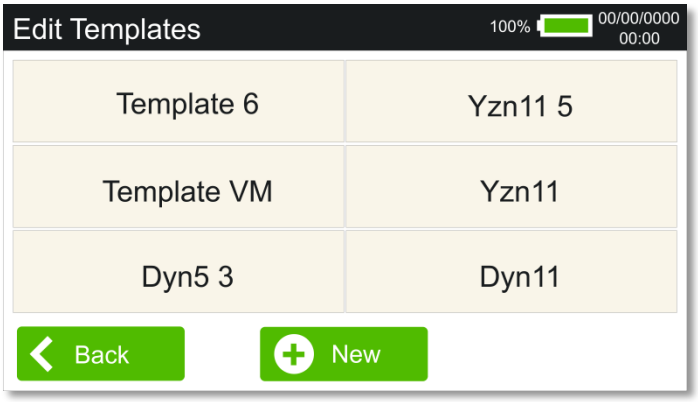


After entering the corresponding values, TURA will show the actual values (theoretical) of turns ratio and voltage ratio of the transformer to be tested.



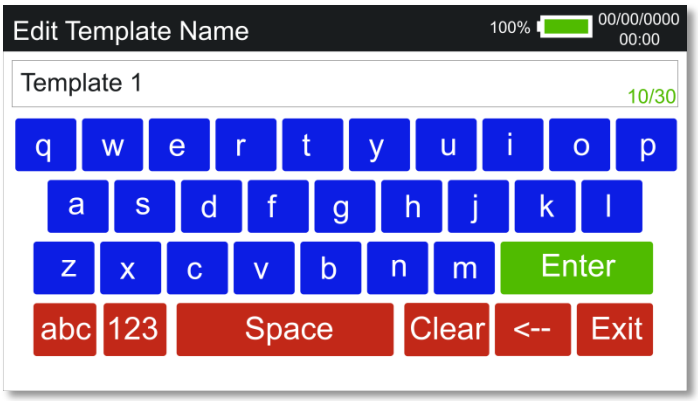
2.5 Templates

You can create templates for frequently used transformers and make their tests easier and faster. From the Templates menu, you can view / modify your existing templates or add new templates. You can save up to 6 different templates in total.



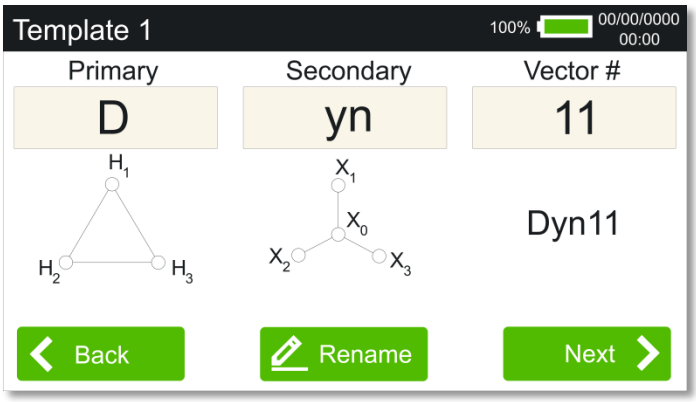
Necessary changes can be made on existing templates or can be deleted by pressing on the template. To create a new template:

- Press on **'+New'** tab
- Select a Vector Group
- Select/Enter Transformer Values and Test Voltage
- Enter User Data
- Enter Transformer Information

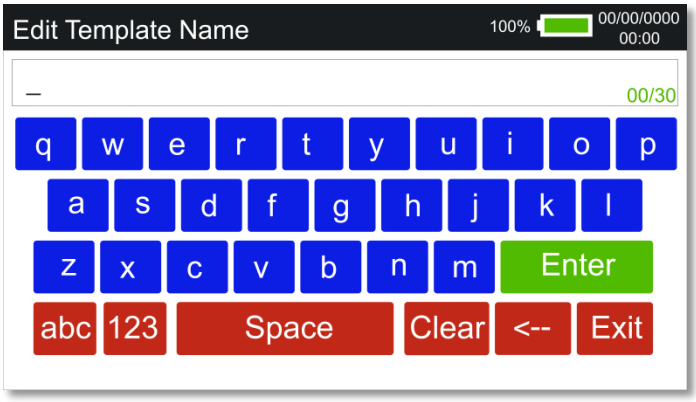


2.5.1 Selecting Vector Group

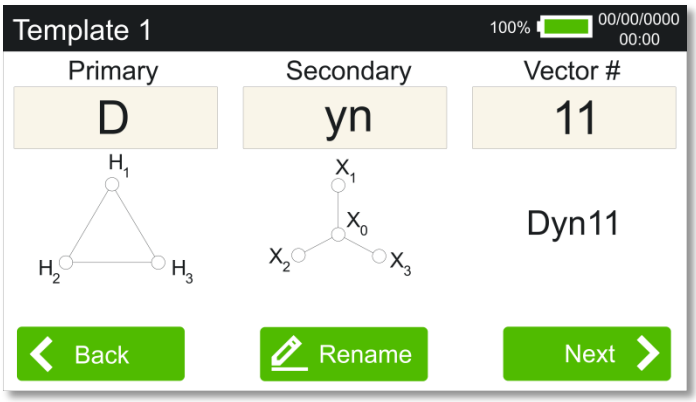
When you press the **'+New'** tab, a '**Vector Group Selection**' screen will appear as below. Select the vector group of the power transformer using '**Primary**', '**Secondary**' and '**Vector#**' tabs.



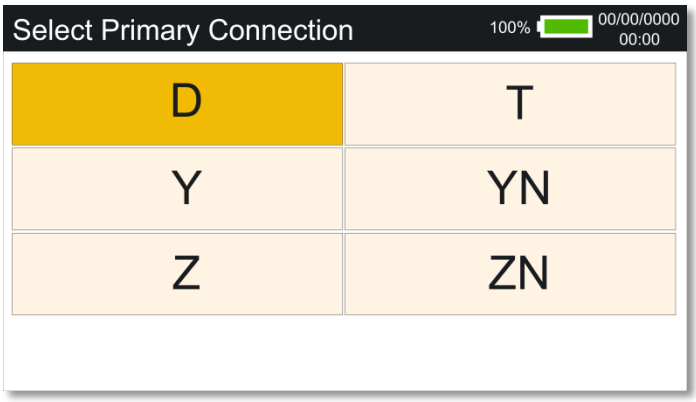
To rename the template use '**Rename**' tab. The default name for all templates is '**Template**'.



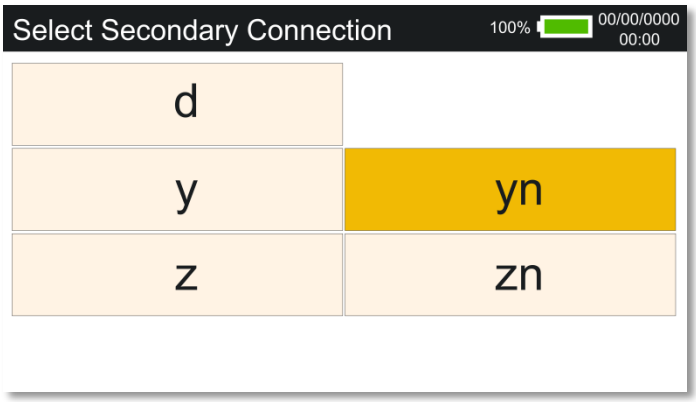
Then proceed selecting vector diagram.



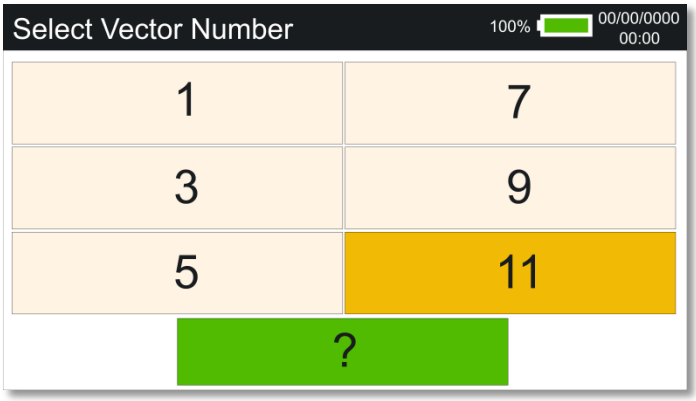
The primary vector group can be selected with the '**Primary**' tab. Select the vector group according to the transformer to be tested.



Press on '**Secondary**' tab to choose the secondary vector group. Then select the desired group according to the transformer to be tested.



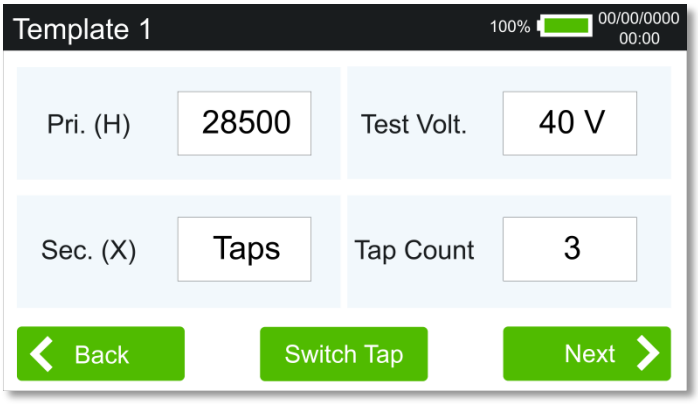
The vector number can be selected with the '**Vector #**' tab. The vector numbers that are appropriate for the primary and secondary selections will be active on the screen. After making your selection, the screen will automatically return to the '**Vector Group Selection**' page.



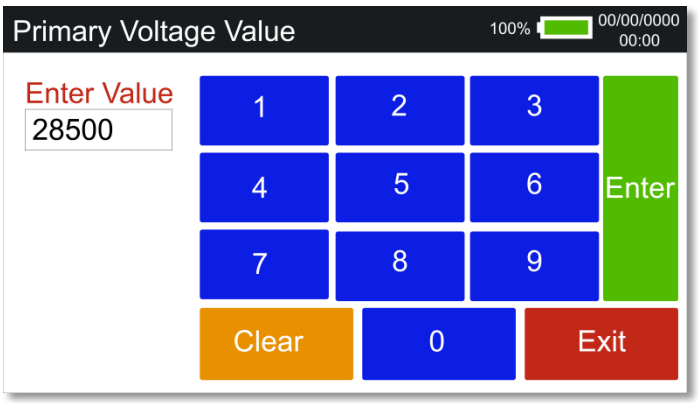
While testing, TURA-03 can automatically detect the vector number of the transformer to be tested. For automatic detection, press on the '**?**' mark tab available on the bottom of '**Vector Number**' menu.

2.5.2 Selecting Transformer Values and Test Voltages

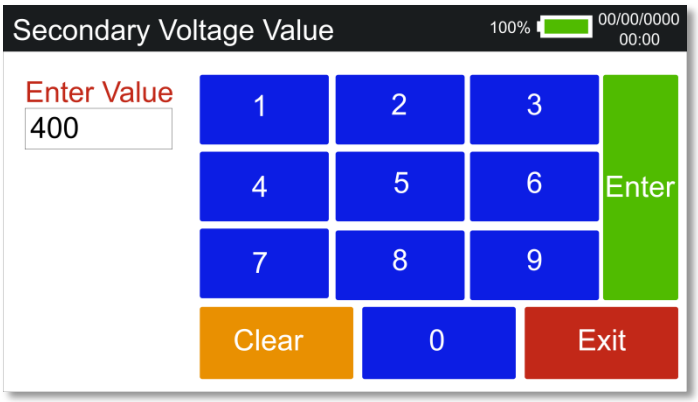
When you press '**Next**' tab, the following page will appear after '**Vector Group Selection**' screen. You can enter the primary and secondary voltages, test voltages, and number of taps of the power transformer to be tested.



If your transformer is single tap, enter the primary voltage value on '**Pri (H)**' tab. If it consists of more than one tap, you can enter the tap voltage values by pressing the '**Tap**' tab or selecting with '**Next**' tab and enter the voltage values on the next screen.

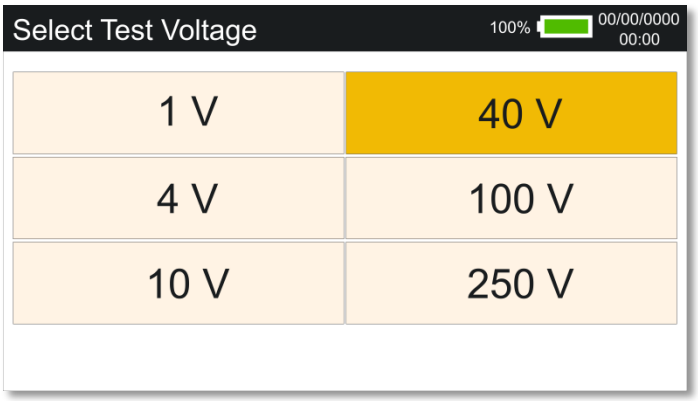


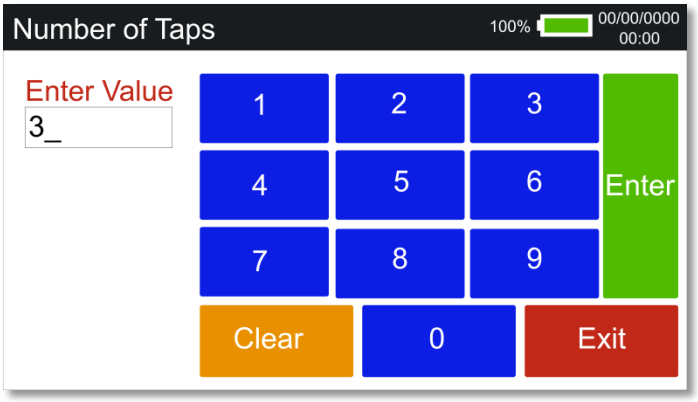
By using the '**Pri (H)**' tab you can enter Primary Voltage using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.



By using the '**Sec (X)**' tab you can enter Secondary Voltage using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.

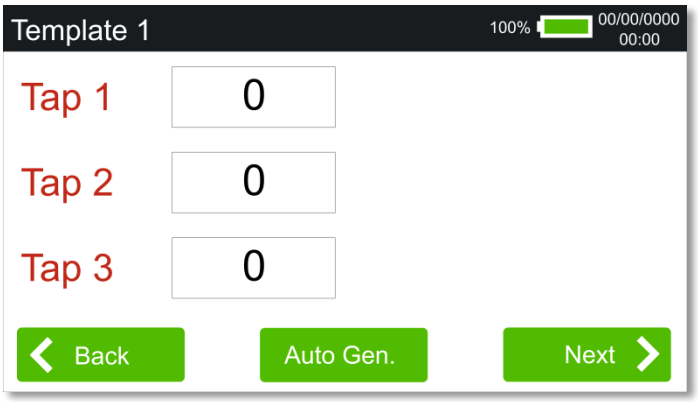
To change the test voltage, press the '**Test Volt**' tab and the following selection screen will appear. You can make your selection by pressing on the desired test voltage.



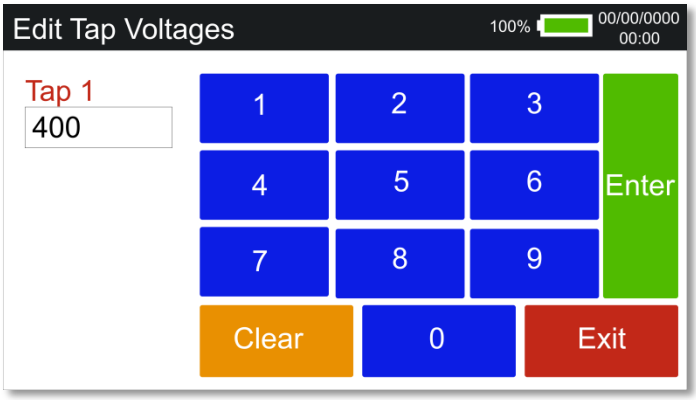


You can enter the number of taps using the on-screen keyboard with the '**Tap Count**' tab. You can test up to 25 tap transformers. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.

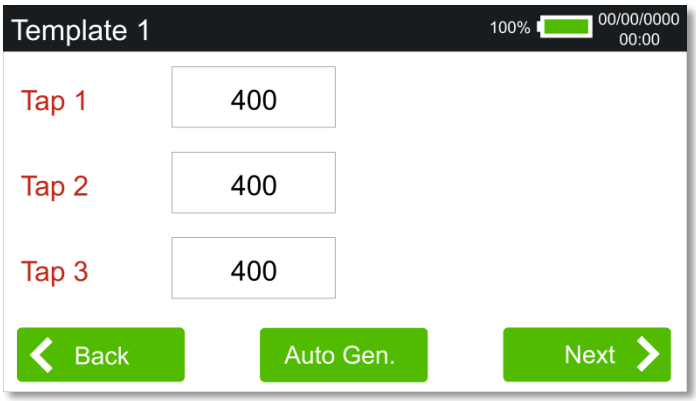
Press '**Next**' to navigate to the following page where you can enter all the tap voltages. After entering Tap1 and Tap2, you can use '**Auto Gen**' tab to automatically generate voltage values of the remaining taps.



Enter Tap values one by one using the On-screen Keyboard.



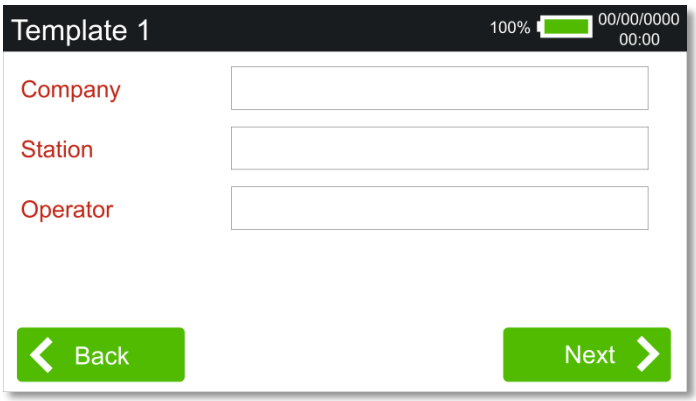
After entering Tap1 and Tap2, you can use '**Auto Gen**' tab to automatically generate the values for the remaining taps.



Press '**Next**' to move to the next screen and enter the user information.

2.5.3 Entering User Info

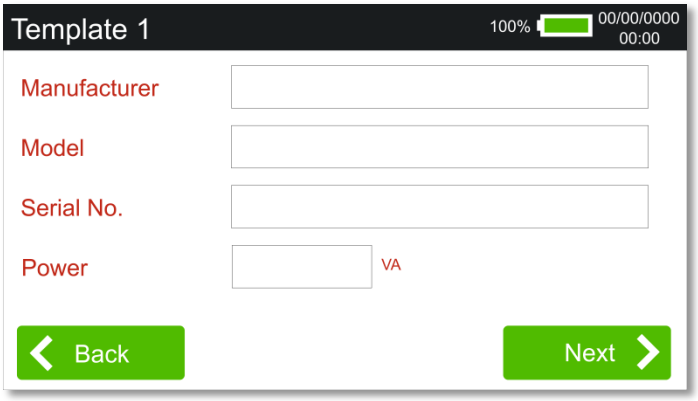
When you press '**Next**' tab on '**Tap Voltages**' screen, the following screen will appear.



By using this menu, you can enter Company, Station, and Operator to the template you created. Click on the relevant tab to enter data using the on-screen keyboard.

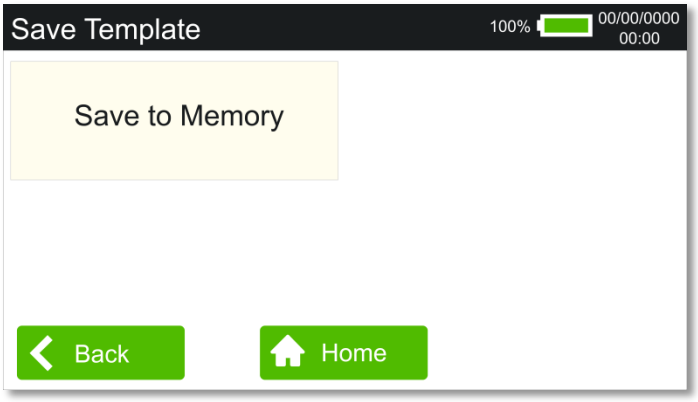
2.5.4 Entering Transformer Information

To enter the details like Manufacturer, Model, Serial number and Power values of transformer to be tested.



2.5.5 Template Save

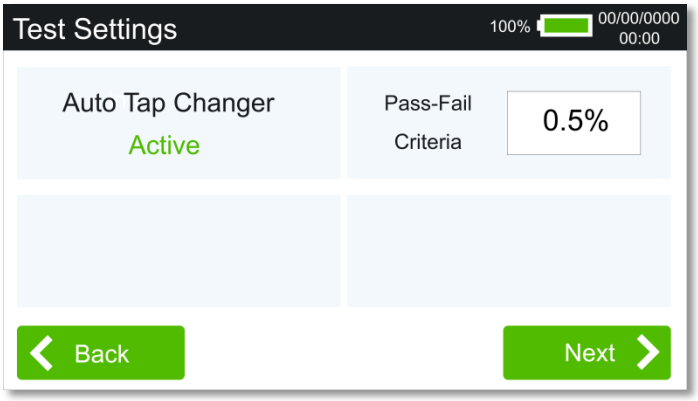
Pressing the '**Next**' tab on the '**Transformer Information**' screen will display the following page.



For an already created template, there will be an additional option '**Delete Template'** to delete the saved template.

2.6 Comparator Settings

Pass- Fail comparison is possible by setting a limit value for turns ratio check.



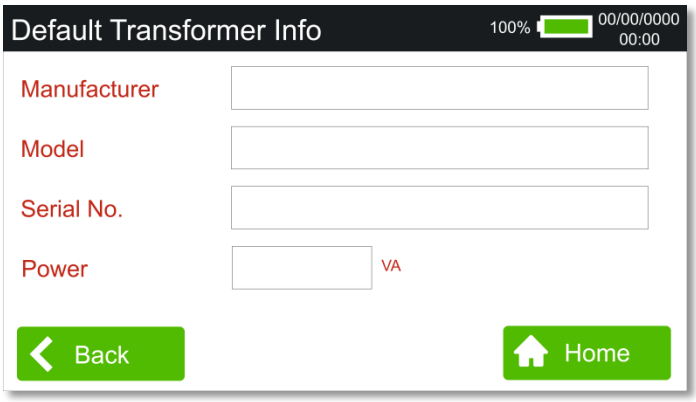
2.7 Default Device Info

To add default Device Info to the device. You can always change it after performing a test or while making a test template.

By using this menu, you can enter Company, Station, and Operator to the template you created. Click on the relevant tab to enter data using the on-screen keyboard.

2.8 Default Transformer Info

To add default Transformer info to the device. You can always change it after performing a test or while making a test template.

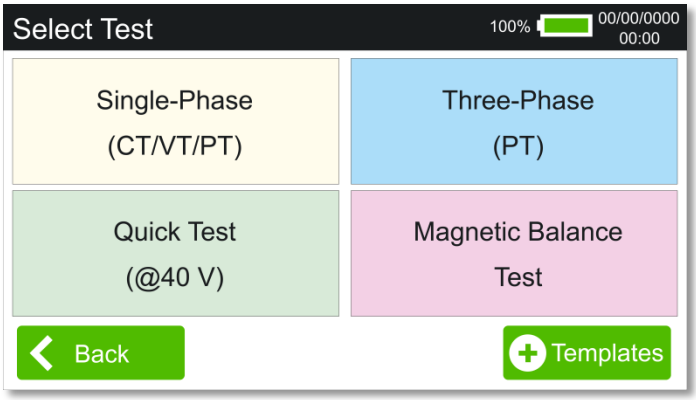


You can enter the details like Manufacturer, Model, Serial number and Power values of transformer to be tested.

3. Ratio Test

You can carry out test using this menu. In the menu;

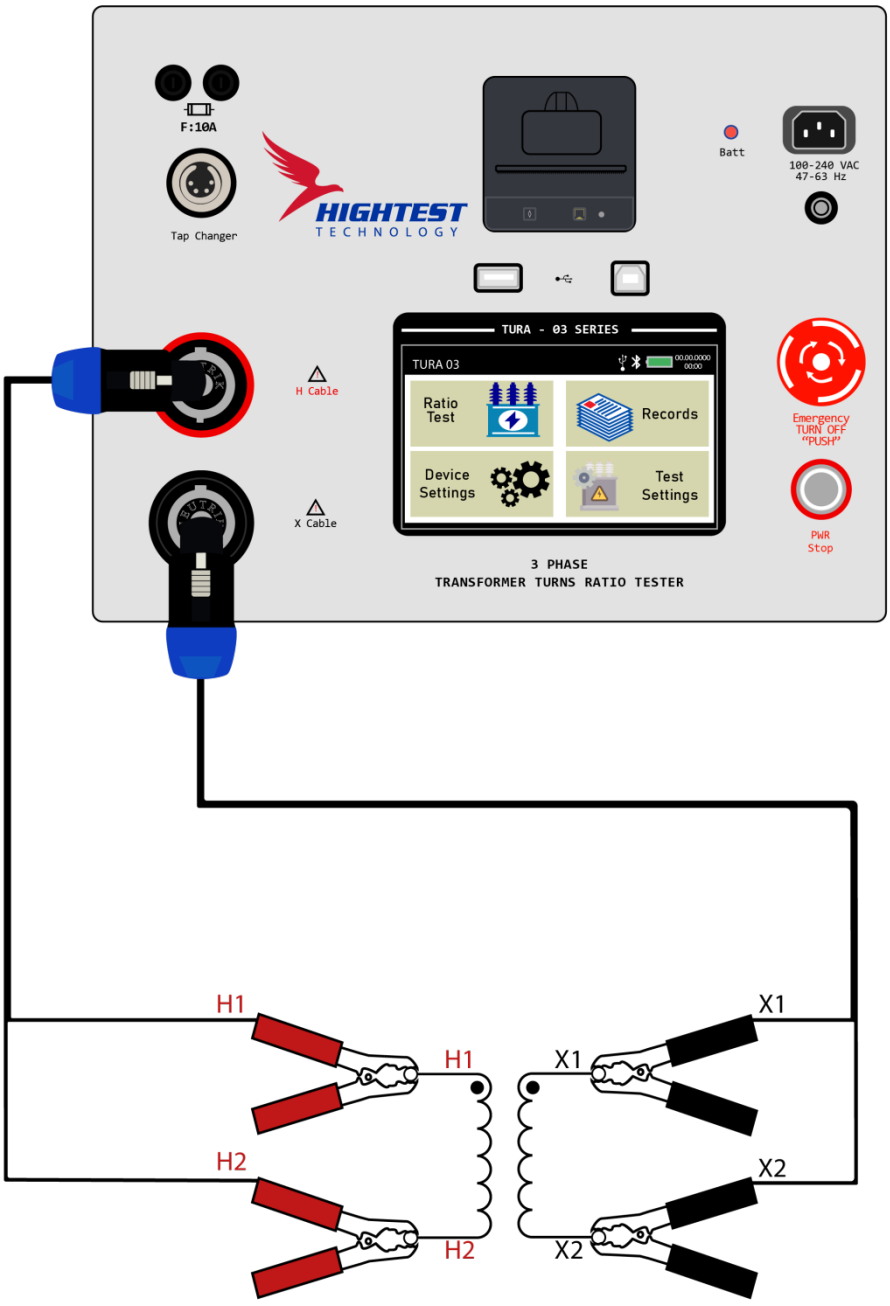
- Single Phase Test (Current, Voltage, and Power Transformer)
- Three Phase Test (Power Transformer)
- Quick Test
- Magnetic Balance Test
- Template Test

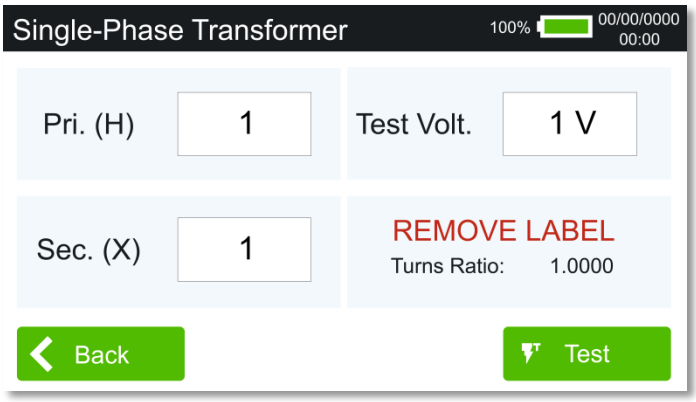


3.1 Single phase test

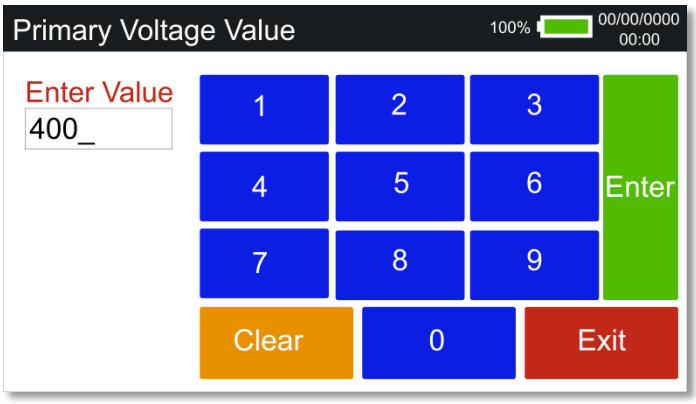
To test single-phase current, voltage and power transformer. Follow the steps for testing:

Connect the test cables to the transformer to be tested. (as shown in the following figure)

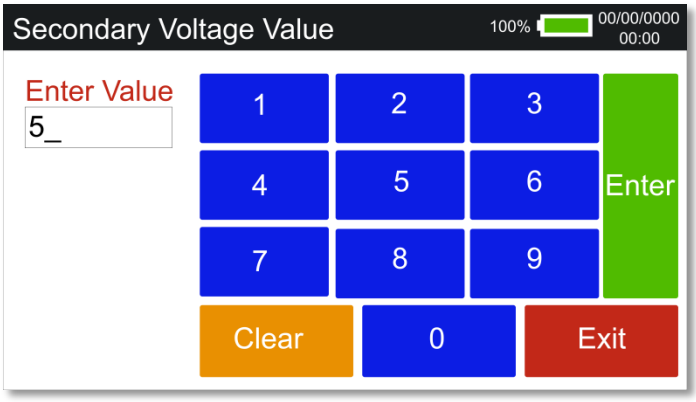




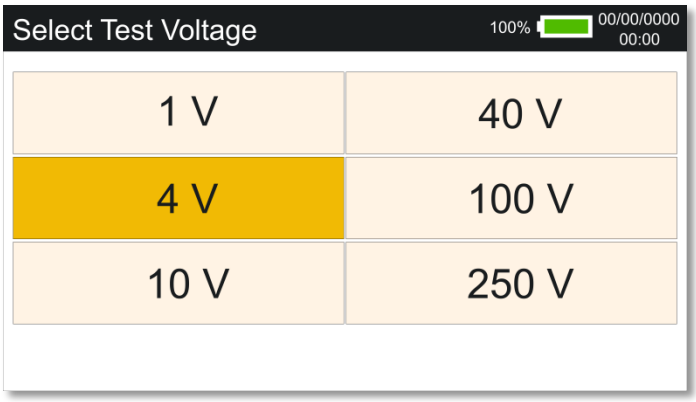
Enter the primary voltage by pressing on '**Pri. (H)**' tab on the screen and you can enter the value using on-screen keyboard and press '**Enter**'.



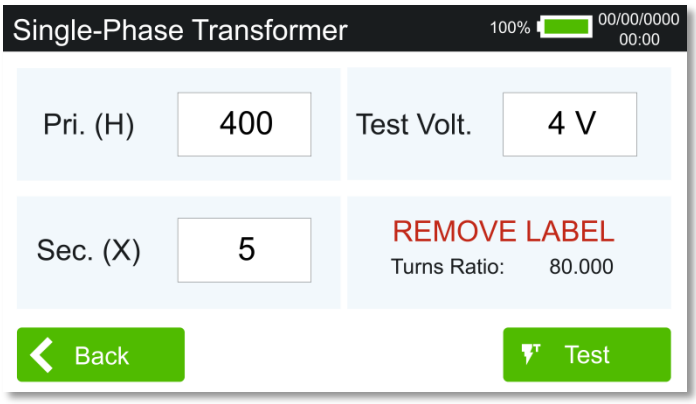
Then enter the secondary voltage by pressing on '**Sec. (X)**' tab on the screen and you can enter the value using on-screen keyboard and press '**Enter**'.



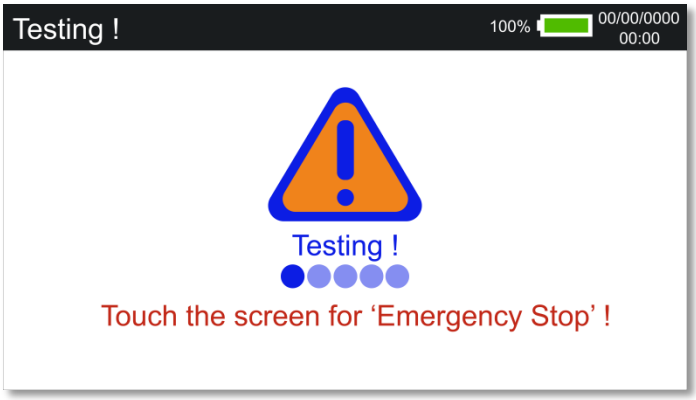
Select the appropriate test voltage for your transformer by pressing on '**Test Volt.**' tab on the screen and you can choose from the following menu. The page will automatically return to the previous page once you made your selection.



Compare the calculated turn ratio, which is displayed on the bottom right part of the screen with the transformer label, if it is correct, start the test by pressing the '**Test**' tab.



The testing screen will look as following and you will automatically direct to the result page when the test completes.

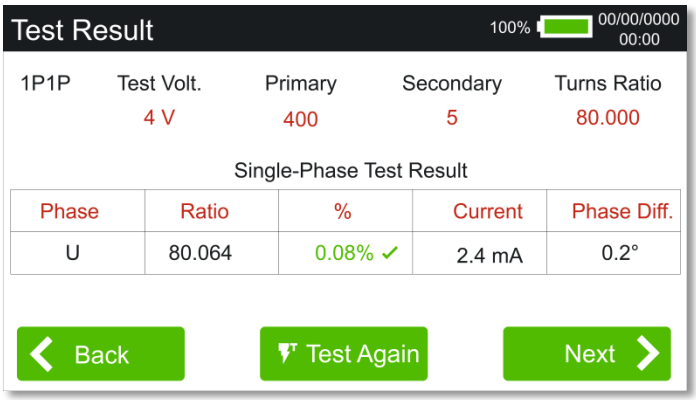


CAUTION!

During the test, you can press 'Emergency Stop' button on the front panel or you can touch on the 'Screen' or simply press the 'Power Button' in an emergency situation. The test will be cancelled immediately.

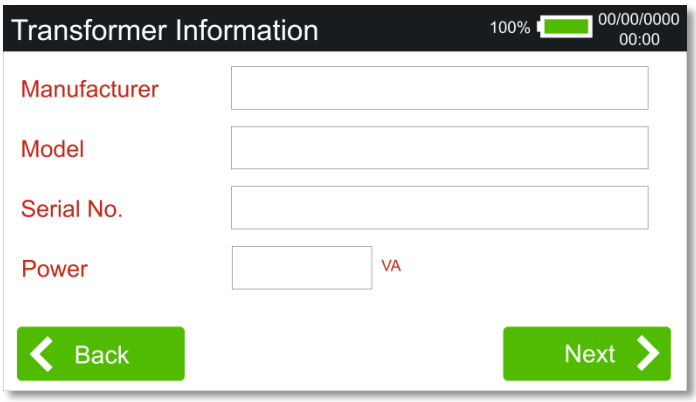
The result will be displayed, once the test has been completed. Following details are displayed on the result screen:

- Measured ratio
- % Error of measured rate according to calculated rate
- Excitation current
- You can see the phase difference between primary and secondary.

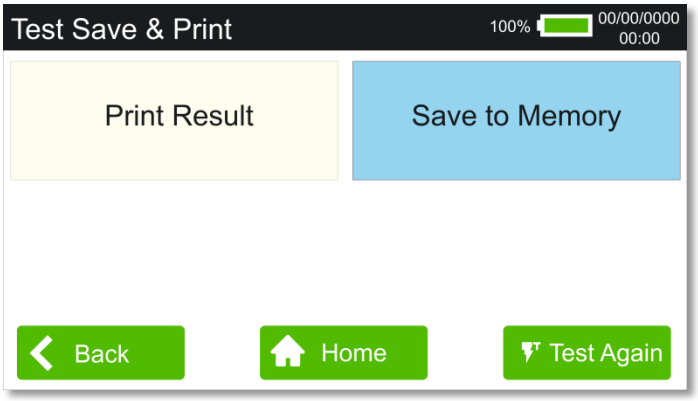


You can repeat the test or proceed to save the result by pressing '**Next**'. The result can either be saved on device memory or on external USB or print the result with TURA-03's built-in printer. The '**User Information**' screen is as follows. You can enter new data or can use already existing default details.

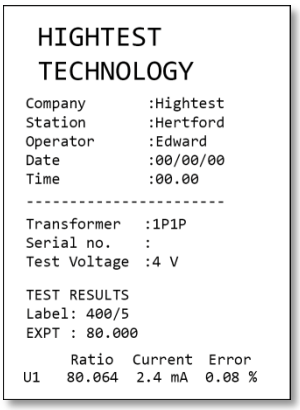
The '**Transformer Information**' screen is as follows. You can enter new data or can use already existing default details.



When you press '**Next**', you will be directed to the page where you can Save or Print the test result. If a USB is inserted to the device, the test result will be saved to the USB instead of Device memory.

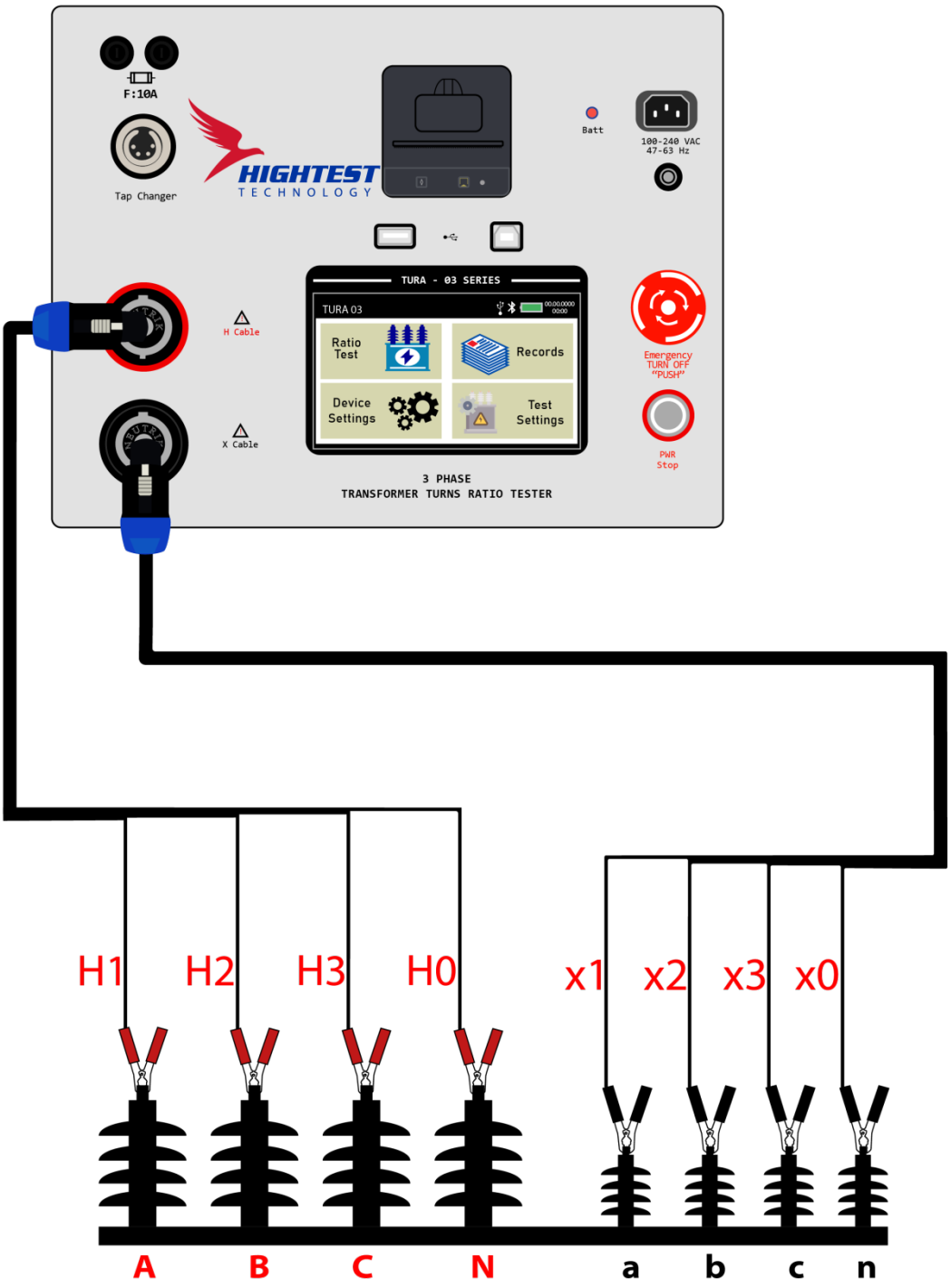


The printed result will look like as follows.



3.2 Three Phase Test

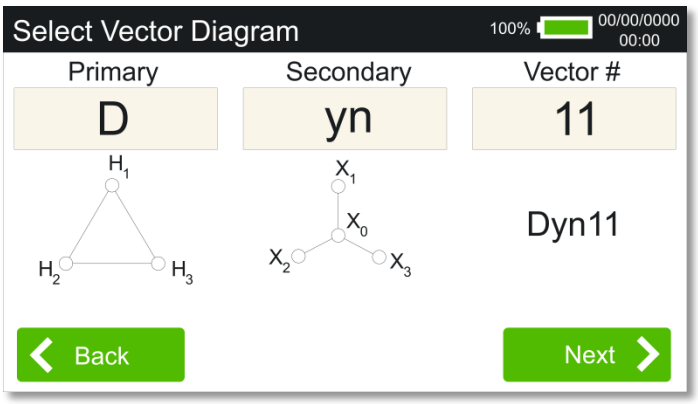
It is used to test three phase power transformers. Connections can be done as shown in the following figure.



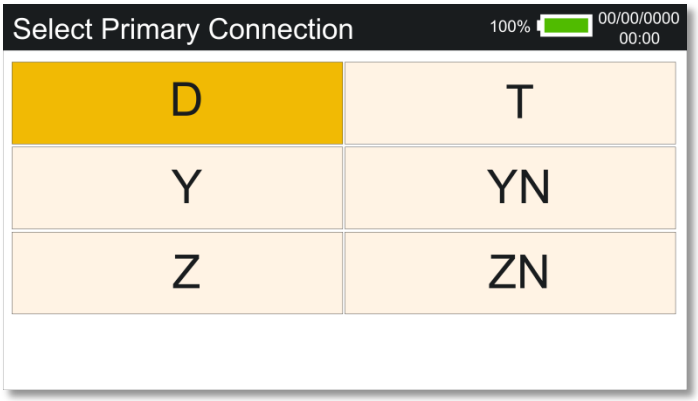
Follow the order for testing:

- Select the vector group. Also TURA-03 can automatically detect the vector number of the transformer to be tested.
- Enter the number of taps.
- Enter the primary voltage.
- Enter the secondary voltage.
- Select the appropriate test voltage for your transformer.
- Connect the test cables to the transformer according to the wiring diagram given on the display before each test.
- Check the values entered in the test information display and start the test.

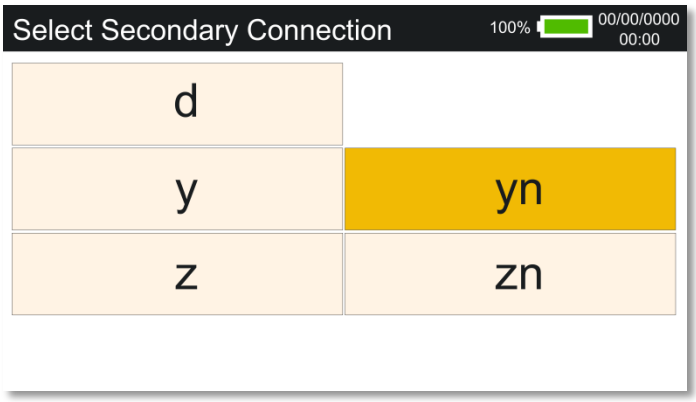
When you press '**Ratio Test**' and choose '**Three Phase (PT)**' on the main menu the following page will open.



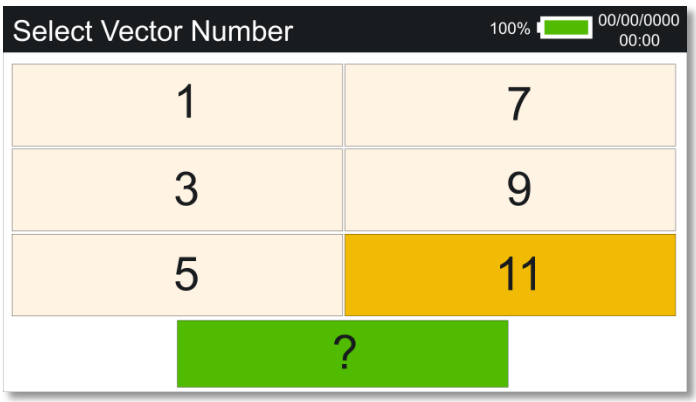
Press on '**Primary**' tab to choose the primary connection group.



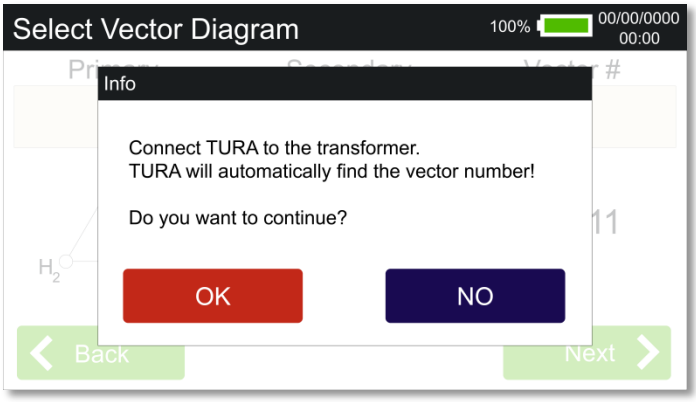
After making the selection, the screen will return to '**Vector Group Selection**' page. Then press on '**Secondary**' tab to choose secondary connection group.



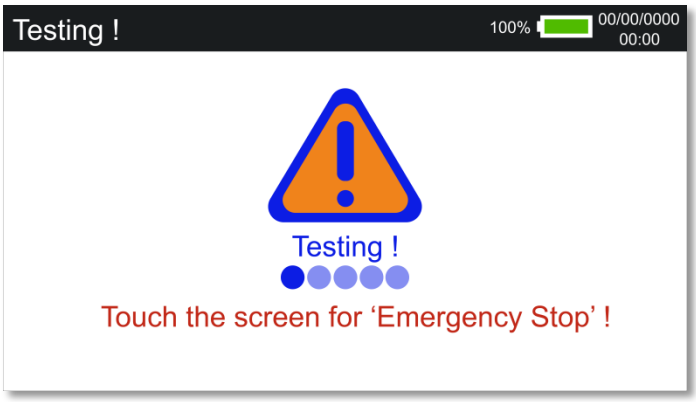
After making the selection, the screen will return to '**Vector Group Selection**' page. After choosing the connection group for primary and secondary of the transformer to be tested, press on '**Vector #**' to choose the vector number. The vector number that is appropriate for the primary and secondary selections will be active in the screen.



Also you can request TURA-03 to automatically detect the vector number by pressing on the '**[?]**' tab in the bottom part of the screen.



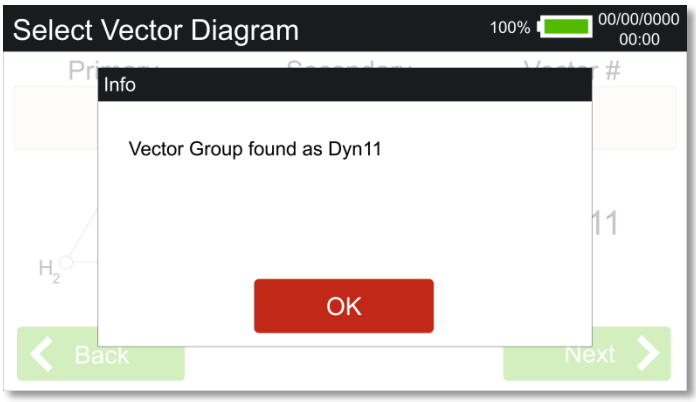
Press **OK** to continue.

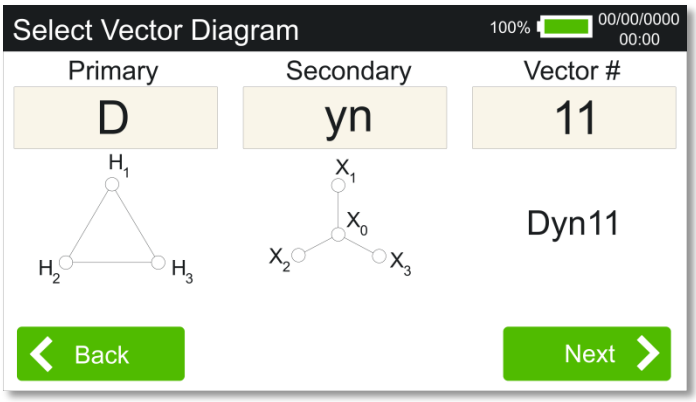


CAUTION!

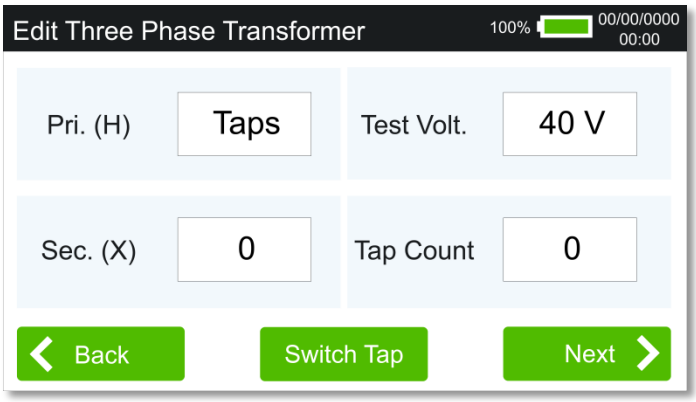
During the test, you can press 'Emergency Stop' button on the front panel or you can touch on the 'Screen' or simply press the 'Power Button' in an emergency situation. The test will be cancelled immediately.

The following screen will appear after testing which we need to press **OK** to proceed.

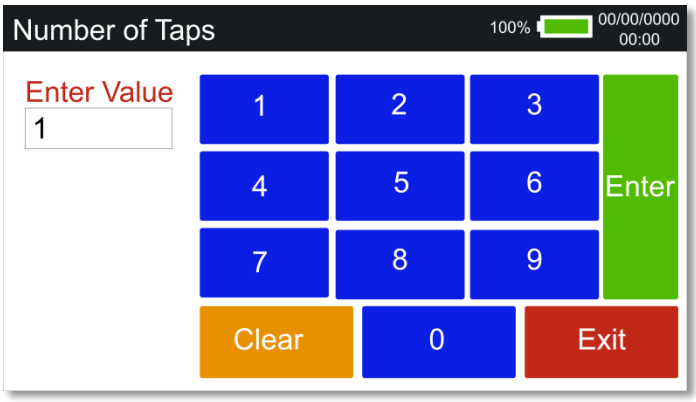




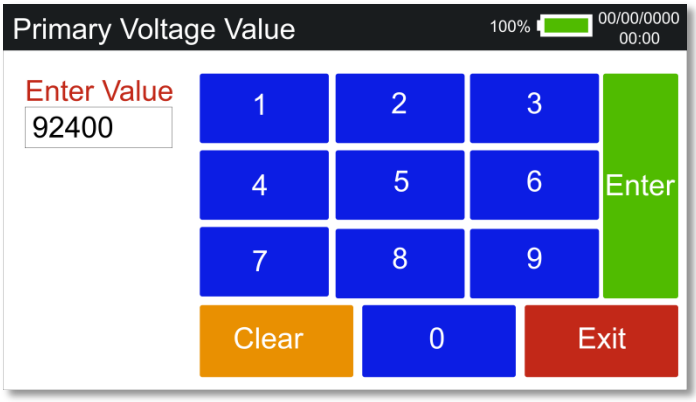
Use the '**Next**' tab to move on to the next screen and enter the primary and secondary voltage, test voltage, and number of taps for the power transformer on the following page.



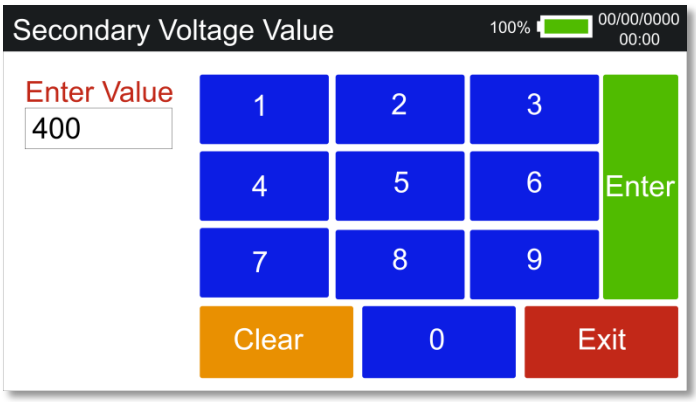
If your transformer is single tap, enter the primary voltage value on '**Pri (H)**' tab. If it consists of more than one tap, you can enter the tap voltage values by clicking the '**Tap**' button or selecting with '**Next**' tab and enter the voltage values on the next screen. You can also switch the Taps between Primary and Secondary.



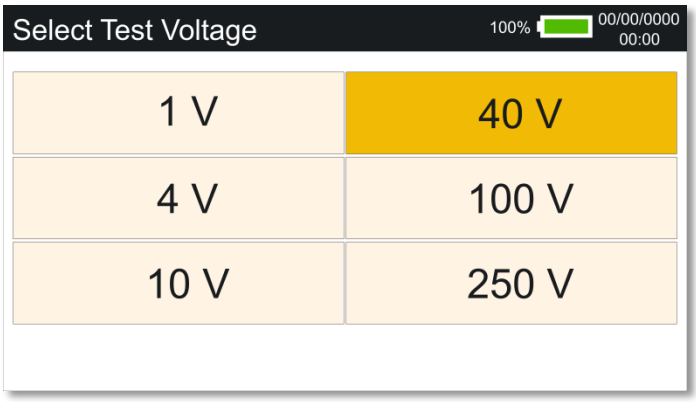
You can enter the number of taps using the on-screen keyboard with the '**Tap Count**' tab. You can test up to 25 tap transformers. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.



By using the '**Pri (H)**' tab you can enter Primary Voltage using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.



You can enter Secondary Voltage with using '**Sec (X)**' button using the on-screen keyboard. To save the entered value press '**Enter**'. If you press on '**Exit**' instead of '**Enter**' the values will not be saved and you will return to the previous page.

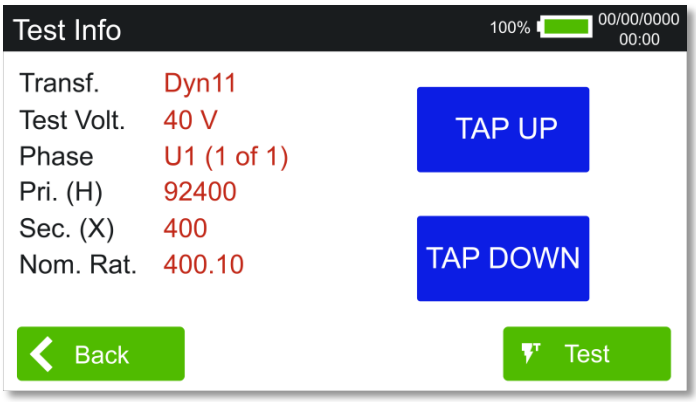


To change the test voltage, click on the '**Test Volt.**' tab and the following selection screen will appear. You can make your selection by clicking on the desired test voltage. You will return to the previous page once you make your selection.

Press '**Next**' to proceed to test. You will be directed to a '**Test Information**' screen by pressing the '**Next**' tab.

The Test Info screen shows you the following information.

- Vector group.
- Test voltage
- The tap and phase number to be tested
- Calculated turns ratio
- Tap Up & Tap Down tabs



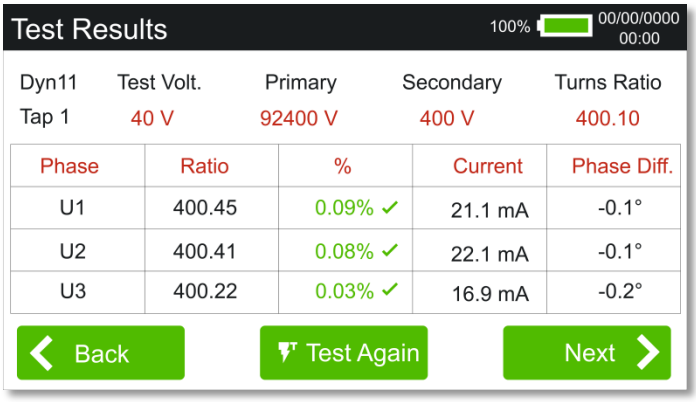
You can start the test by pressing on the '**Test**' tab. The test screen will look like as follows and you will automatically direct to the result page once the test finishes.

CAUTION!

During the test, you can press 'Emergency Stop' button on the front panel or you can touch on the 'Screen' or simply press the 'Power Button' in an emergency situation. The test will be cancelled immediately.

On the result screen, following details are shown

- Measured ratio
- Percentage Error of measured ratio according to calculated ratio
- Excitation current
- Phase Angle difference between primary and secondary.

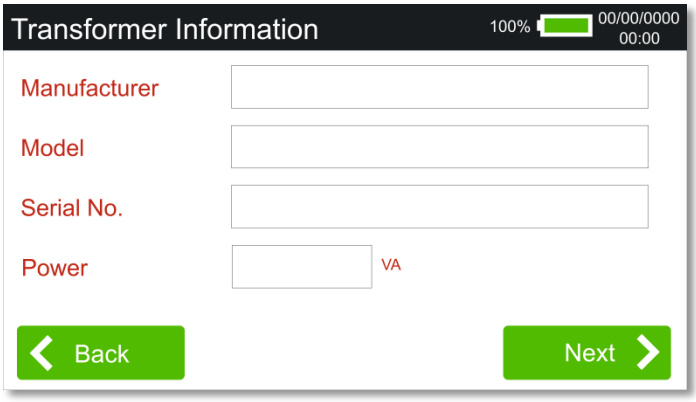


If you want, you can repeat the test for that phase after each result screen has been reached, or you can move to the next '**Phase**' or '**Tap**' with the '**Next**' tab. Once the test completes, you can save the test results to the device memory, USB memory, and print the test using TURA-03 built-in printer.

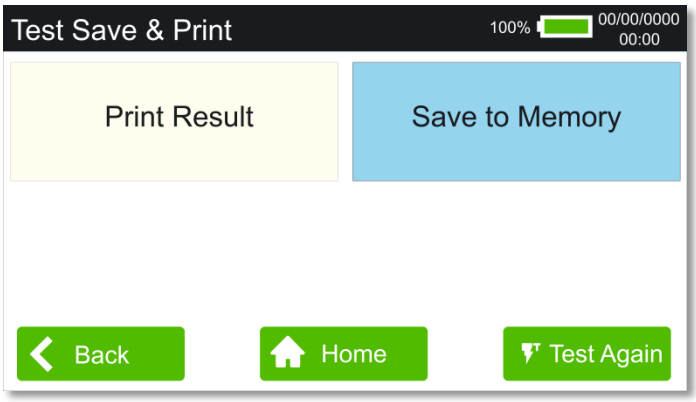
You can repeat the test or proceed to save the result by pressing '**Next**'. The result can either be saved on device memory or on external USB or print the result with TURA-03's built-in printer.

The '**User Information**' screen is as follows. You can enter new details or can use already existing default details. Tap on the concerned tab to enter each detail. You can input the details using on-screen keyboard of TURA-03.

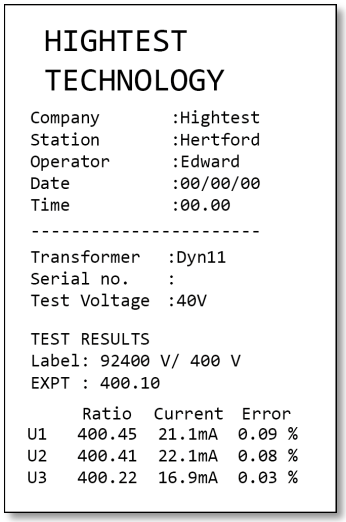
The '**Transformer Information**' screen is as follows. You can enter new data or can use already existing default details. Tap on the concerned tab to enter each detail. You can input the details using on-screen keyboard of TURA-03.



When you press '**Next**', you will be directed to the page where you can Save or Print the test result. If a USB is inserted to the device, the test result will be saved to the USB instead of Device memory.



The printed result will look like as follows.

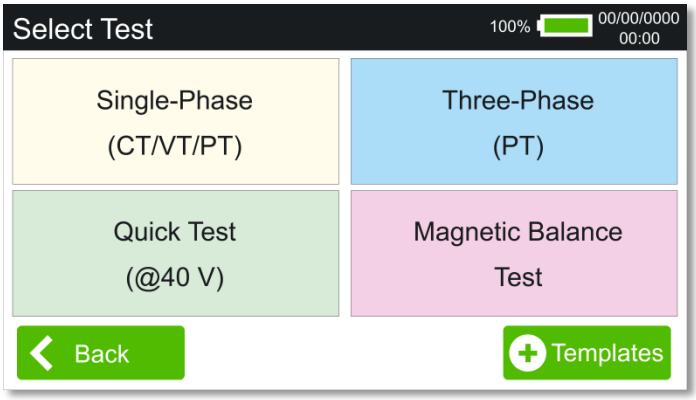


HIGHTEST
TECHNOLOGY

```
Company        :Hightest
Station        :Hertford
Operator       :Edward
Date           :00/00/00
Time           :00.00
-----------------------

Transformer    :Dyn11
Serial no.     :
Test Voltage   :40V

TEST RESULTS
Label: 92400 V/ 400 V
EXPT : 400.10

      Ratio   Current  Error
U1    400.45  21.1mA   0.09 %
U2    400.41  22.1mA   0.08 %
U3    400.22  16.9mA   0.03 %
```

3.3 Quick Test

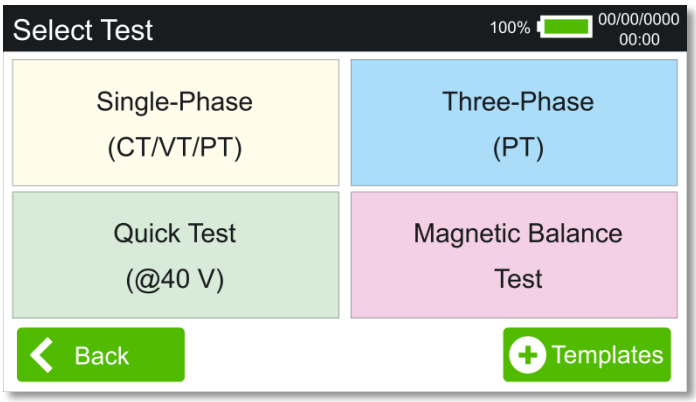
It is used to test quickly without entering any information about transformer. You can adjust the test voltage to be used as described in the test settings section. Test, result, information, and recording screens are similar to those described in the '**Single Phase Test**' section.



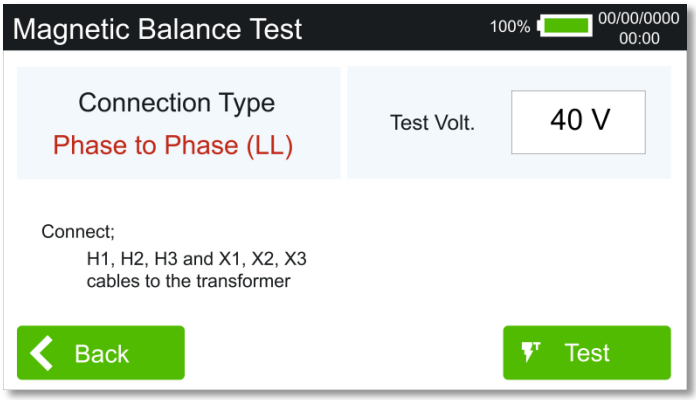
3.4 Magnetic Balance Test

Magnetic Balance tests are performed to figure out the magnetic imbalance of core of the transformer to be tested. There is no accurate result for Magnetic Balance Tests and can only interpret with another transformer test like Winding Resistance measurement.

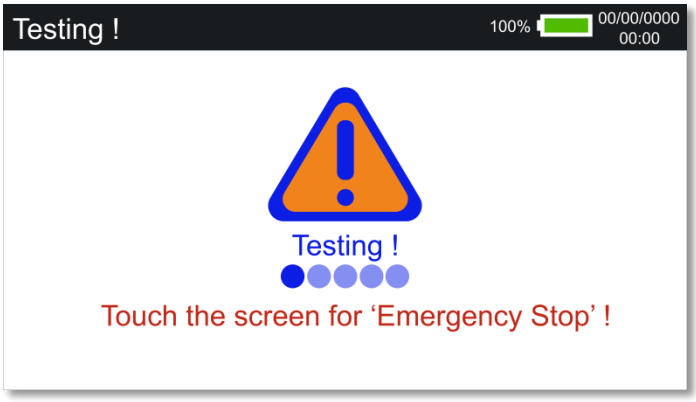
To perform Magnetic balance test using TURA-03, choose '**Magnetic Balance Test**' under 'Ratio Test' menu.



Then make the connections as shown on the screen.



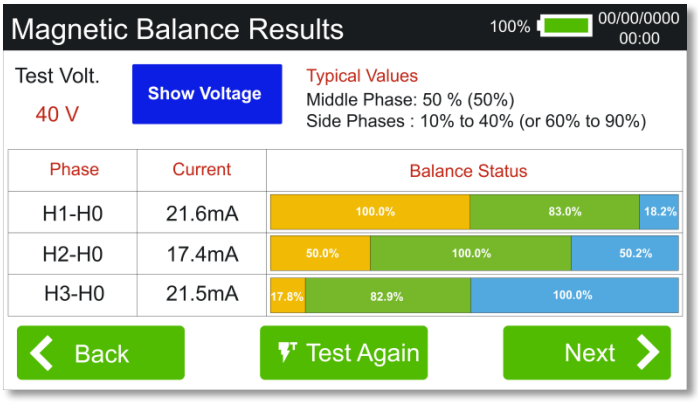
You can choose the connection type as '**Phase to Phase (LL)**' or '**Phase to Neutral (LN)**'. You can assign the test voltage on '**Test Volt.**' tab. Then press '**Test**'.



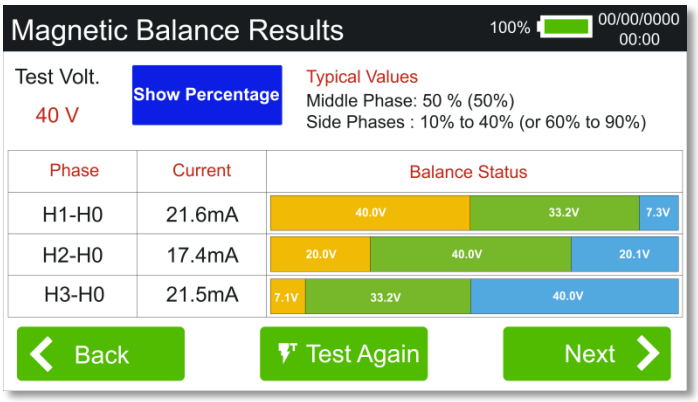
CAUTION!

During the test, you can press 'Emergency Stop' button on the front panel or you can touch on the 'Screen' or simply press the 'Power Button' in an emergency situation. The test will be cancelled immediately.

The result page will appear as follows.



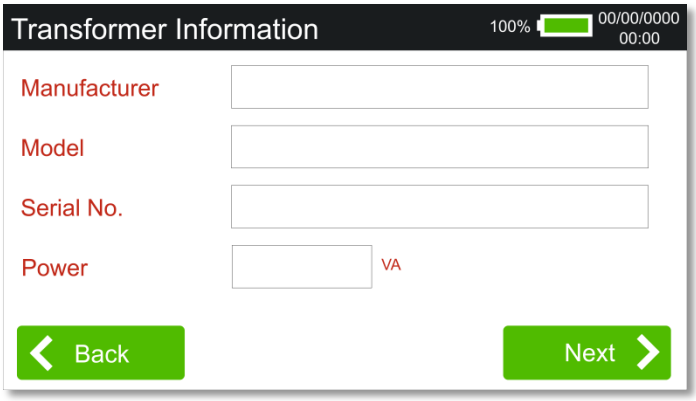
You can also view the results in terms of voltage. For that, press on '**Show Voltage**' tab.



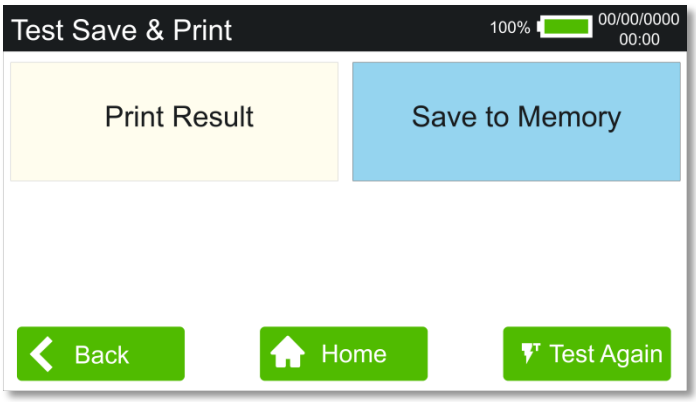
You can repeat the test or proceed to save the result by pressing '**Next**'. The result can either be saved on device memory or on external USB or print the result with TURA-03's built-in printer.

The User Information screen is as follows. You can enter new details or can use already existing default details.

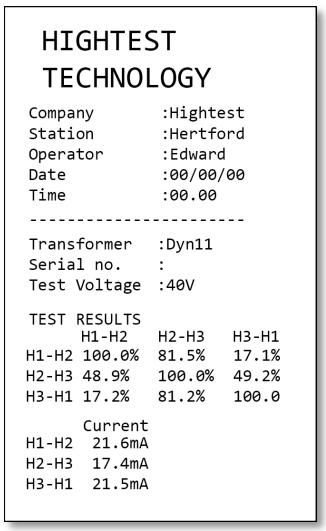
The 'Transformer Information' screen is as follows. You can enter new data or can use already existing default details.



When you press 'Next', you will be directed to the page where you can Save or Print the test result. If a USB is inserted to the device, the test result will be saved to the USB instead of Device memory.



The printed result will look like as follows.



HIGHTEST
TECHNOLOGY

```
Company       :Hightest
Station       :Hertford
Operator      :Edward
Date          :00/00/00
Time          :00.00
-----------------------
Transformer   :Dyn11
Serial no.    :
Test Voltage  :40V

TEST RESULTS
      H1-H2   H2-H3   H3-H1
H1-H2 100.0%  81.5%   17.1%
H2-H3 48.9%   100.0%  49.2%
H3-H1 17.2%   81.2%   100.0

      Current
H1-H2  21.6mA
H2-H3  17.4mA
H3-H1  21.5mA
```

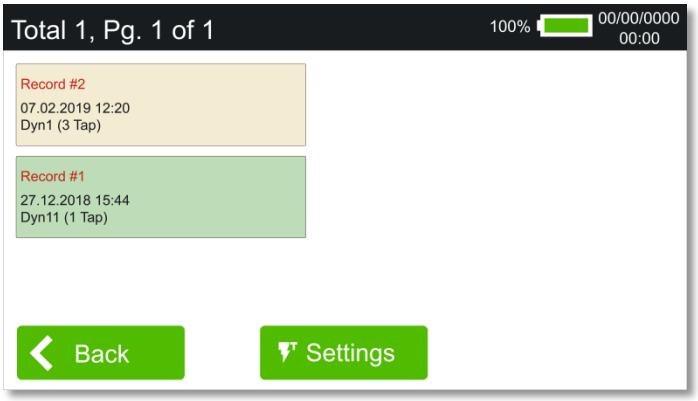
3.5 Template Test

To test transformers using already saved templates. Choose the desired template and proceed to '**Test**'. Test steps and displays are similar to those described in the '**Three Phase Test**' section.

4. Test Records

You can access the test results that you have already saved from the '**Test Records**' menu. You can also quit the tests at a point, and later continue from the point where you left the test.

TURA-03 can store 100 test results in its internal memory. Each test can hold up to 75 measurements. TURA-03 can hold up to 7500 measurements in total. In addition to the internal memory, TURA-03 has unlimited extended memory by using an external USB. When a USB is connected, the test records will be saved to USB.



You can use the '**Next**'/ '**Back**' buttons to navigate through the pages.

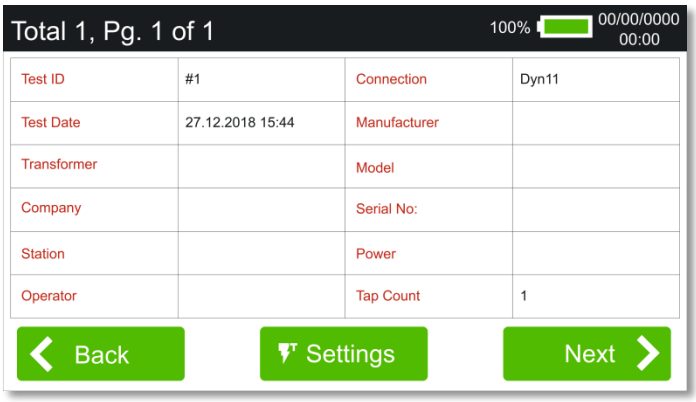
When we examine this page:

- The records in Green colour indicates test is incomplete
- 1st Line Record Number,
- 2nd Line test date and time,
- 3rd Line indicates the transformer vector group and the number of taps.

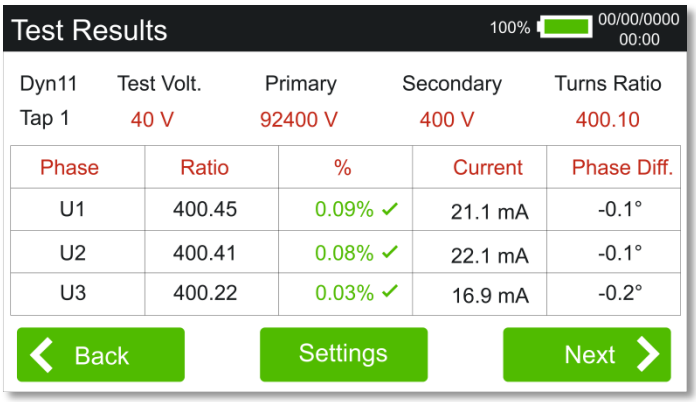
And

- The records in Yellow colour indicates test is complete,
- 1st Line Registration Number,
- 2nd Line test date and time,
- 3rd Line indicates the transformer vector group and the number of taps.

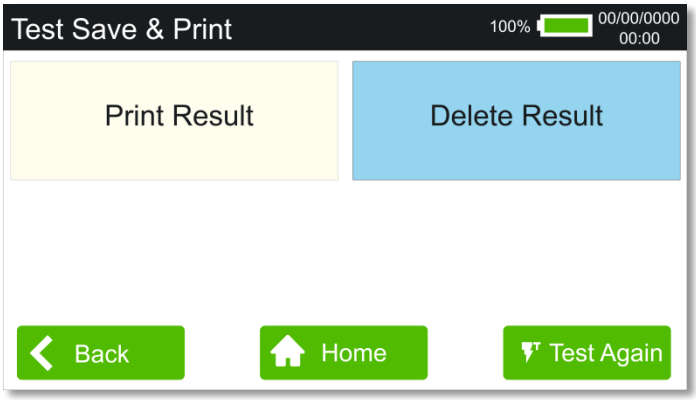
You can access the details of the records by clicking on them and you can navigate through the screens with the '**Next**'/ '**Back**' tabs.



The details of the test records will be displayed as shown in the picture given above. You can delete or print the test using the 'Settings' tab.



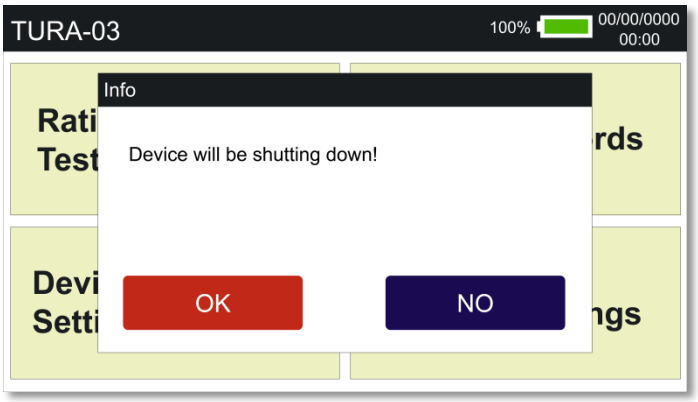
The test results will be displayed on the screen above. Use the 'Next' tab to move to the next step. For the completed tests, you can either print results or delete a result from record.

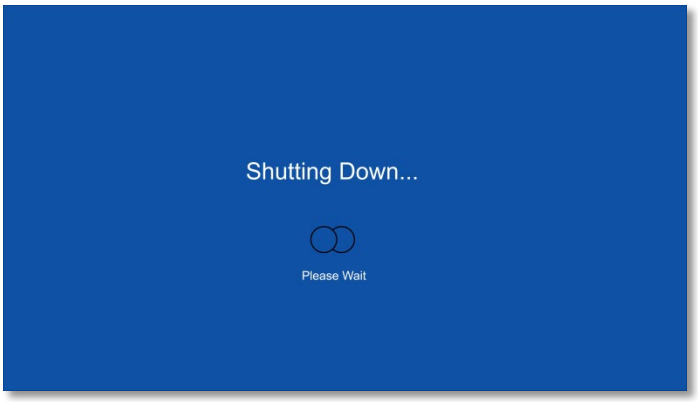


To Turn-off the device

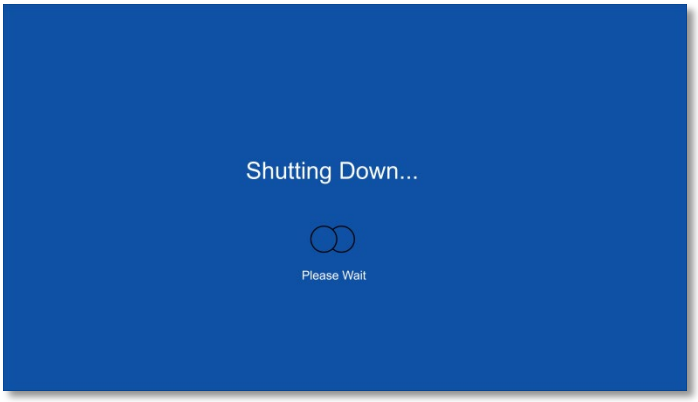
When you finish the tests, please make sure to remove all cables from the control-panel according to the instructions described above and switch off the device.

When the screen is on "**Home Page**" you can switch off the device by pressing the power button once, then click the '**Ok**' tab. This is recommended because it saves all changes made on test information.





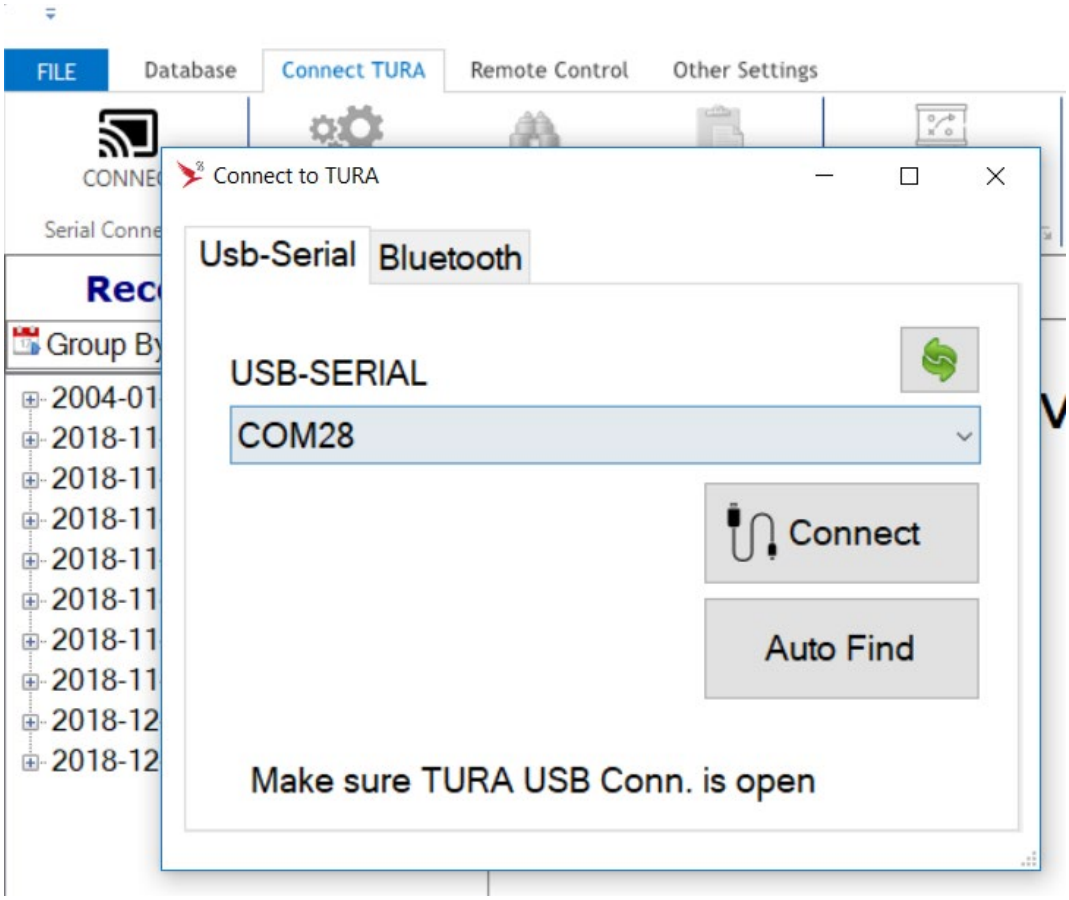
Users can switch off the device automatically by pressing the power button for 2 seconds (Display status is negligible). This is not recommended because it may lose the last recorded test information.



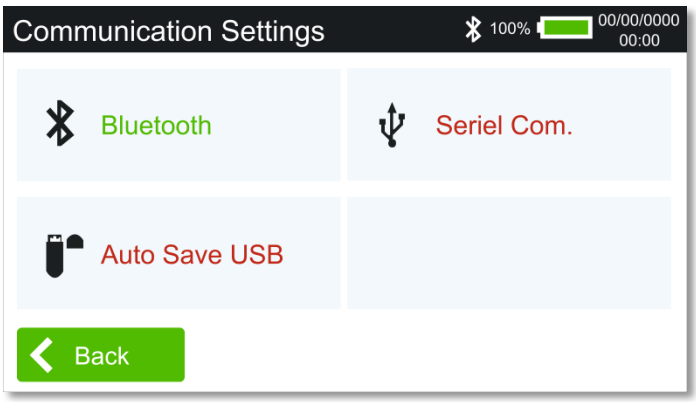
DMP SOFTWARE

DMP software can be used to view and manage the test results by using PC. You may connect TURA to PC via USB. The cable must be no longer that 1 m. You can download the updated software from the link provided with the package.

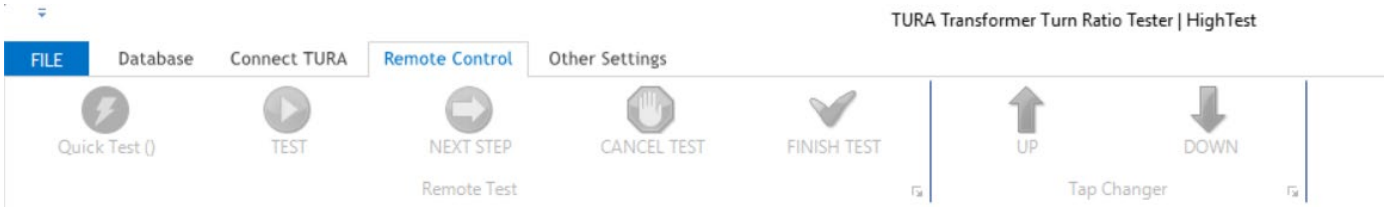
The connection must be done either via USB or Bluetooth.



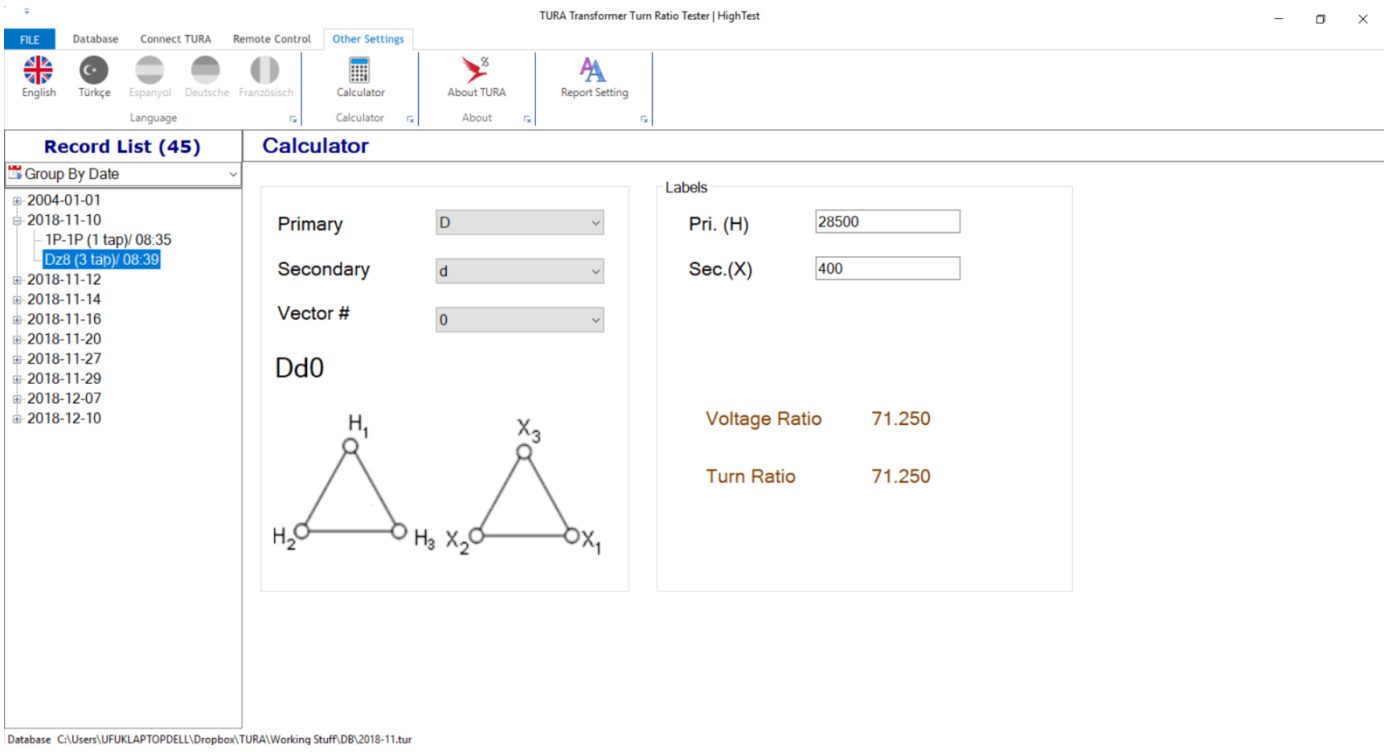
Also make sure to choose the appropriate connection from 'Communication settings' of TURA. If you are choosing 'Bluetooth', then select 'Bluetooth' on TURA as well.



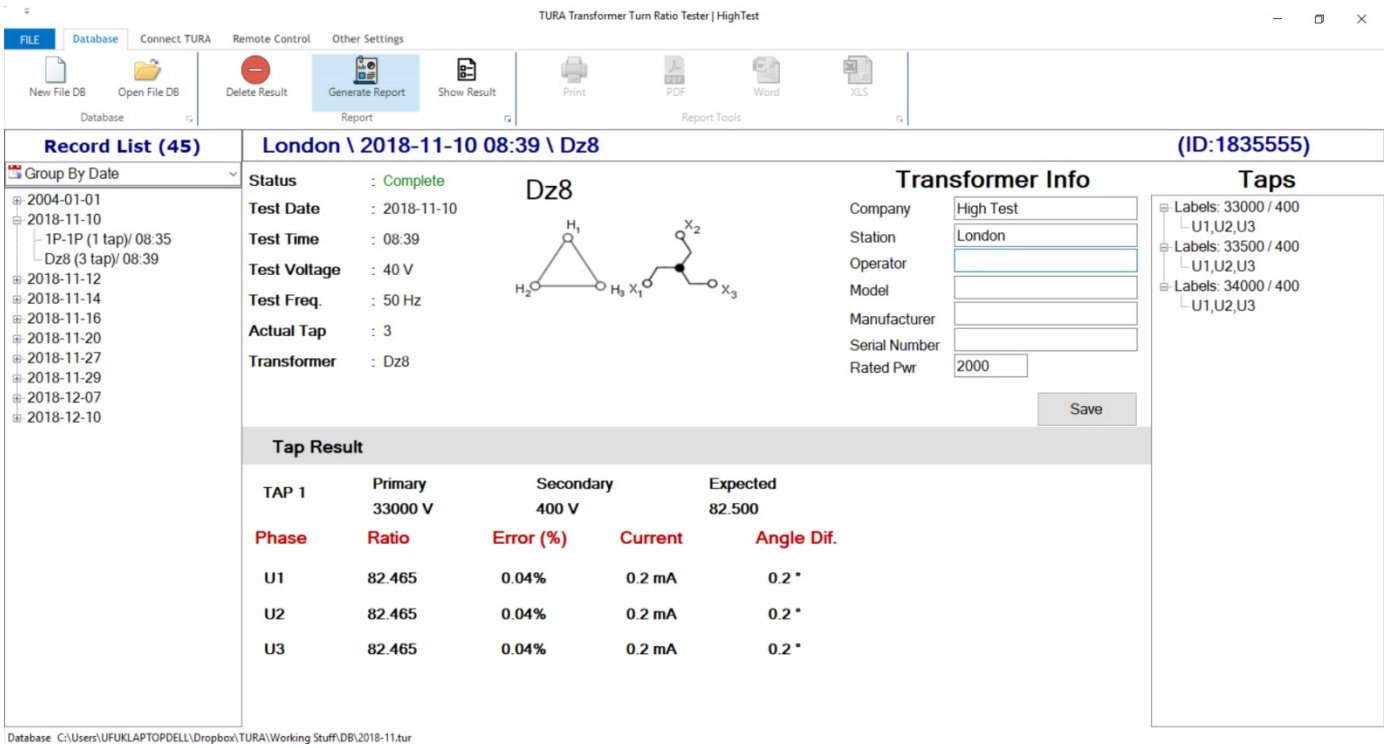
You can control TURA remotely and perform test by using DMP software. Provided the cable must be no longer than 1 m or the TURA must be in standard Bluetooth range if the connection is done via Bluetooth.

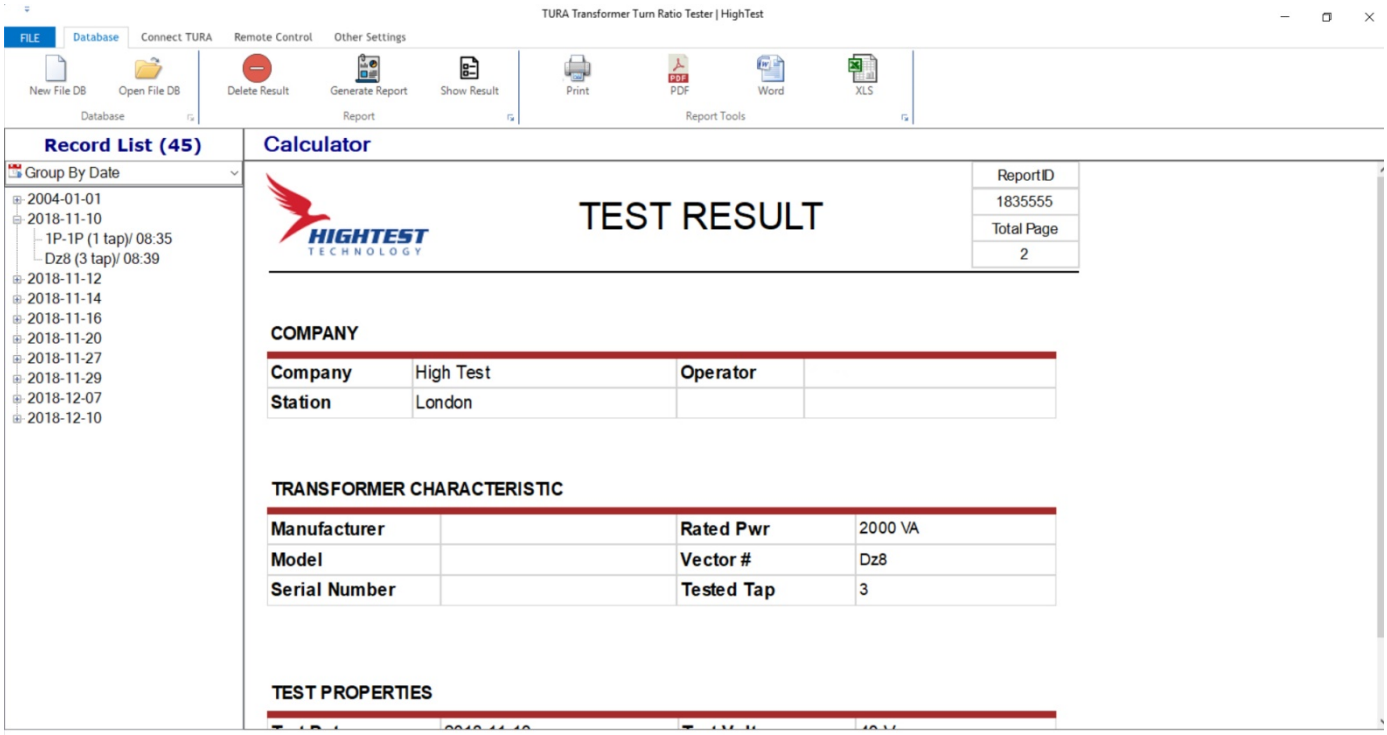


You can use the 'Calculator' to calculate the theoretical ratio before performing the test.



You can perform the test, enter the user info, transformer info and station info after completing the test and save or print the result with DMP TURA viewer.


TURA Transformer Turn Ratio Tester | HighTest
FILE
Database
Connect TURA
Remote Control
Other Settings
New File DB
Open File DB
Delete Result
Generate Report
Show Result
Print
PDF
Word
XLS
Database
Report
Report Tools
Record List (45)
Group By Date
2004-01-01
2018-11-10
1P-1P (1 tap)/ 08:35
Dz8 (3 tap)/ 08:39
2018-11-12
2018-11-14
2018-11-16
2018-11-20
2018-11-27
2018-11-29
2018-12-07
2018-12-10
London \ 2018-11-10 08:39 \ Dz8
(ID:1835555)
Status : Complete
Test Date : 2018-11-10
Test Time : 08:39
Test Voltage : 40 V
Test Freq. : 50 Hz
Actual Tap : 3
Transformer : Dz8
Dz8
Transformer Info
Company High Test
Station London
Operator
Model
Manufacturer
Serial Number
Rated Pwr 2000
Save
Taps
Labels: 33000 / 400
U1,U2,U3
Labels: 33500 / 400
U1,U2,U3
Labels: 34000 / 400
U1,U2,U3
Tap Result
TAP 1
Primary 33000 V
Secondary 400 V
Expected 82.500
Phase Ratio Error (%) Current Angle Dif.
U1 82.465 0.04% 0.2 mA 0.2 °
U2 82.465 0.04% 0.2 mA 0.2 °
U3 82.465 0.04% 0.2 mA 0.2 °
Database C:\Users\UFUKLAPTOPDELL\Dropbox\TURA\Working Stuff\DB\2018-11.tur


TURA Transformer Turn Ratio Tester | HighTest
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2018-11-16
2018-11-20
2018-11-27
2018-11-29
2018-12-07
2018-12-10
Calculator
HIGHTEST TECHNOLOGY
TEST RESULT
ReportID
1835555
Total Page
2
COMPANY
Company High Test
Operator
Station London
TRANSFORMER CHARACTERISTIC
Manufacturer
Rated Pwr 2000 VA
Model
Vector # Dz8
Serial Number
Tested Tap 3
TEST PROPERTIES

HighTest Technology Ltd. is a leading manufacturer based in the UK which produces high precise test equipment. We mainly focus on the development, manufacture and marketing of Transformer test systems.

We have several years of experience in the field of developing and producing high end test equipment. Customer satisfaction is our prime motto. We supply our test equipment worldwide to Transformer manufacturers, Electrical utilities, general contractors and service companies. Our test equipment is designed and produced according to the most widely adopted international standards. As we value our customers the most, our well experienced team always provide an excellent after-sales support and technical assistance.

Please contact HighTest Technology Ltd. or our authorised distributor in your region for any queries regarding this device.

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