HIGHTEST TECHNOLOGY LIMITED

WINRES-20 SERIES INSTRUCTION MANUAL

INDEX

CONTENT	PAGE NO:
Features	3
Technical Specifications	3
Precautions	4
Scope of Supply	5
Overview	6
Winding Resistance Test Principle	6
Application Fields of Transformer Winding Resistance Tester	7
Front Panel Components	8
Operating Instructions	11
Display Introductions	12
Home Page	12
1. Device Settings	12
1.1 Language Settings	13
1.2 Date and Time Settings	14
1.3 Communication Settings	14
1.4 Sound and Display Settings	15
1.5 Factory Default	15
1.6 About WINRES	15
2. Test Settings	16
2.1 Test Sequence	18
2.2 TPA Settings	19
2.3 Connection Type	20
2.4 Temperature Settings	20
2.5 Calculator	21
2.6 Comparator Settings	22
2.7 Main Channel	23
2.8 Labels	23
2.9 Default Device Info	24
3. Resistance Test	24
3.1 Winding Test	24
3.2 Shunt Resistance Test	36
3.3 Heat Run Test	45
3.4 Load tap Changer	50
3.4 Demagnetisation Test	52
4. Test Records	54

Features

- 2-channel resistance measurement
- Measurements from 0.01 μ Ω to 100,000 Ω
- 0.001 A to 20 A DC adjustable current output
- High accuracy (0.1%)
- Demagnetisation feature
- User-friendly operation menu
- Temperature correction (1 input, sensor optional)
- Built-in printer (2.28-inch)
- Data Management Platform (DMP) enables to control WINRES-20 and analyse results
- Optional Battery Power
- Internal memory, USB Flash Drive
- PC control via USB cable
- Optional Bluetooth control and communication
- 7-inch large colour touch display
- Emergency stop
- Multi-language
- Optional Three-Phase Adapter (TPA-03) makes WINRES-20 outputs once a time connectable to three-phase power transformers primary and secondary sides.

Technical Specifications

Measurement Parameters	2-channel resistance		
Test Voltage	50 V		
Current output	From 0.001 A to 20 A DC (User-selectable)		
Resistance Measurement	From 0.01 μ Ω to 100,000 Ω		
Accuracy	Current Value	Resistance Value	Accuracy
	1 mA – 10 mA	Up to 100 kΩ	0.1 % rdg 0.1 % of Fs
	10 mA – 100 mA	Up to 5 kΩ	0.1 % rdg 0.1 % of Fs
	100 mA – 1 A	Up to 500 Ω	0.1 % rdg 0.1 % of Fs
	1 A	Up to 50 Ω	0.1 % rdg 0.1 % of Fs
	20 A	Up to 2.5 Ω	0.1 % rdg 0.1 % of Fs
Demagnetisation	Yes		
Power Supply	100 – 240 V, 47/63 Hz		
Battery (Option)	14.4 V 6.9 Ah battery (Factory Install Option)		
Memory	Up to 500 records (include up to 25 tap results)		
Printer	2.28-inch Built-in Printer		
Communication	USB 2.0/1.1 Standard-A, USB 2.0/1.1 Standard-B, Bluetooth (Factory install option)		
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 kg (models with Battery)		
Working Temperature	-10 °C to +60 °C		
Protection Class	IP67 (case closed)		
Set of Package	WINRES-20, Power Cable, Ground Cable , 1x 5 m Current Cable Set, 2 x 5 m Voltage Cable Set, USB Cable, Tap Changer Cable Set, Jumper Cable, Printer Paper (x2), USB flash drive, Instruction Manual (Soft Copy), DMP Software, Cable Bag		
Options	Hard carrying case, Battery, Bluetooth (factory install), Three-Phase Adapter TPA-03, Temperature Sensor, 30 feet Long Cable Sets for Current and Voltage channels,		
Ordering Information	WINRES-20, 20A winding Resistance Tester with Built-in Printer WINRES-20 BLUE, 20A winding Resistance Tester with Built-in Bluetooth & Printer WINRES-20B, 20A winding Resistance Tester with Built-in Battery & Printer WINRES-20B BLUE, 20A winding Resistance Tester with Built-in Battery, Bluetooth & Printer		

Note

Specifications are valid at/under 25 °C (77°F) temperature. *Contents subject to change without notice.

Precautions

• Please read all instructions before turning on the unit and likewise follow the instructions while operating the device.

• Follow all safety precautions while operating, servicing or repairing the device.

• The user shall accept all responsibility for the operation of the device with the purchase of the device.

• Use, design and manufacture of the device have been carried out with precautions or other special instructions contained in this manual.

• Failure to follow safety instructions and other special instructions may cause problems to the design, and operation of the device.

• HIGHTEST Technology ltd. accepts no responsibility for improper use or improper operation of the device or non-compliance with safety precautions.

1. Safety Operation

• Only qualified personnel are allowed to operate.

• Before operating the device, all test personnel must read the operational and safety instructions and thoroughly understand the device.

• All testing personnel; either directly or indirectly, must keep away from high-voltage devices while testing.

• Make sure the device is grounded to reduce the risk of electric shock.

• Make sure that the power cord (PWC-01) supplied with the device is plugged into a grounded power outlet.

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

2. Prior to Turn ON

• Check that all external connections to the transformer to be tested have been disconnected and still not working.

• Do not operate the device in the presence of inflammable or explosive materials.

3. Avoid Unauthorised Disassembly

• The operator must NOT remove the case of the device.

• The device can only be removed from the case and repaired ONLY by authorised technical service. The disassembly of the device by unauthorized persons will exclude the warranty of the device.

• Do not touch or replace the electronic components of the device with the power cord (PWC-01) inserted.

• To avoid injury, make sure that the circuit has been disconnected from the external and/or internal voltage sources and that the circuit has been discharged before replacing the internal components.

Scope of Supply

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

Standard Content List

WINRES-20	: 20A Winding Resistance Tester with built-in Printer
PWC-01	: 1.5 m Power Cord
GC-01	: 2.5 m Ground Cable
MCS-WINRES-I1	: 5 m Standard Test Cable Set(Current) (1 x)
MCS-WINRES-U1	: 5 m Standard Test Cable Set (Voltage) (1 x)
MCS-WINRES-U2	: 5 m Standard Test Cable Set (Voltage) (1 x)
TCS-WINRES	: Tap Changer Cable Set
JCS-WINRES	: Jumper Cable
USB Cable	: USB Cable (USB 2.0/1.1 Standard-B)
HIGHTEST USB	: USB Flash Drive (DMP, Manual, Brochure)
PP-11	: 2 x Printer Paper
Cable Bag	

External/Optional Accessories

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

TPA-03	: Three-phase Adapter
TEMP-WINRES	: Temperature Sensor
LCS-WINRES-I1	: 10 m Long Cable Set (Current) (1 x)
LCS-WINRES-U1	: 10 m Long Cable Set (Voltage) (1 x)
LCS-WINRES-U2	: 10 m Long Cable Set (Voltage) (1 x)
Battery*	
Bluetooth*	

**Battery and Bluetooth options are factory installed for specified models.*

Overview

WINRES-20 is designed using advanced engineering technology to measure the winding resistance of transformers. WINRES-20 can measure current, voltage, power transformer windings and shunt resistors. Applying up to 20A Direct Current allows WINRES-20 to measure the resistance of the transformers fast and accurate.

The smart design of the WINRES-20 makes easier to determine the end of measurement automatically according to users' decision. WINRES-20 can measure two resistance values simultaneously with its two voltage measurement channels. Users can prefer to test two primaries or two secondary or one primary and one secondary winding according to the configuration of transformers.

Beginning from 0.01 μΩ resistances, WINRES-20 can measure up to 100,000 Ω resistances. WINRES-20 discharges the measured circuit after each test. For inductive load, WINRES-20 can demagnetise the load. The temperature measurement input enables one to connect an optional sensor to WINRES-20 and perform temperature correction automatically.

WINRES-20's intelligent software allows controlling the current flow if there is a failure in the current circuit. With this feature, WINRES-20 procures added safety to users. A 7-inch TFT touch display allows WINRES-20 to show all measurement results on a single screen. WINRES-20 can be controlled by USB and optional Bluetooth interface and users can record/store measurement results.

In case setting up Laptop or PC for the field test is difficult; users can record data to the device's internal memory (up to 100 Test Records) or to an external USB flash memory. With the HighTest Data Management Platform (DMP Software), users can control WINRES-20, analyse and manage measurement results using a PC. Operators can easily print the measurement results with the 2.28-inch built-in Printer of WINRES-20.

WINRES-20 has an optional battery power feature which allows users to make tests even when there is no electricity. Multi-language capability and user-friendly operation menu make it easy to control WINRES-20, even by less trained staffs.

Three-Phase Adaptor TPA-03 (optional accessory) allows connecting all primary and secondary sides concurrently, whereby users can select either to test the resistance of all phases or selective phases. With the TPA-03 option, WINRES-20 can control tap changer (raise and lower) with its tap changer outputs.

WINRES-20 is a light, compact and rugged device with the protection class IP67 (case closed)..

Winding Resistance Test Principle

Winding resistance testing is performed during transformer commissioning, after the occurrence of internal faults, and during periodic maintenance as recommended by the manufacturer. Winding resistance tests are performed to assess the integrity of a transformer's windings, tap changer, and internal connections.

With aging infrastructure, the routine maintenance and testing of large power transformers has become increasingly necessary to ensure that the equipment remains in good working condition.

Application Fields of Transformer Winding Resistance Tester

- To detect issues such as;

    - loose connections
    - discontinuities
    - problems exist with the internal portion of the transformer

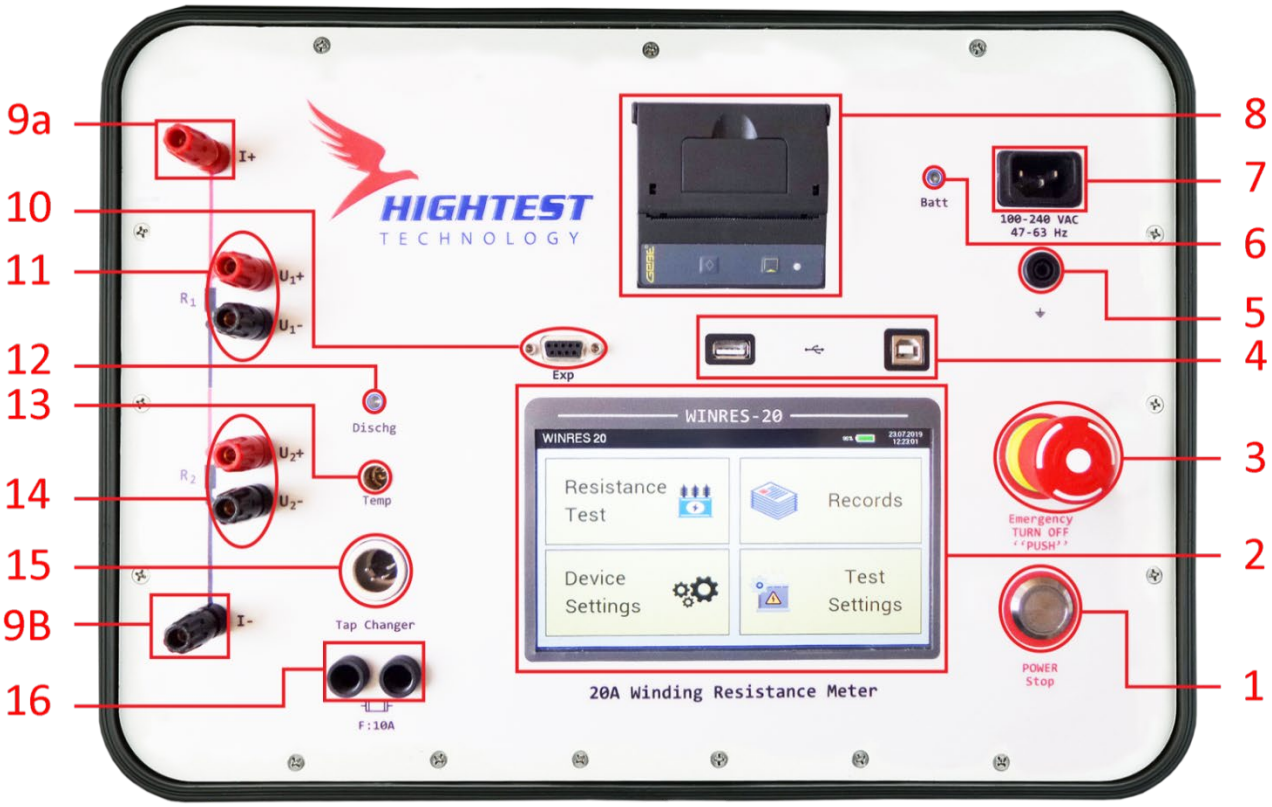
- To verify factory test readings “as received” such as;

    - winding taps
    - lead
    - link connection tightness

- To determine average winding temperature, before and after a heat run
- To determine the condition of the transformer taps and winding connections in later life as part of routine preventive maintenance program.

Section 1

Front Panel Components



1. Power Button

- The Power Button has some specific tasks other than the designated purpose.
- To turn ON the device.
- Pressing the power button for 2 seconds while the device is switched 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 be used as "**Emergency Stop**" button in the test state.

2. Display

- 7-inch Resistive Touch TFT Display great convenience to users.
- It allows WINRES-20 to include maximum measurement results on a single screen.
- Visibility in daylight and low light levels
- Able to adjust brightness level.

3. Emergency Stop Button

Push the emergency button while testing to stop the ongoing test in an emergency situation. In addition to designated 'Emergency Button', WINRES-20's power button will also function as 'Emergency Stop', you can press power button while testing in order to cancel the ongoing test.

4. USB Connection Port

There are two USB ports available on WINRES-20.

- 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 WINRES-20 via computer. The cable to be used should not be longer than 1 meter.

5. Ground Connection

- To connect the ground cable while performing tests.
- Make sure the Ground is connected prior to energizing and testing.

6. 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.

7. Power Connection

- WINRES-20 AC power input.
- The input voltage should be between 100-240V AC 47/63 Hz.

8. Printer

WINRES-20 comes with 2.25-inch built-in printer which allows the operator to print the measurement results. If the paper is empty, lift the printer lid up to load new paper roll and close the lid.

9a & 9b. Current Output

Test connector (female) for connecting current test leads.

10. Expansion

To make TPA-03 (Three-Phase Adapter) connection for extension purpose.

11. Voltage Sensing Channel 1 (U1)

Test connector (female) for connecting voltage sensing test leads.

12. Discharge Indication LED

This LED flashes when the WINRES is discharging the stored energy from the transformer. Do NOT disconnect test leads when this light is on. Failure to follow the instructions and warning may cause injury to test personnel and /or damage to the device.

13. Temperature Sensor Connector

To connect temperature sensor with WINRES in order to obtain automatic temperature correction.

14. Voltage Sensing Channel 2 (U2)

Test connector (female) for connecting voltage sensing test leads.

15. Tap Changer Connector

To connect WINRES-20 with the test transformer's tap changers.

16. Fuse

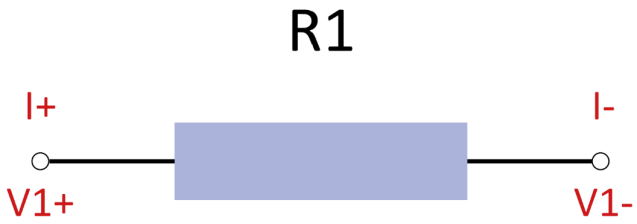
To provide overcurrent protection for electrical circuit of WINRES-20.

Section 2

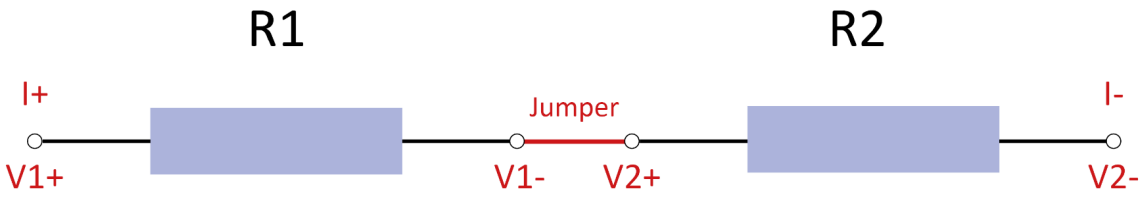
Operating Instructions

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.
- Connect both I+& I- and V1+& V1- to both side of resistance as shown in the figure below.



- In case, two resistances measurement are done at the same time, connect the jumper cable between resistance and connect the I+ to the open side of the R1 and I- to the open side of the R2, and V1+ to the open side of R1 and V1- to the other side of the R1 and V2+ on the side where the jumper is connected and V2- to the open side of the resistance (as shown in the following figure).

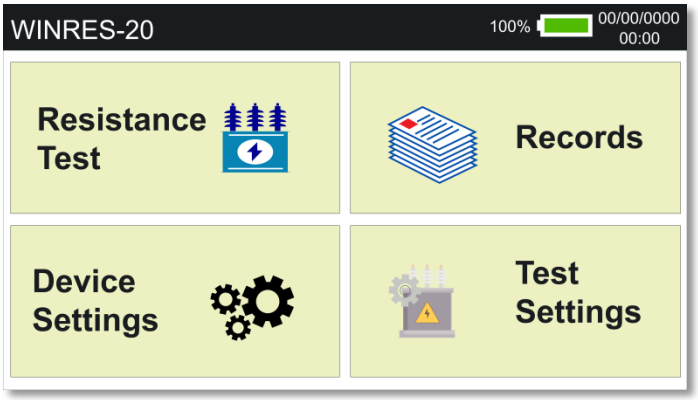


- Switch ON the device by pressing the power button of the device.
- Apply the procedures described as below and introduce the test parameters to the instrument.
- Finally, you can test by pressing **"Test"** tab, save the test results in the device memory or print them.

Section 3

Display Introductions

Home Page



- To perform single-phase or multi-phase transformer testing.
- To access test records.
- To alter device settings.
- To add test settings
- 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 a critical level, no test can be performed.

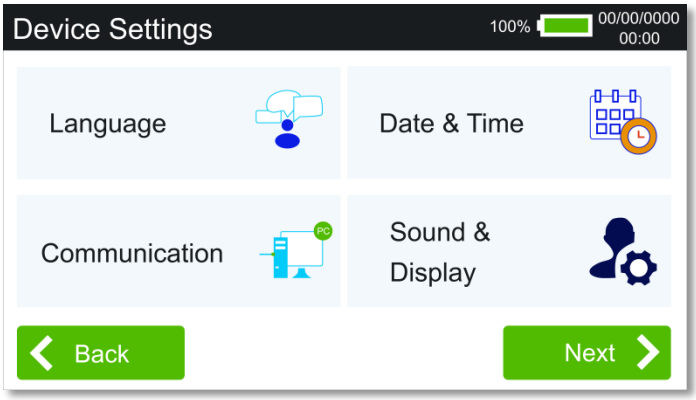
1. Device Settings

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:

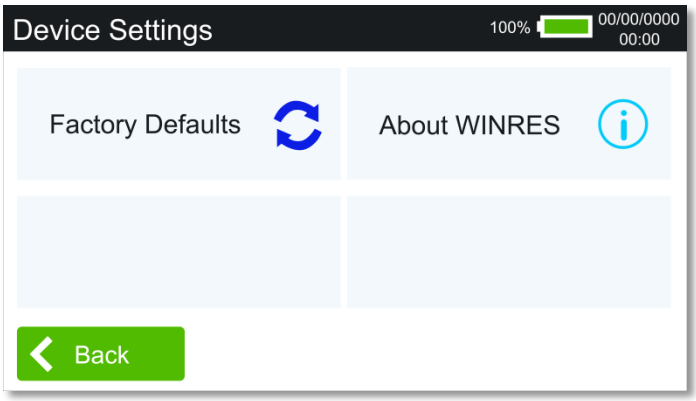
1. Language Settings
2. Date and Time Settings
3. Communication Settings
4. Audio & Display Settings
5. Factory Defaults
6. TPA Settings

7. About WINRES

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

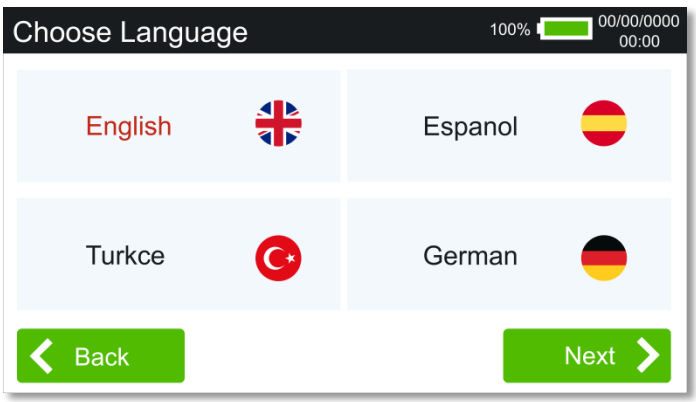


Press the '**Next**' tab to navigate to page 2 of '**Device Settings**'



1.1 Language Settings

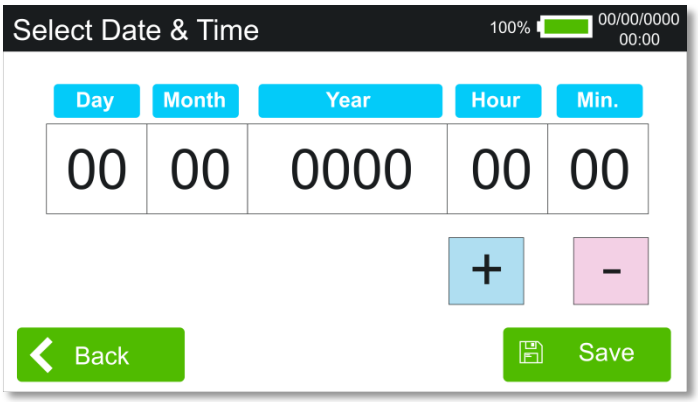
WINRES-20 supports multiple languages including EN, ES, TR, DE and FR. (Portuguese, Korean and many more will be added soon). Press the '**Language**' tab to choose the desired language for changing the default language of the device. The active language is marked in red. You can exit the menu using the '**Back**' tab.



1.2 Date and Time Settings

WINRES-20 has a high accuracy real-time clock.

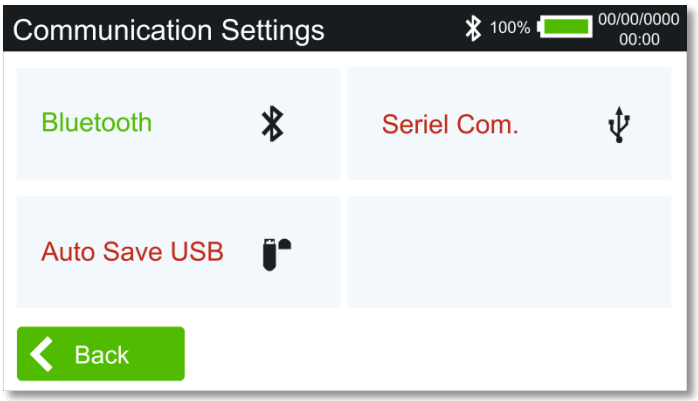
- Press '**Date & Time**' tab in the '**Device Settings**' menu to change date or time.
- Choose the parameter to be changed and then use '+/-' tabs to alter it.
- Press '**Save**' after making the necessary changes.



1.3 Communication Settings

WINRES-20 has multiple communication options.

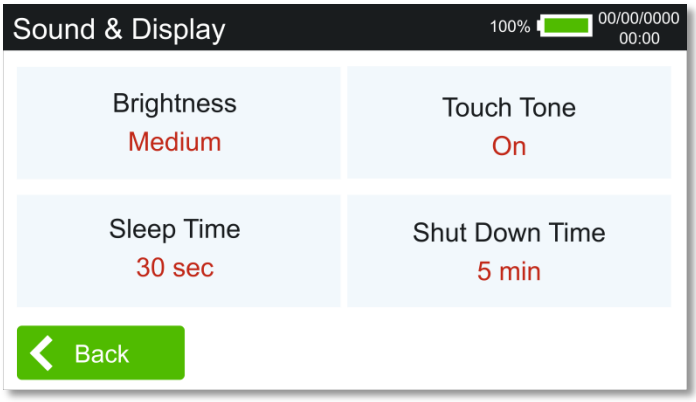
- To control WINRES-20 via Bluetooth, activate Bluetooth broadcasting by pressing the '**Bluetooth**' tab.
- To control WINRES-20 via PC Software, activate connection by pressing '**Serial Com.**' tab.
- WINRES-20 cannot be controlled simultaneously by Serial Communication and Bluetooth. Either one of 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 Settings

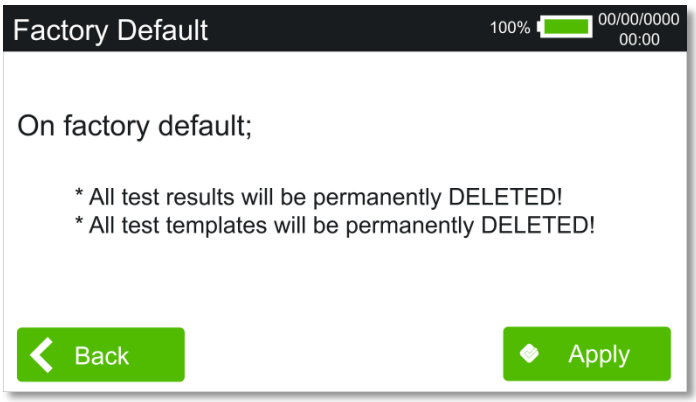
To change sound and display settings of the unit;

- **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 timer to automatically turn OFF the device after a certain seconds/minutes of inactivity.



1.5 Factory Default

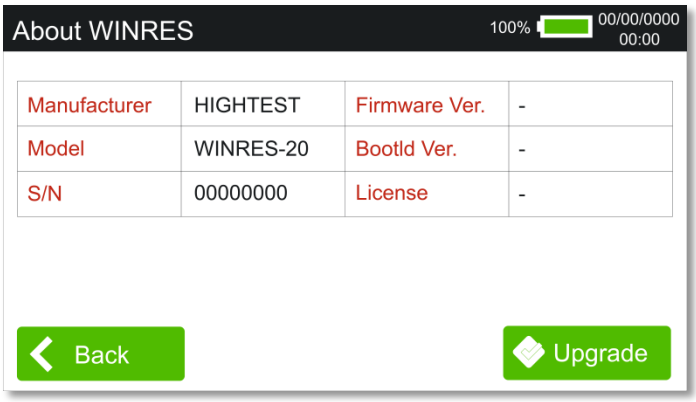
To reset the device to factory default settings. Pressing the 'Apply' will result in deleting all saved test results and other information saved on the device permanently.

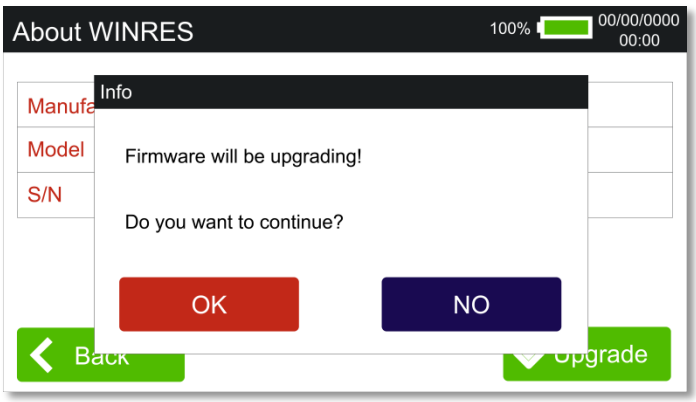


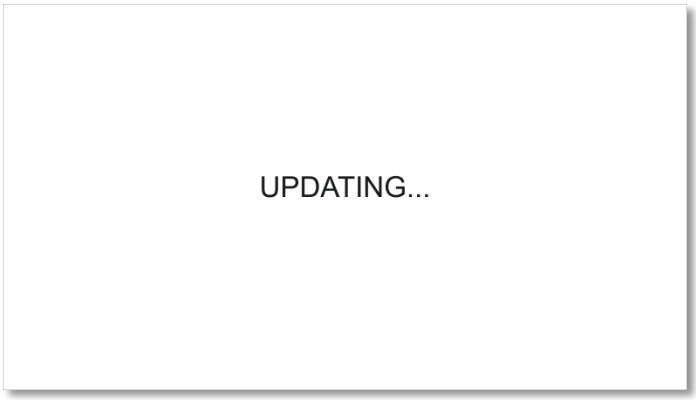
1.6 About WINRES

The complete information about the WINRES unit is available in this menu.

You can download the latest version of the firmware from www.hightest.co.uk and using a USB you can update the device by pressing 'Upgrade' tab.





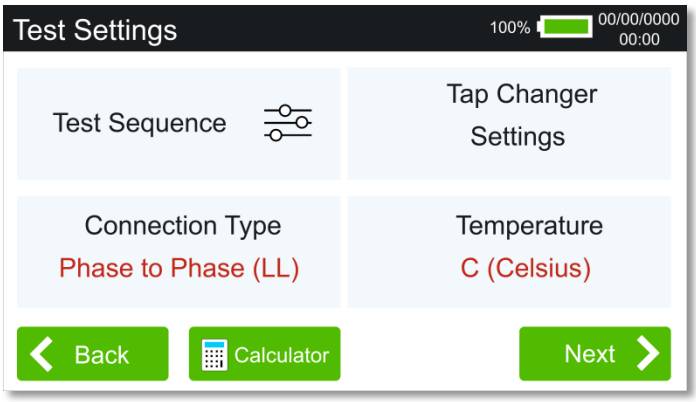


2. Test Settings

Available on the '**Home Page**' to make necessary settings related to the test to be performed. Test settings consist of 3 pages and you can use the '**Next**'/'**Back**' tabs to navigate through the pages. You can make the following settings under this menu:

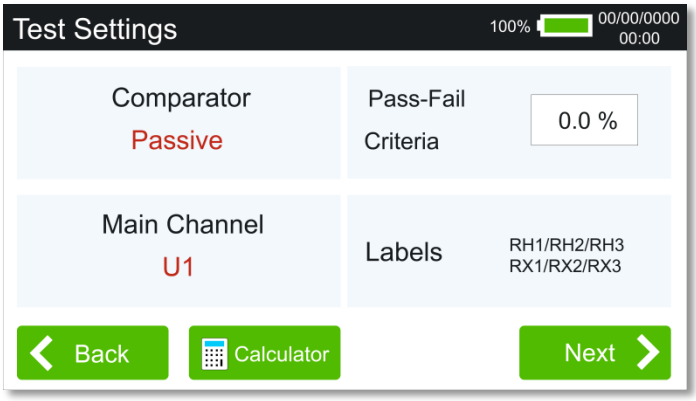
Page 1

1. Test Sequence
2. Tap Changer Settings
3. Connection Type
4. Temperature
5. Calculator



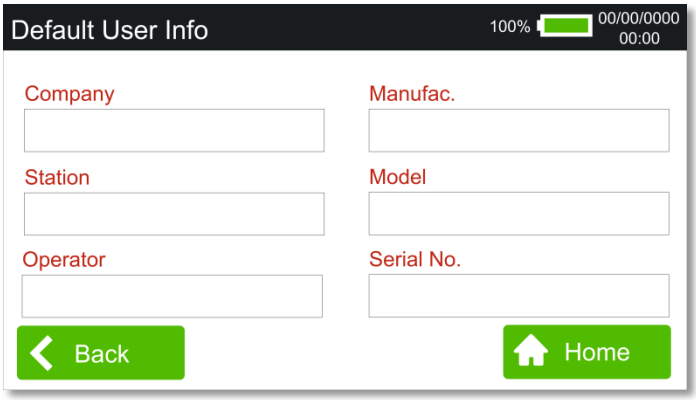
Page 2

6. Comparator
   6.1 Pass-Fail criteria
7. Main Channel
8. Labels



Page 3

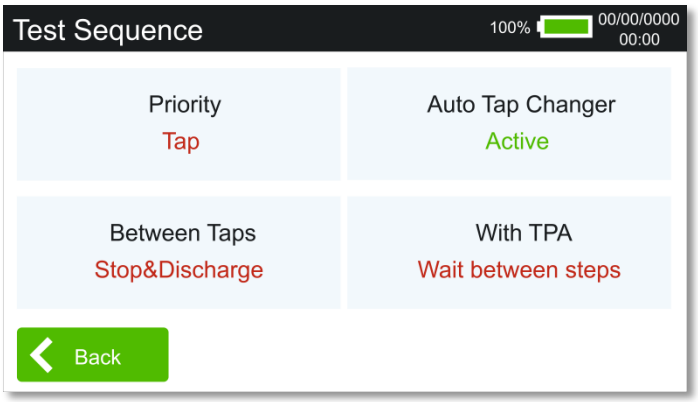
9. Default Device info

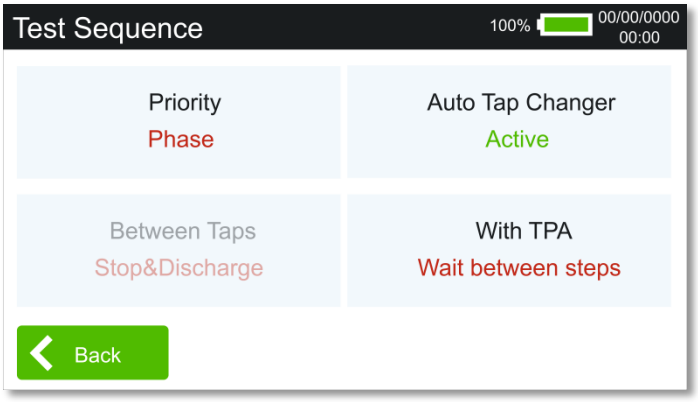


2.1 Test Sequence

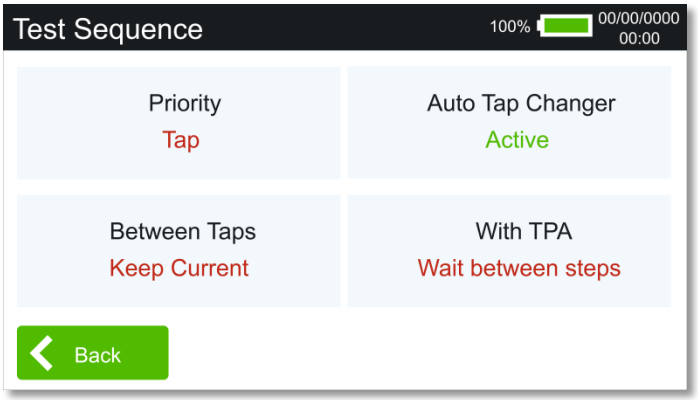
In this menu, users can determine whether the device should discharge every time after testing each tap.

WINRES has been set the default to **'Stop & Discharge'** as it is highly recommended to avoid the risk of electric shock. Users can either choose **'Stop & Discharge'** or **'Keep Current'** according to their wish/requirement while performing the test.





Preferring **'Keep Current'** will execute the test faster as it will not take time to discharge; given, the user/operator **MUST NOT MAKE DIRECT CONTACT** with the transformer under test.

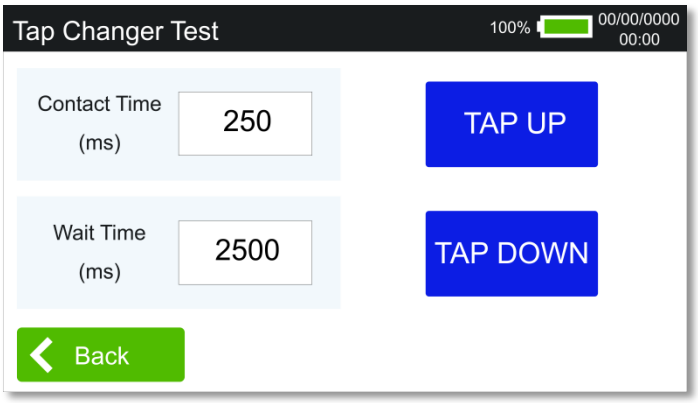


Additionally, users can set '**Auto Tap Changer**' to '**Active**' or '**Passive**' by hitting on the concerned tab. The fourth tab '**With TPA**' in this page let you set tap changing options either to 'Wait between Steps' or to 'Auto next step'. This will be enabled only when WINRES is used along with our three-phase adapter, TPA-03.

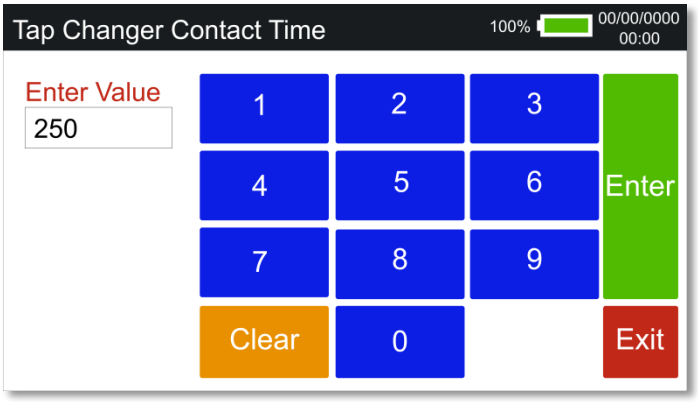
2.2 TAP CHANGER Settings

To set the contact and wait time of the tap changer.

- '**Contact Time**' is the pulse duration for the automatic tap changer.
- '**Wait Time**' is the waiting time after automatic tap is changed.



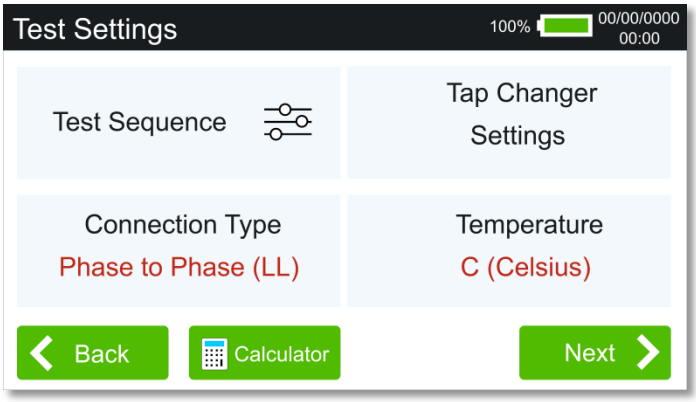
To set the contact time, tap on the space provided to enter '**Contact Time**'. Then the following window will open. Press '**Enter**' to save the value and return to the previous page.



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.

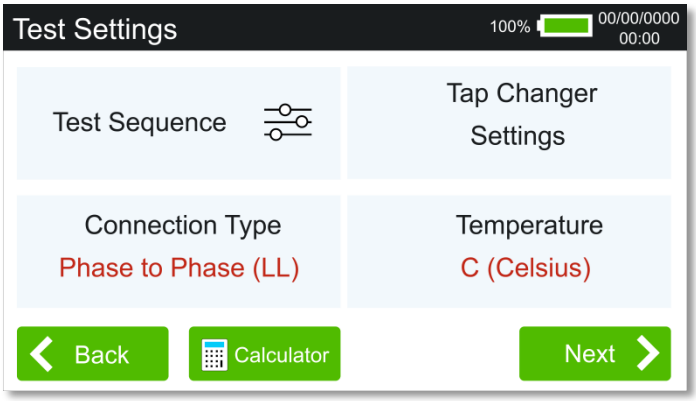
2.3 Connection Type

Users can choose connection type among **'Phase to Phase'** and **'Phase to Neutral'** for testing. Hit on the tab for connection type to switch between 'Phase to Phase' and 'Phase to Neutral'.



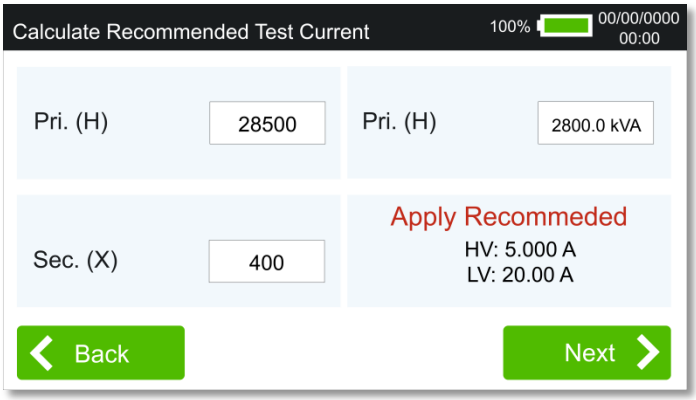
2.4 Temperature Settings

Users can choose units of temperature among **'°Celsius'**, **'Kelvin'** and **'°Fahrenheit'** according to their convenience. Hit on the 'Temperature' tab to switch between these units.



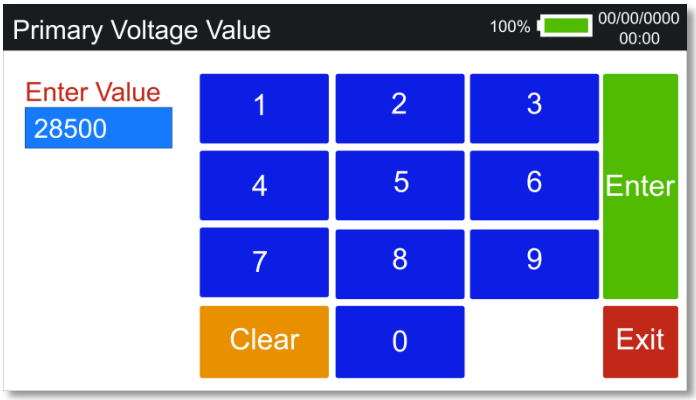
2.5 Calculator

If you need any help to find primary and secondary test current values, you can press on the tab '**Calculator**' provided on the test screen which will calculates and show you what value to be entered to perform the test. You only need to enter the primary voltage, secondary voltage and power of the transformer to be tested. WINRES will calculate and display the test current applicable on both HV and LV side.

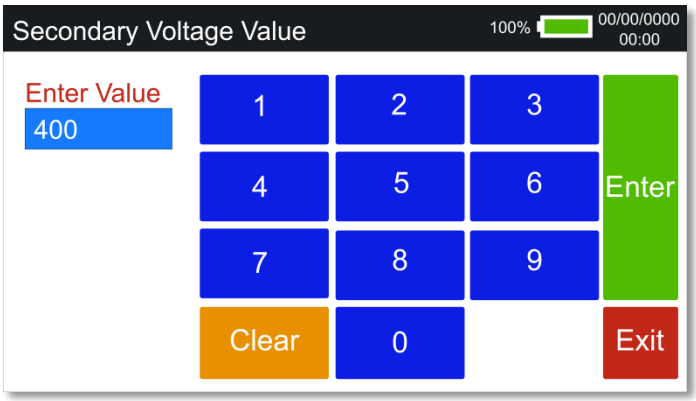


You can enter primary voltage, secondary voltage and transformer power manually by using the onscreen keyboard.

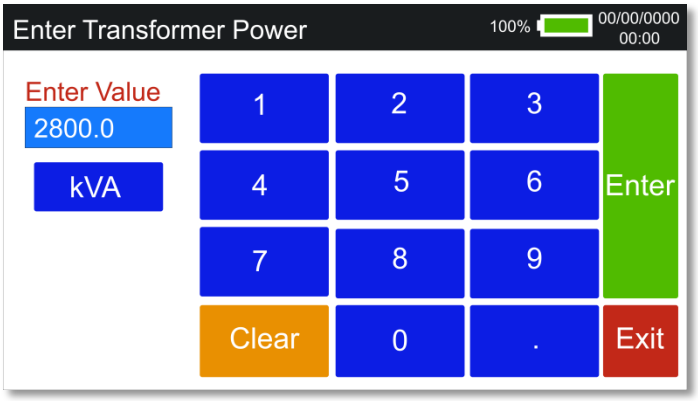
Hit on the '**Pri. (H)**' to enter the primary voltage value;

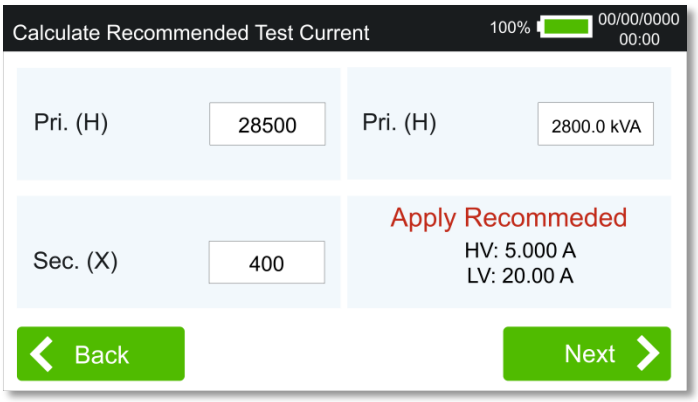


Hit on the '**Sec. (X)**' to enter the secondary voltage value;



Hit on the '**Power**' to enter the power of the transformer to be tested. Here, users can switch between '**kVA**' and '**MVA**' by pressing on the concerned tab right below '**Enter Value**'.

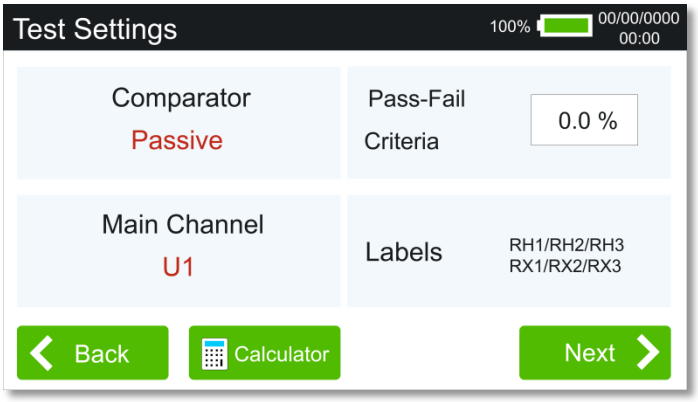




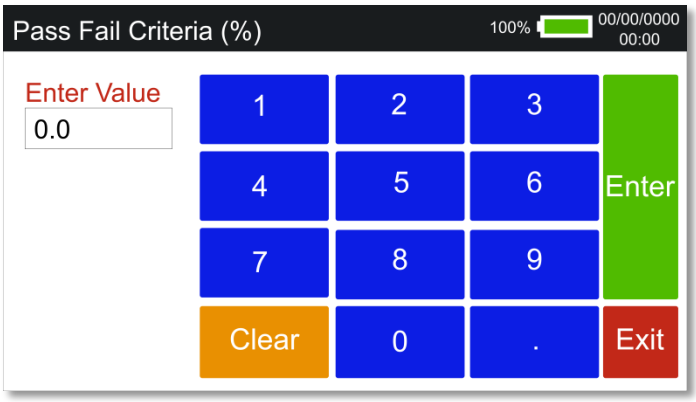
The recommended test current will be displayed on the screen. Press '**Next**' or '**Back**' to return to the previous page.

2.6 Comparator Settings

Pass- Fail comparison is possible by setting a limit value for resistance test.

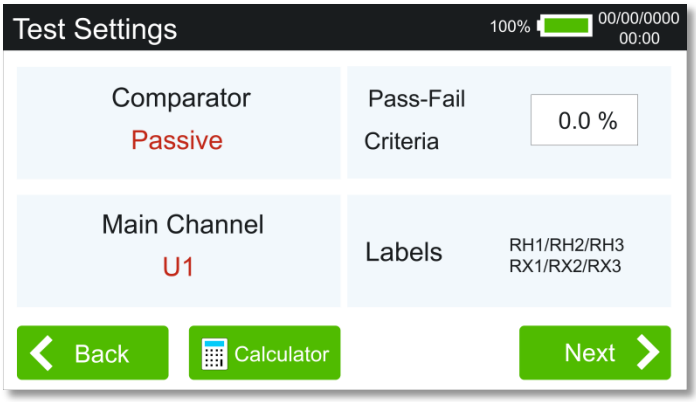


You can enter a percentage value for '**Pass-Fail**' comparison using the on-screen keyboard of WINRES-20.



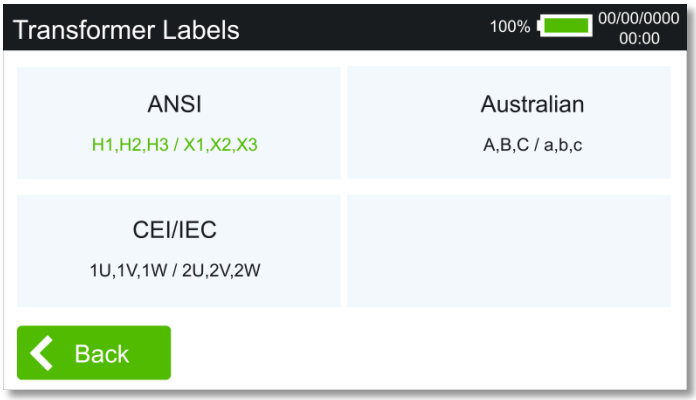
2.7 Main Channel

To set the channel through which the resistance test is going to carry out. Users can switch between U1 and U2 using this menu.



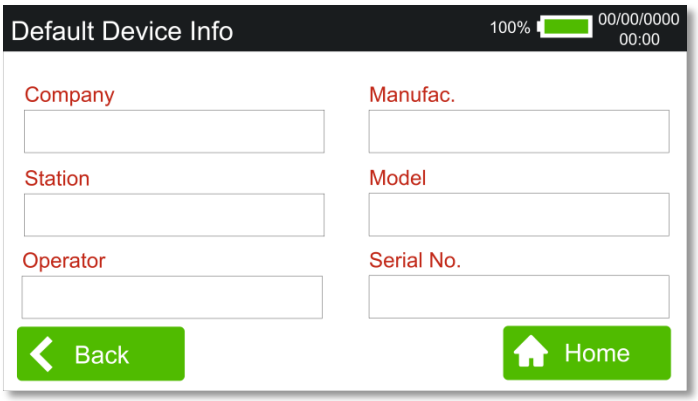
2.8 Labels

To set the labels according to the country's nationally accepted standards.



2.9 Default Device Info

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.



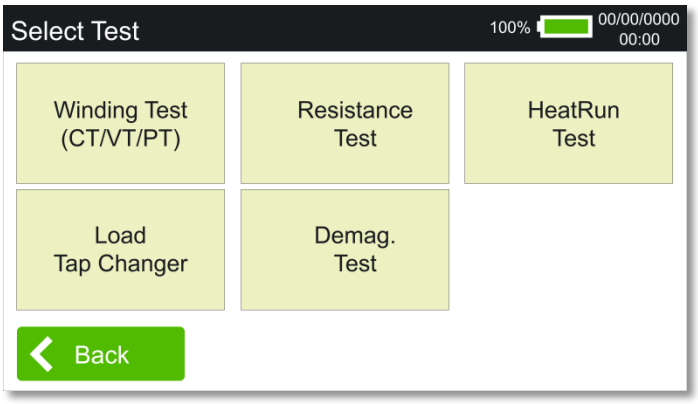
3. Resistance Test

You can carry out following tests using this menu.

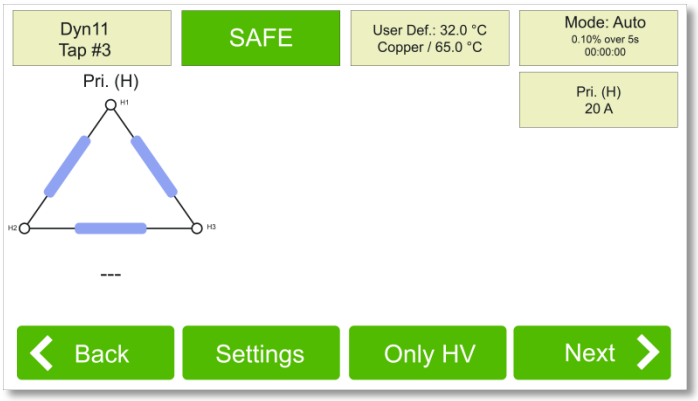
1. Winding Test
2. Shunt Resistance Test
3. Heat-Run Test
4. Load Tap Changer
5. Demagnetisation

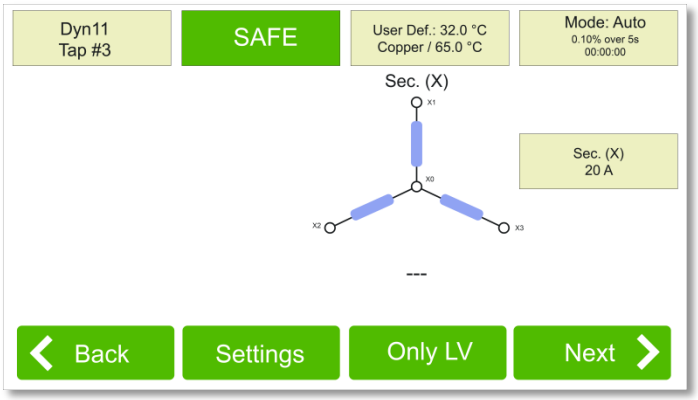
3.1 Winding Test

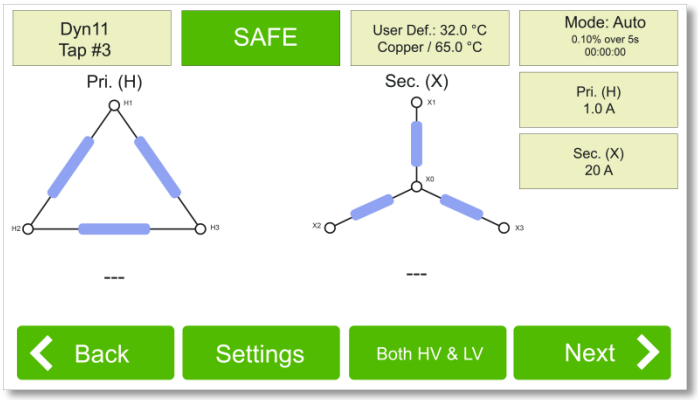
Winding test is performed to confirm each circuit is wired properly and connections are tight.



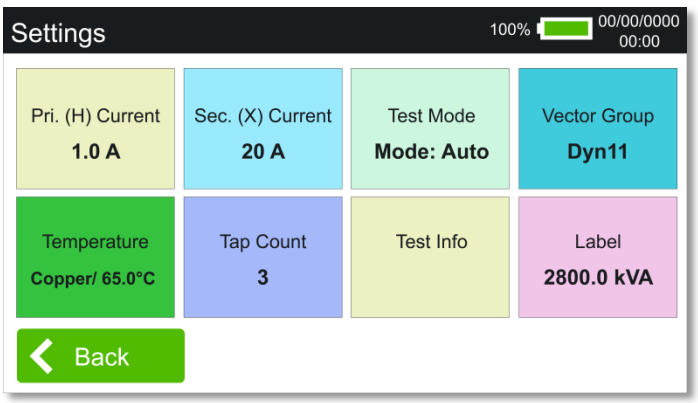
Press the '**Winding Test**' tab perform the wind test for CT, VT and PT. You can choose to test only primary or secondary or both at a time. You can press on the tab provided in the bottom part of the screen showing '**Switch to LV**' or '**Switch to Both'** or '**Switch to HV'** to make necessary choice.



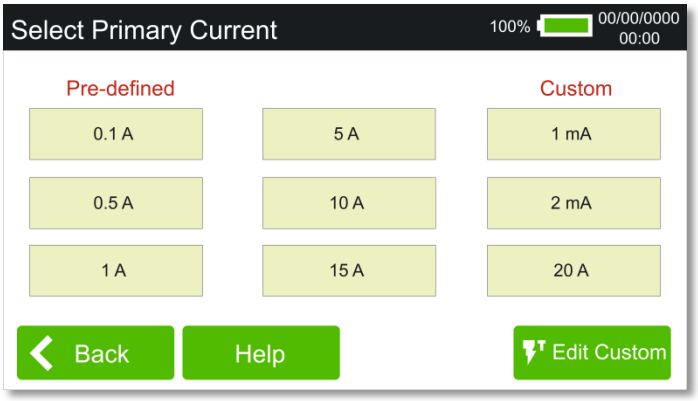




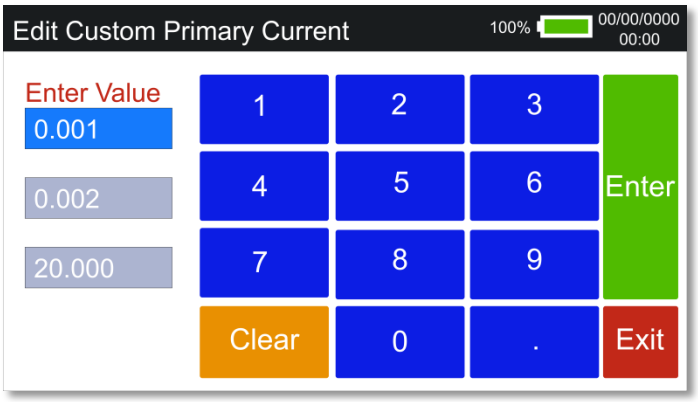
Press on the '**Settings**' to enter/alter the test settings.



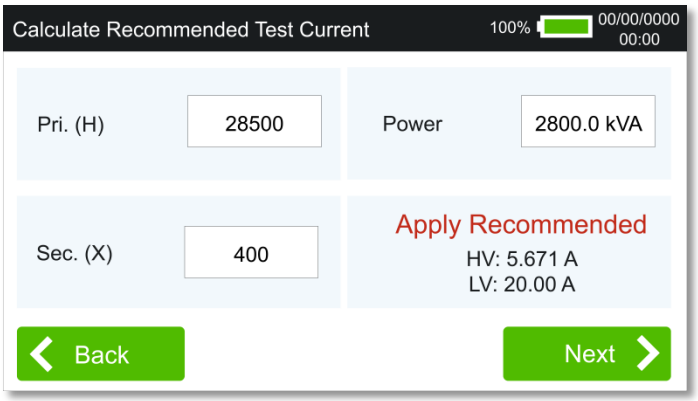
Press on the corresponding tabs to enter/choose test details. Press '**Pri. (H) Current**' to enter the primary test current value.



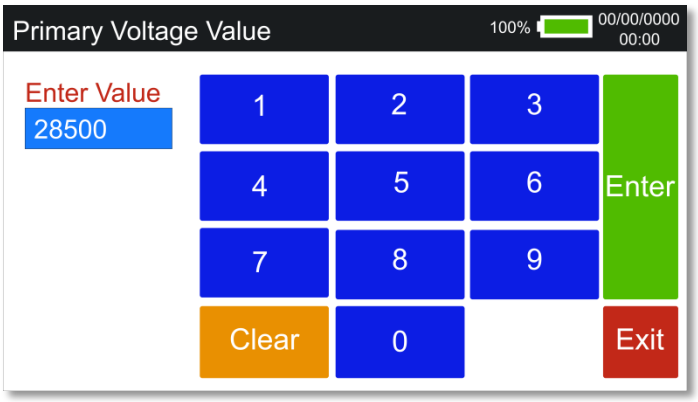
You can easily choose the primary current from predefined values. Or you can enter custom values by pressing the tab '**Edit Custom**' and you can enter the values using on-screen keyboard.

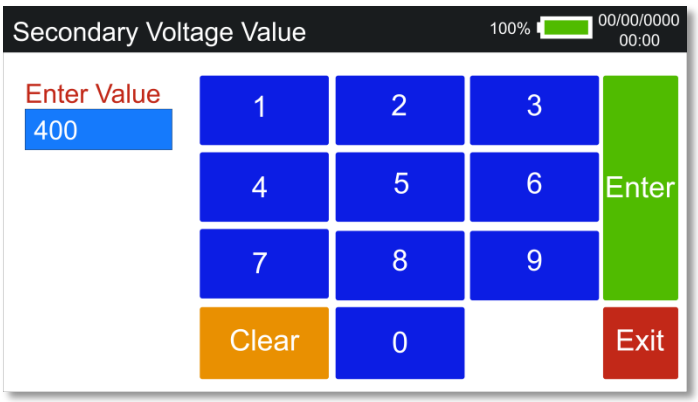


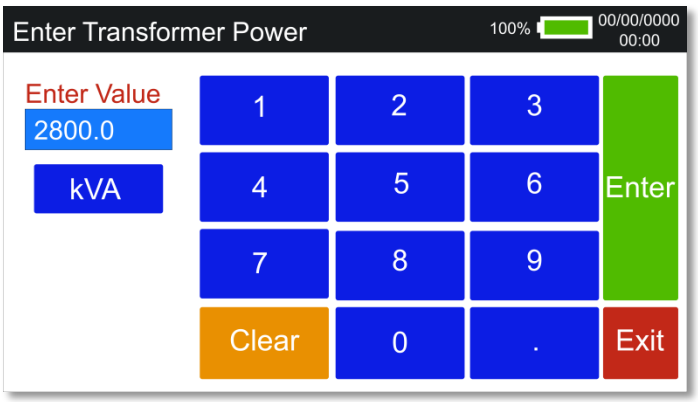
If you need any help to find the primary current values, you can press on the tab '**Help**' which will calculates and show you what value to be entered to perform the test. You only need to enter the primary voltage, secondary voltage and power of the transformer to be tested. WINRES will calculate and display the test current.



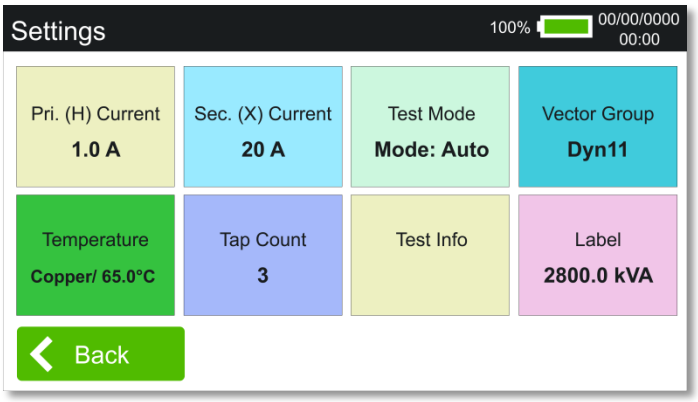
You can enter primary voltage, secondary voltage and transformer power manually by using the onscreen keyboard.

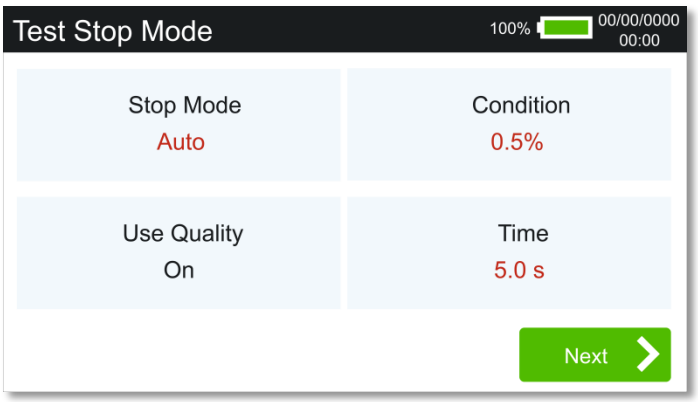






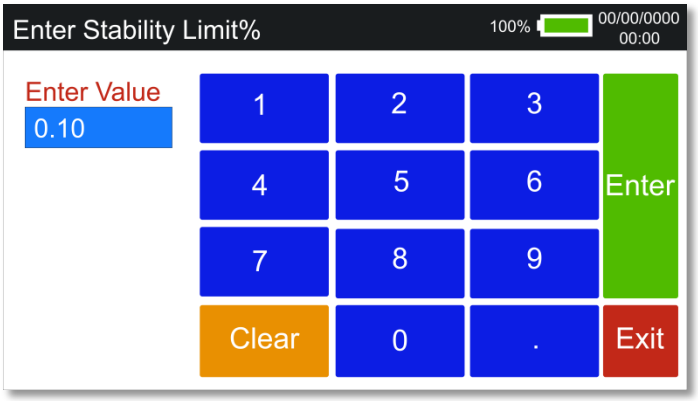
Similarly, press on the '**Sec. (X) Current**' and repeat the same steps as '**Pri. (H) Current**' to enter the secondary test current value. After entering secondary current values, you can choose the test mode by pressing on '**Test Mode**' tab on the following display.



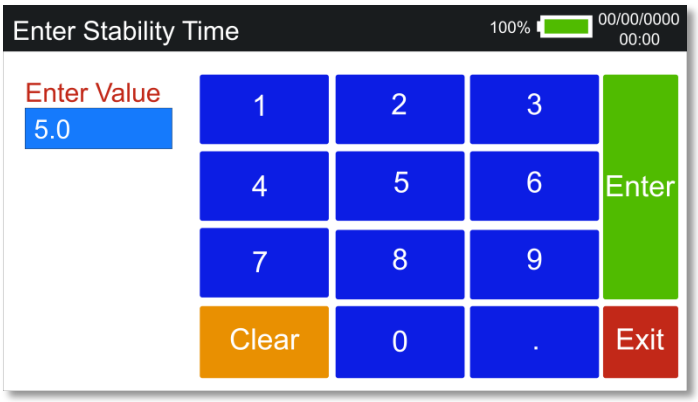


Here, users can choose whether the test should be stopped automatically or by manually. Press on the '**Stop Mode**' to switch between 'Auto' or 'By User'.

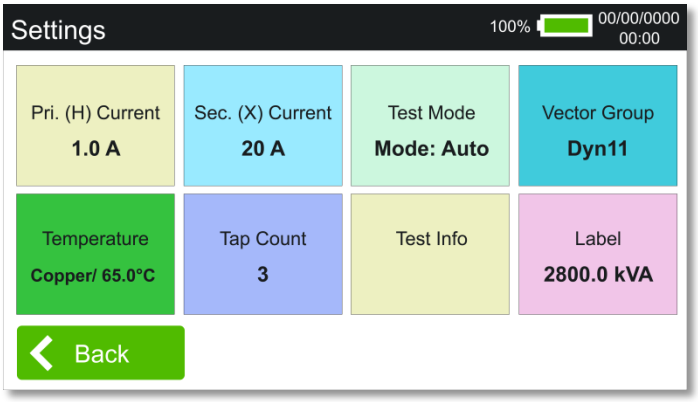
Also, we can change the display quality by pressing on '**Use Quality**' tab. If it's ON, the various tabs on the display change colour according to stability and status of the test, while performing a test. You can set stability limit percentage by pressing on the '**Condition**' tab and enter the limit by using onscreen keyboard.



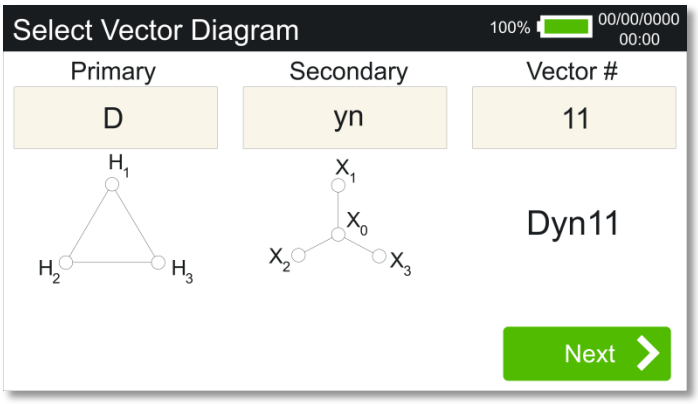
Similarly, you can set the stability time by pressing on the '**Time**' tab and enter the time by using onscreen keyboard.



Press the '**Next**' tab to return to test settings menu.

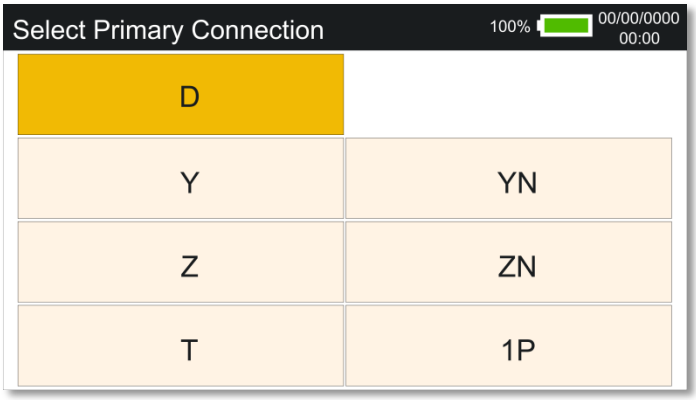


Press the '**Vector Group**' tab to choose the appropriate vector group of the transformer to be tested.

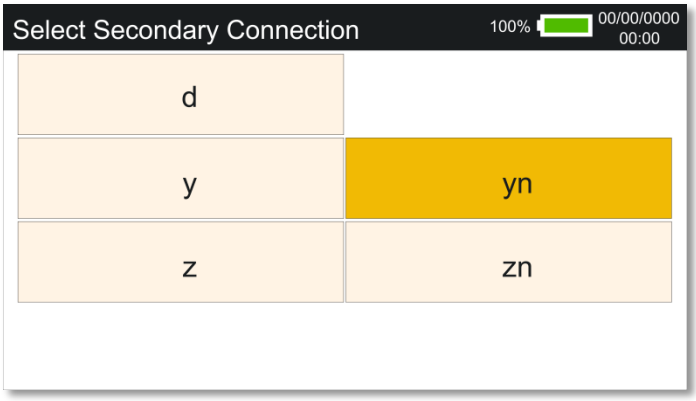


You can make appropriate selections by pressing on corresponding tabs.

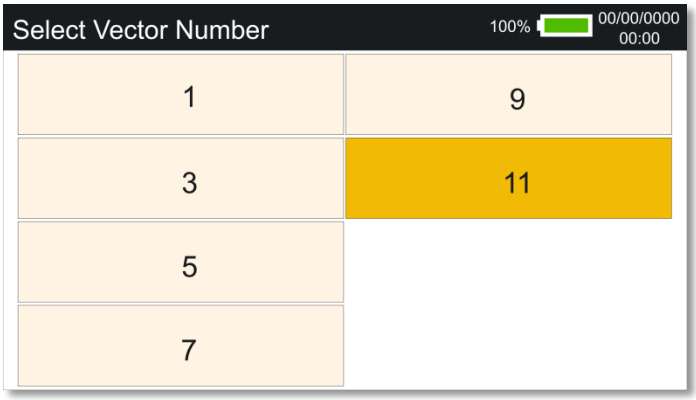
To select the primary connection;



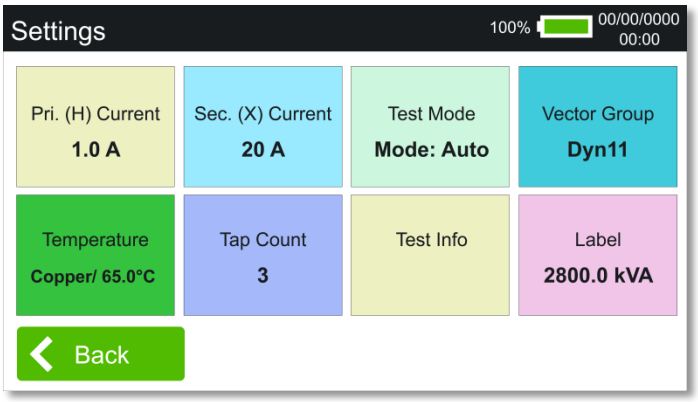
To select the secondary connection;



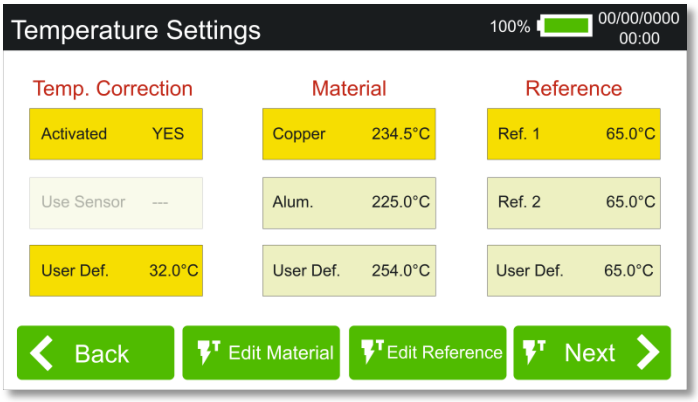
You can choose the vector number by clicking on the tab '**Vector#**'.



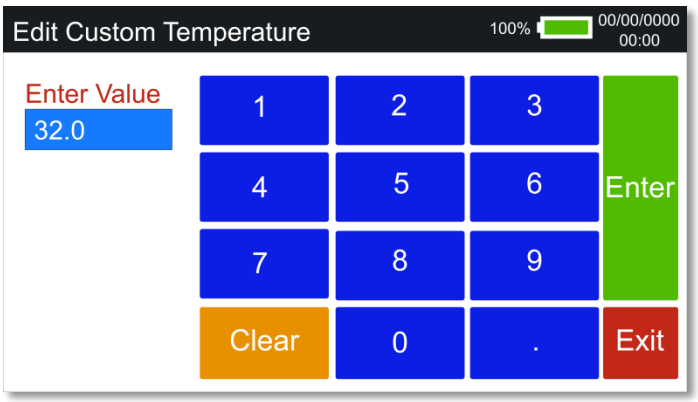
After making the right selection, press the '**Next**' tab to return to test settings menu.



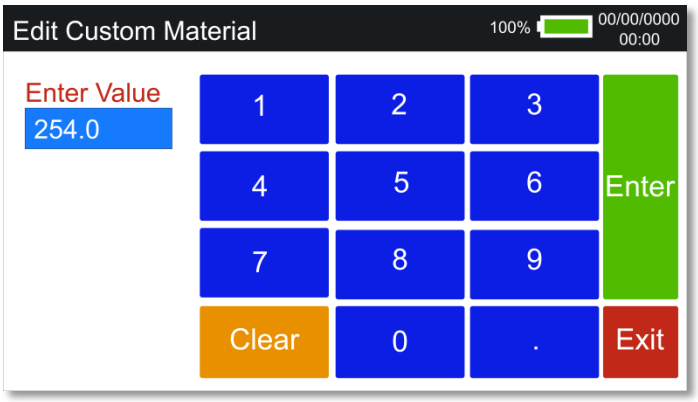
Press on the '**Temperature**' tab to alter the temperature settings for the test.



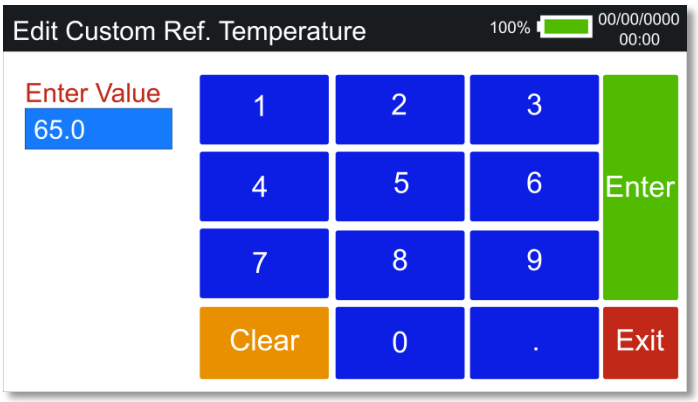
Users can opt for temperature correction or can be leave it as '**NO**' if temperature correction is not required. You can use an optional temperature sensor with WINRES or you can enter the temperature value manually by pressing on the '**Edit Temp.**' tab.



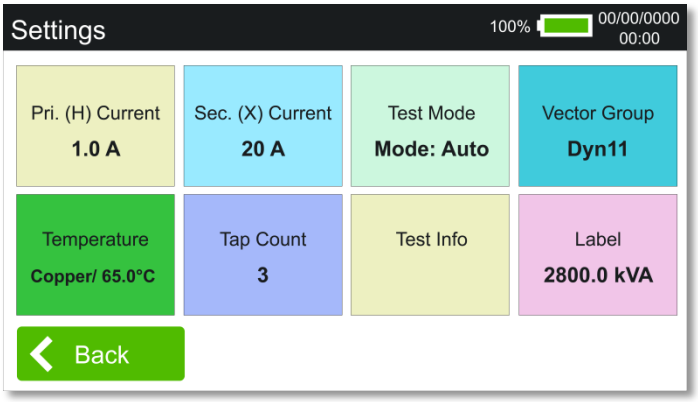
You can choose the heating coefficient of winding material from the options given (Copper or Aluminium) or you can enter the value manually by pressing the '**Edit Material**' tab.



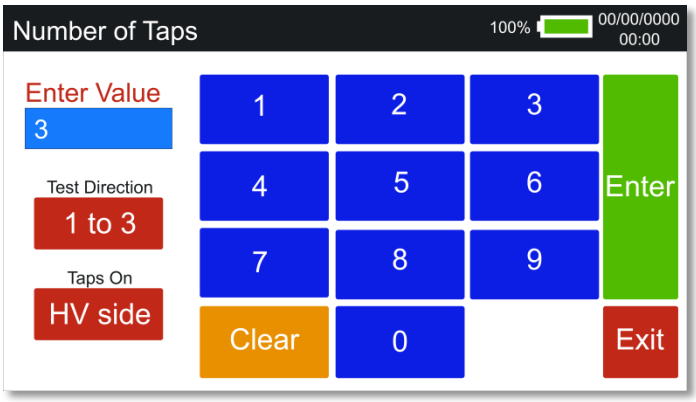
You can choose reference temperature for your test or you can manually set the reference temperature by pressing the '**Edit Reference**' tab.



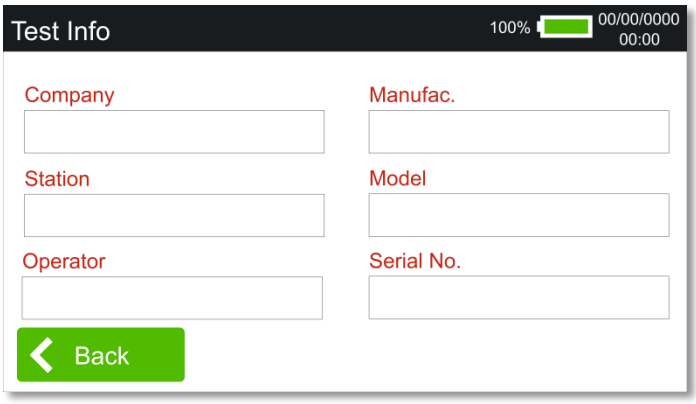
Press the '**Next**' tab to return to the test settings menu.



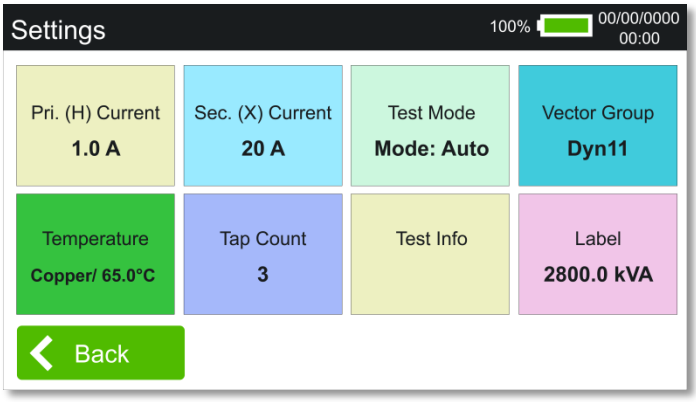
Press on 'Tap Count' to enter the number of taps;

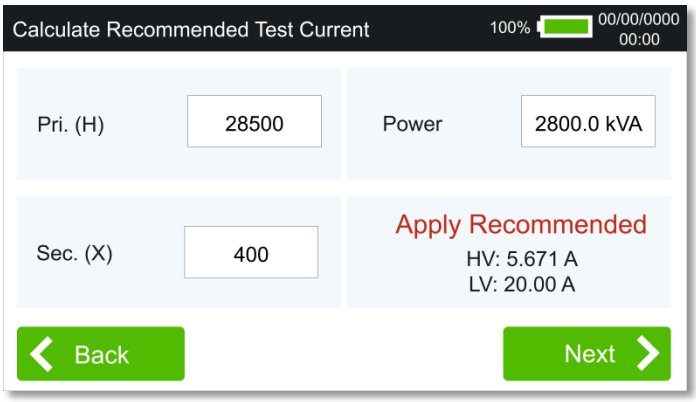


Press on the '**Test Info**' tab to enter details regarding the test such as Company Name, Station, Operator, Transformer info etc.



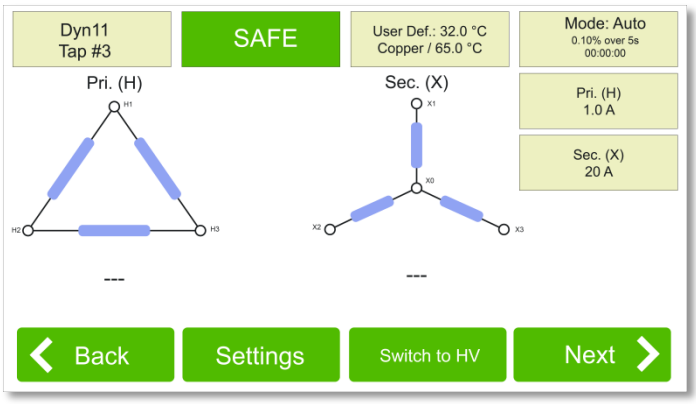
Press the '**Back**' tab to return to the test settings menu and then press the '**Labels**' tab to enter the transformer label.



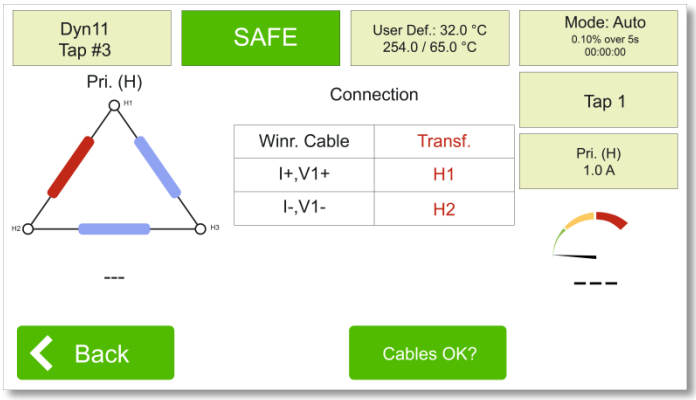


When you enter transformer labels, WINRES will calculate the test current for both HV and LV side.

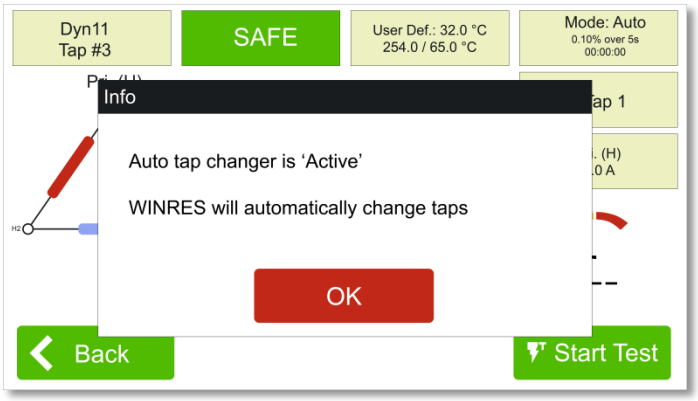
You can also edit all these test settings details by simple pressing on the quick edit tabs displayed on the top part of the display.



After making all necessary settings and the display shows '**SAFE**' then you can proceed to test by pressing the '**Next**' tab.

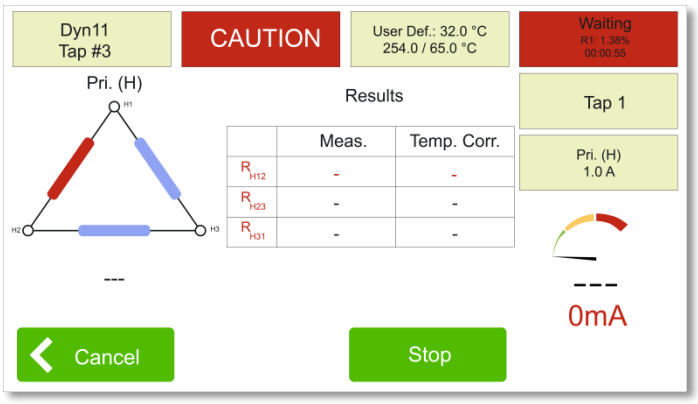


When you press the '**Next**', WINRES shows the cable connection. If your connections are done correctly, press on the tab '**Cables OK**?' to proceed with the test.



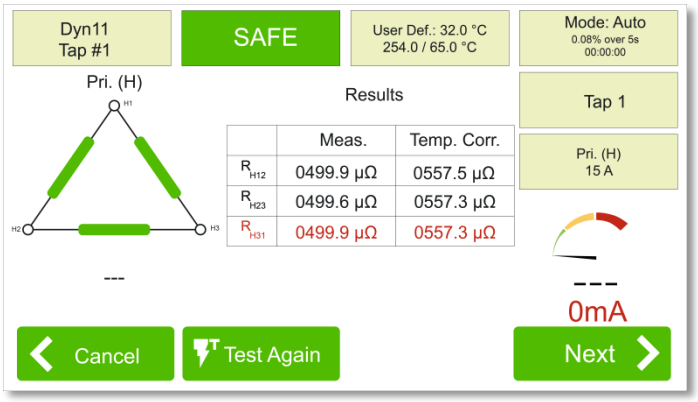
If the '**Auto Tap Changer**' is active, WINRES will automatically change the taps.

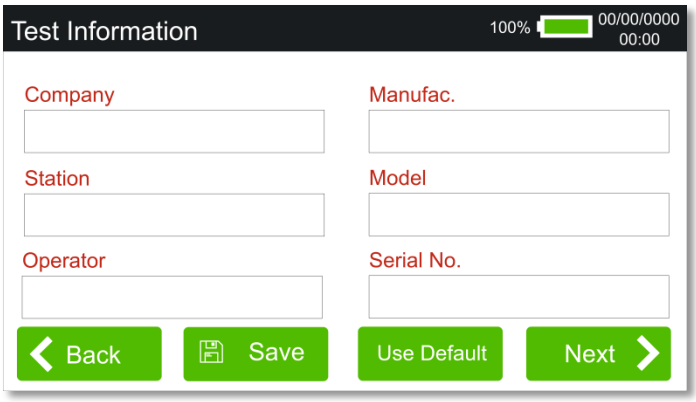
Then press the '**Start Test**' tab to begin the test. WINRES will test the taps one by one and display results for the primary.



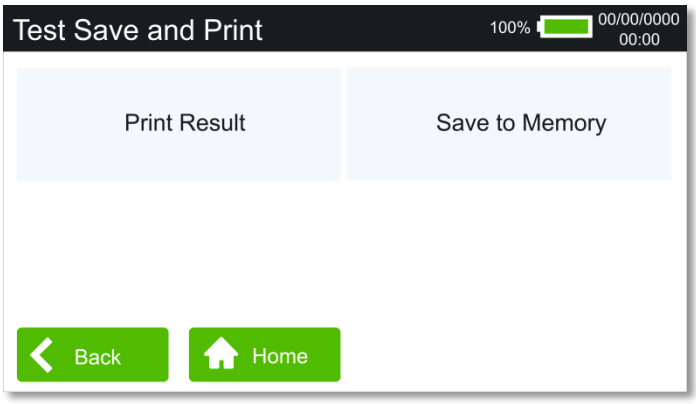
CAUTION!

During the test, you can press 'Emergency Stop' button on the front panel or press the 'Cancel' tab provided on the display or simply press the 'Power Button' in case of emergency. It will be cancelled immediately.





You can enter each data by using onscreen keyboard or can use the default Test Information. Then save entered details and press the '**Next**' to print or save the test result.

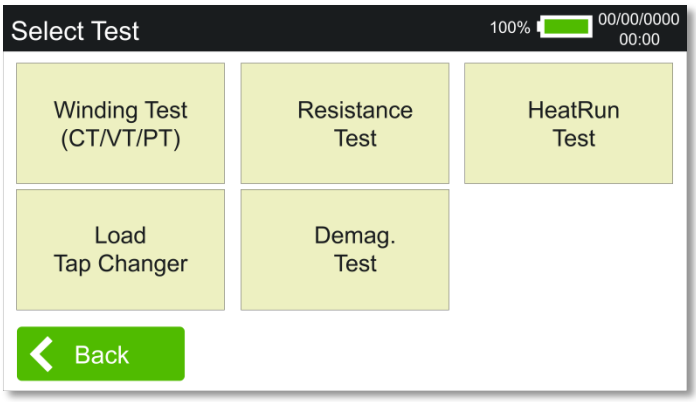


You can save the test result to internal memory for further reference or you can instantly print the result with WINRES-20 built-in printer.

If a USB is connected, you can also save the test result to that USB.

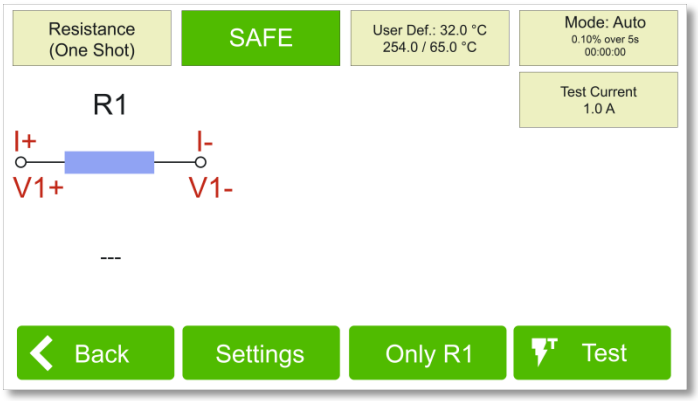
3.2 Shunt Resistance Test

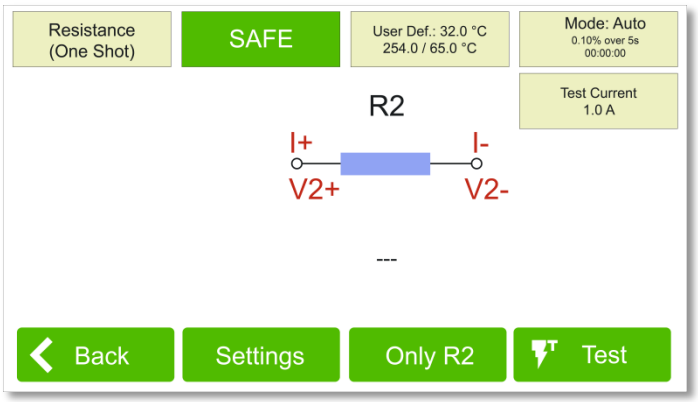
Press the '**Resistance Test**' from the main menu to perform the shunt resistance test.



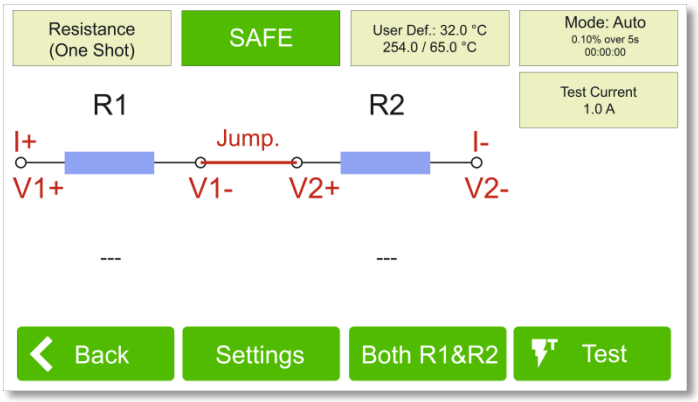
You can perform the test for only R1 or only R2 or both R1 and R2.

For one-shot resistance measurement (one resistance at a time), connections are done according to the diagram shown below on the display.

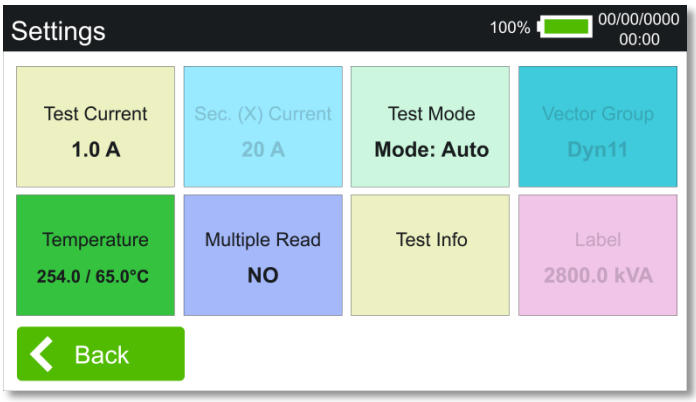




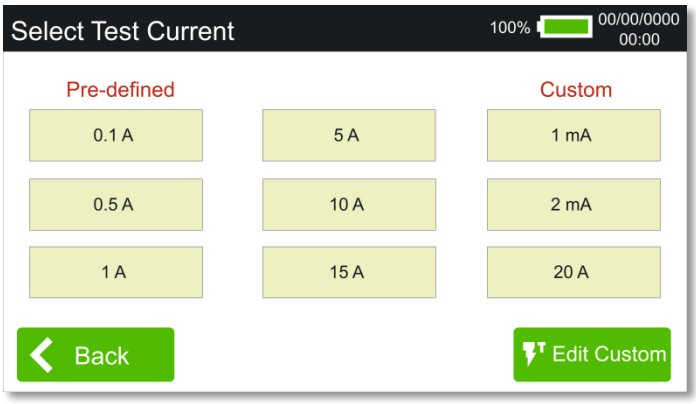
To measure two resistances simultaneously, you need connect a jumper cable as shown in the figure.



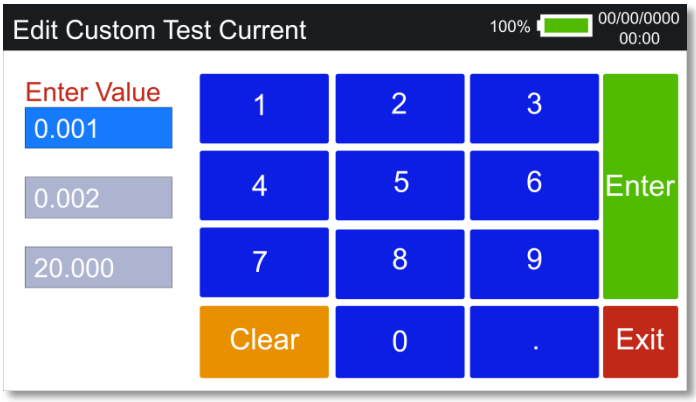
Press on the '**Settings**' to enter/alter the test settings.



To enter the test current value, press the tab '**Test Current**'. You can either choose a predefined value or you can enter custom test current value.

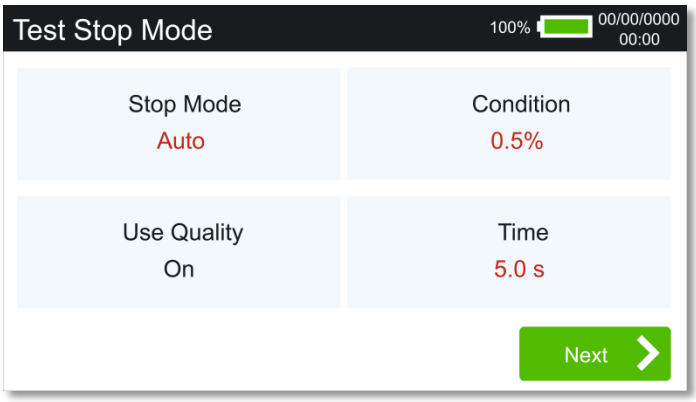


To enter custom value, press the tab '**Edit Custom**' and you can enter values using on-screen keyboard.

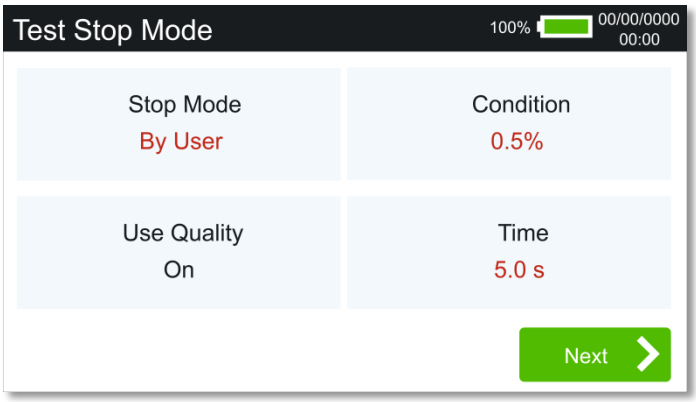


Press '**Enter**' and you will be returned to the previous page and then press '**Back**' to return to the settings menu.

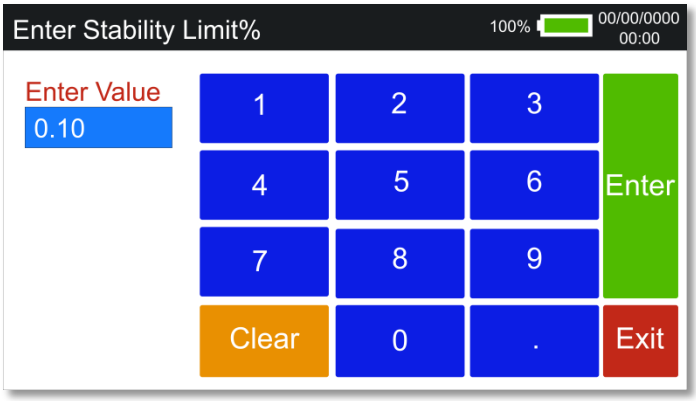
Press the tab '**Test Mode**' where you can decide how to stop a test and other test related settings.



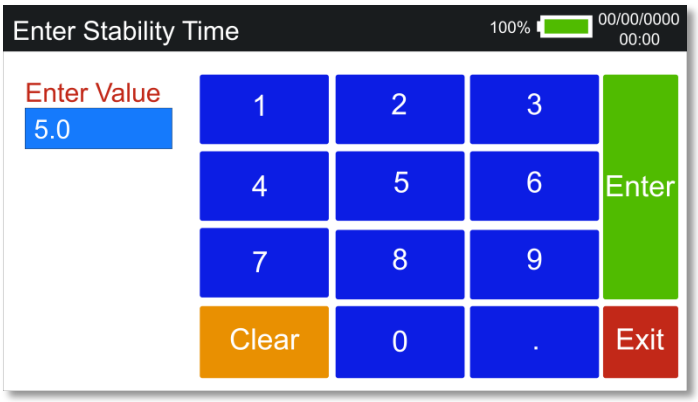
Here, users can choose whether the test should be stopped automatically or by manually. Press on the '**Stop Mode**' tab to change the selection.



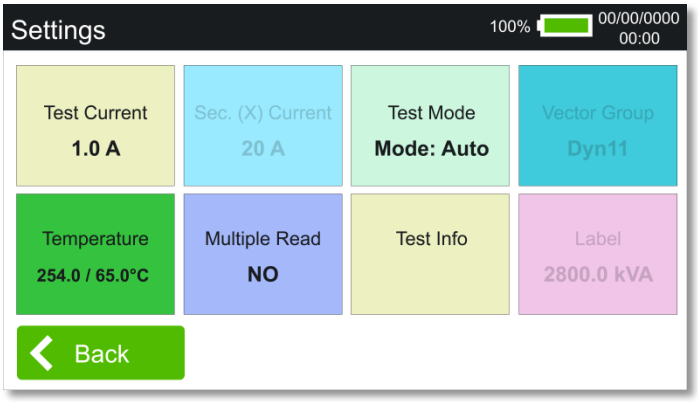
Also, we can change the display quality by pressing on '**Use Quality**' tab. If it's ON, the various tabs on the display change colour according to stability and status of the test, while performing a test. You can set stability limit percentage by pressing on the '**Condition**' tab and enter the limit by using onscreen keyboard.



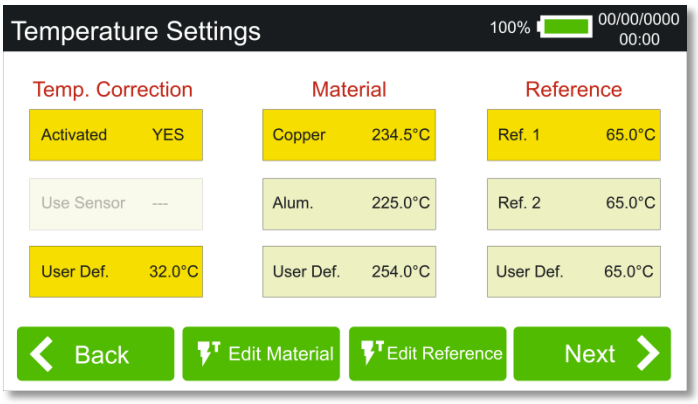
Similarly, you can set the stability time by pressing on the '**Time**' tab and enter the time by using onscreen keyboard.



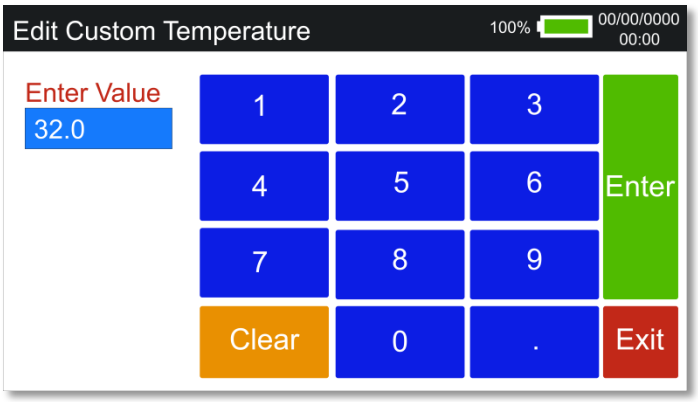
Press the '**Next**' tab to return to test settings menu.



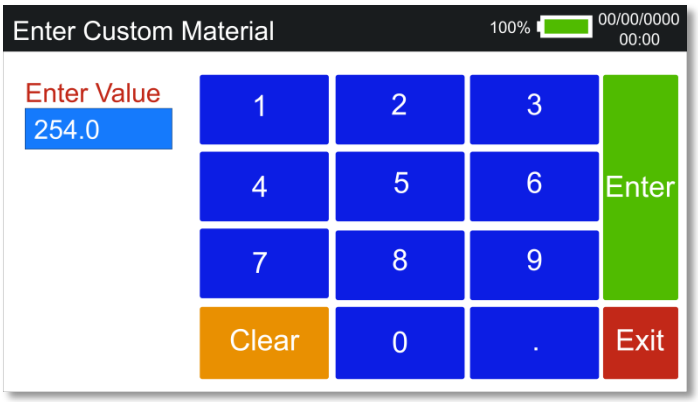
Press on the '**Temperature**' tab to alter the temperature settings for the test.



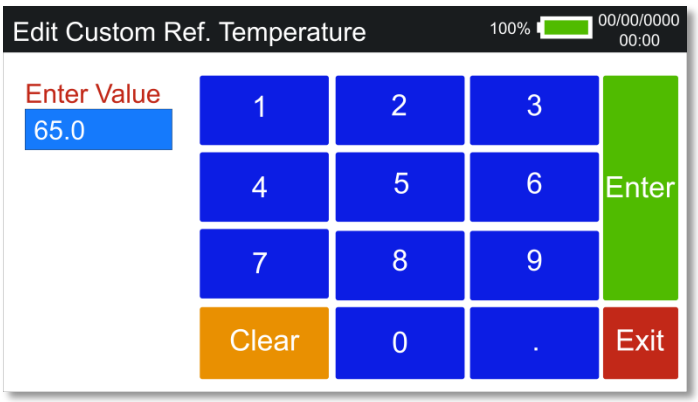
Users can opt for temperature correction or can be leave it as '**NO**' if temperature correction is not required. You can use an optional temperature sensor with WINRES or you can enter the temperature value manually by pressing on the '**Edit Temp.**' tab.



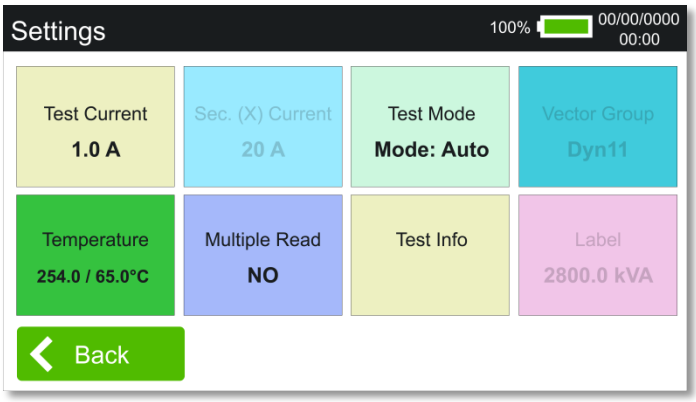
You can choose the heating coefficient of winding material from the options given (Copper or Aluminium) or you can enter the value manually by pressing the '**Edit Material**' tab.



You can choose reference temperature for your test or you can manually set the reference temperature by pressing the '**Edit Reference**' tab.

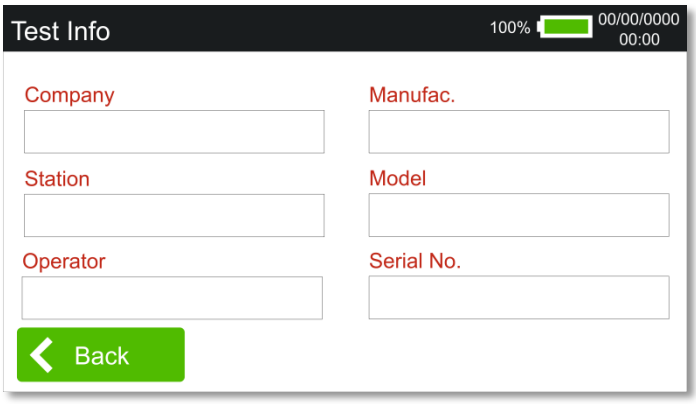


Press the '**Next**' tab to return to the test settings menu.

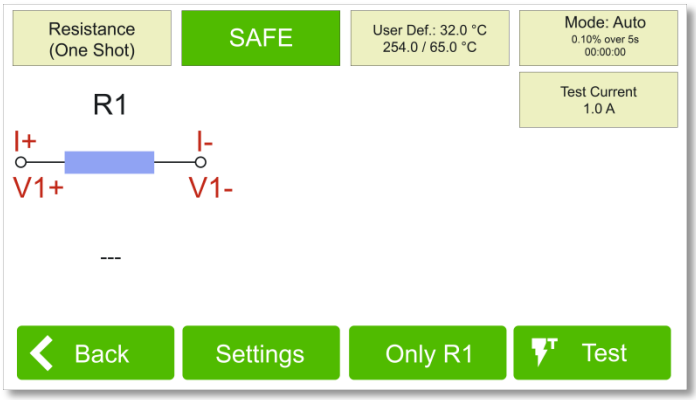


You can also set the test to multiple read by choosing '**YES**' on the '**Multiple Read**' tab.

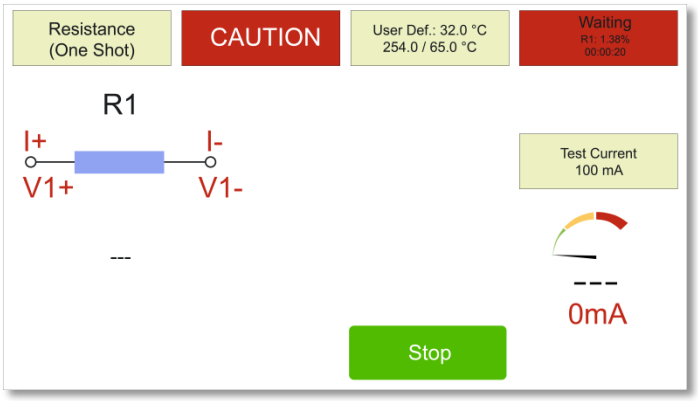
Press on the '**Test Info**' tab to enter details regarding the test such as Company Name, Station, Operator, Transformer info etc.



Press the '**Back**' tab to return to the test settings menu and then press the '**Labels**' tab to enter the transformer label.

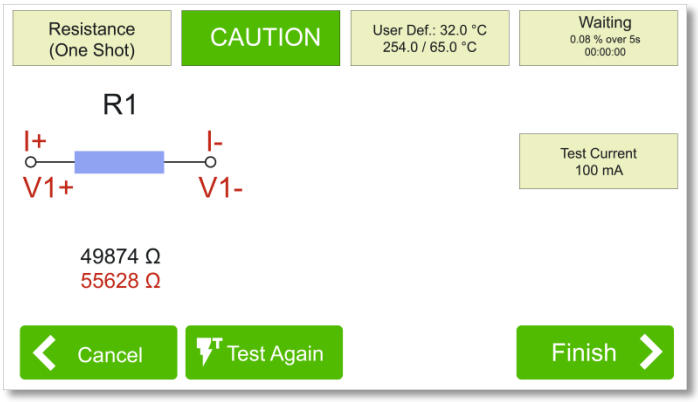


Press the '**Test**' tab to proceed to testing.

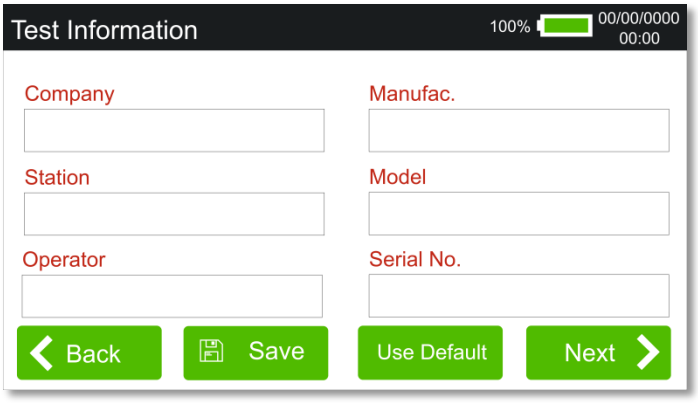


CAUTION!

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.

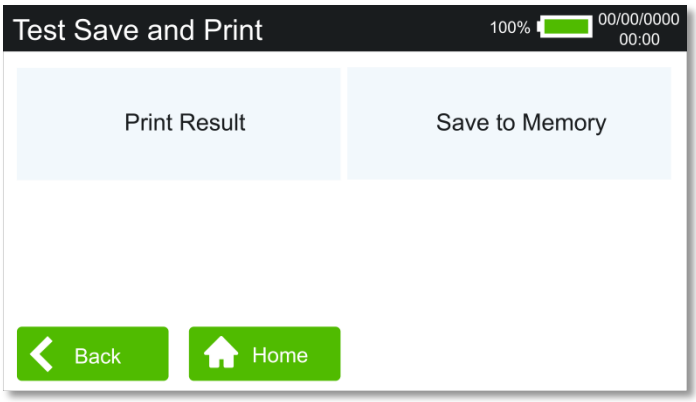


On the display, you can find two different resistance values. The first one is the actual resistance and one in red below is the temperature corrected resistance value. If you want to repeat the test, press the '**Test Again**' or you can press the '**Finish**' to complete the test and proceed to save it.

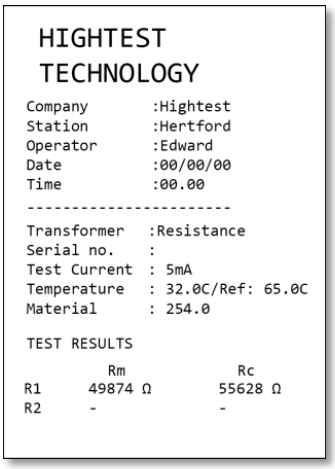


In this page, users can either use default data that has been already saved on WINRES-20 or can manually enter using on-screen keyboard.

Then press the '**Next**' to proceed to print or save the result.



You can save the test result to internal memory for further reference or you can instantly print the result with WINRES-20 built-in printer.



HIGHTEST
TECHNOLOGY

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

Transformer	:Resistance
Serial no.	:
Test Current	: 5mA
Temperature	: 32.0C/Ref: 65.0C
Material	: 254.0

TEST RESULTS

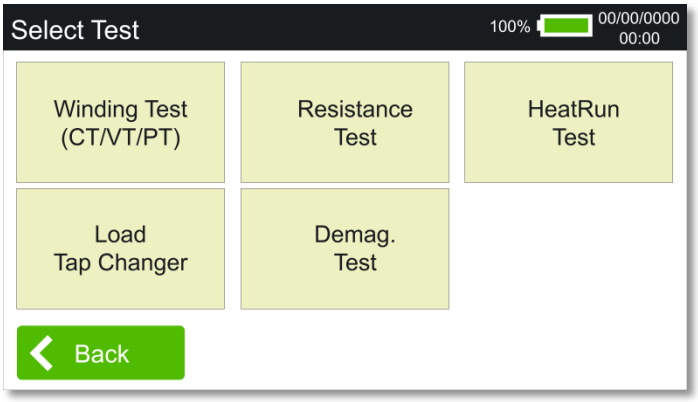
	Rm	Rc
R1	49874 Ω	55628 Ω
R2	-	-

Or else if a USB flash disc is connected, you can save the test result on it.

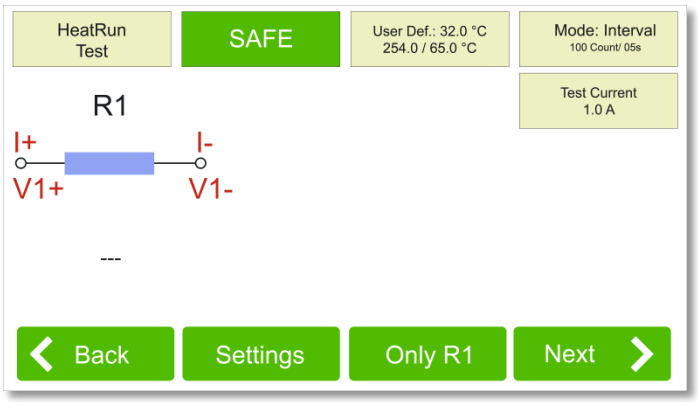
3.3 Heat Run Test

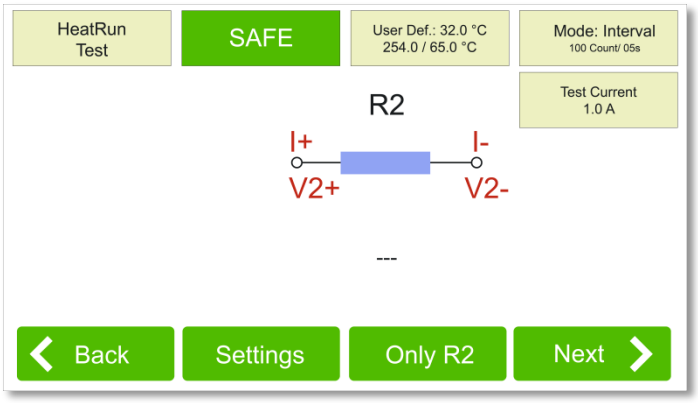
Heat Run Test is one of the type tests on power transformer. It's also called temperature rise test. This test reproduces conditions of continous rated load and the temperature rise occuring during the load.

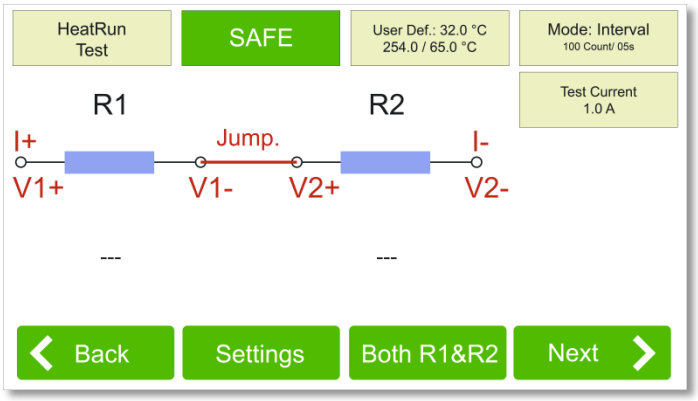
Press the '**HeatRun Test**' tab to carry out the test.



You can choose Only R1 or Only R2 or Both R1 & R2 for testing. Connections are shown on the display.

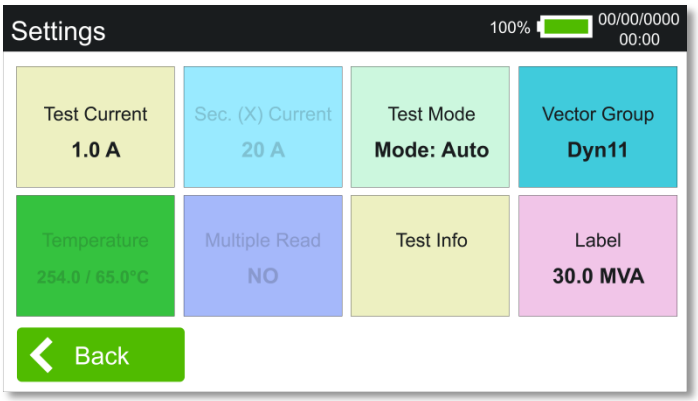




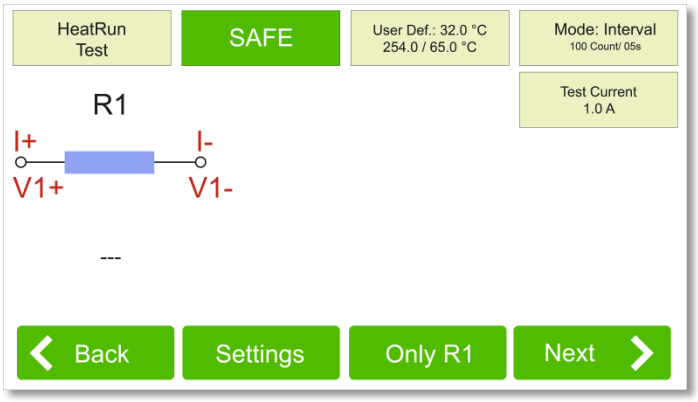


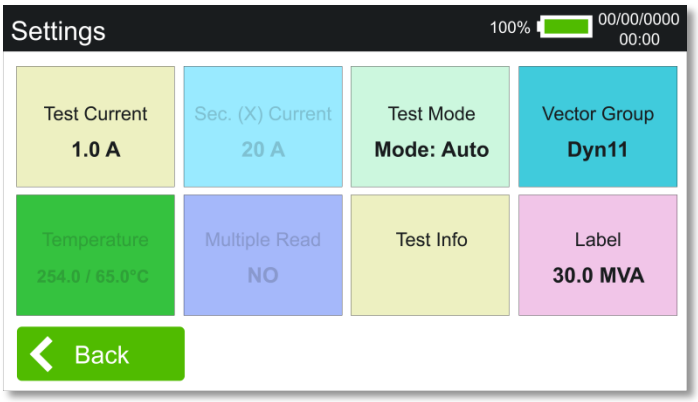
Note: You may need to connect jumper cable between R1 and R2 while testing both simultaneously.

Press the '**Settings**' to make necessary settings for the test.

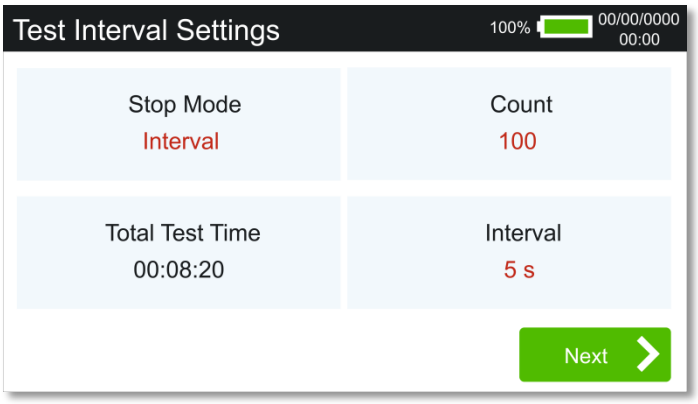


Follow previous steps and enter each value. After entering the values, you can press '**Back**' to return to the previous page.





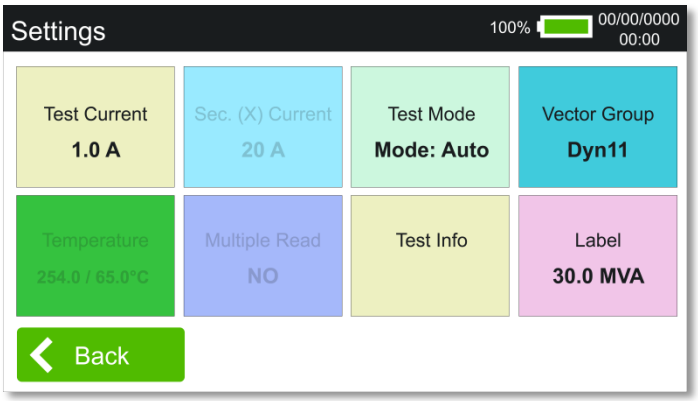
Press on the tab '**Test Mode**' to set an interval for the heat-run test as shown in the picture below; Press the tab '**Next**' to return to the previous page.



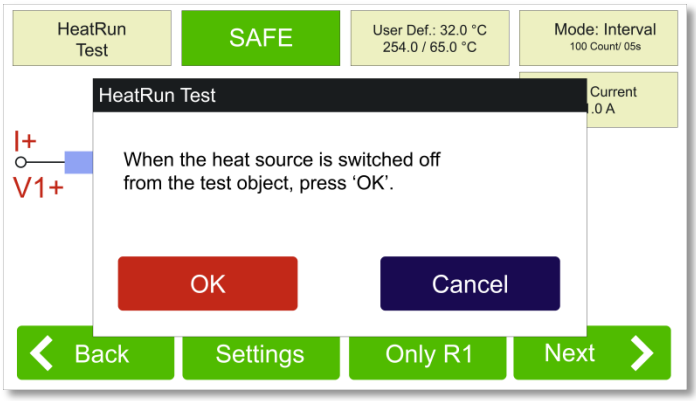
In these test settings, WINRES will continuously check it for 08:20 minutes as the count is chosen as 100 and the interval is 5s.

Note: The minimum value for the interval is 5s. Users can set this value according to their requirement (starting from 5s). And the maximum value for the count is 250.

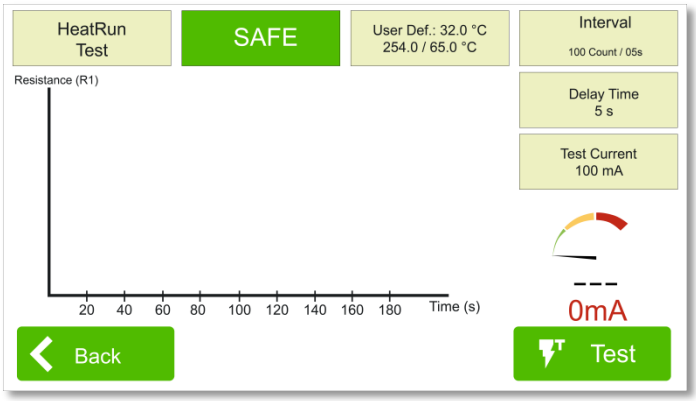
Press '**Back'** to return to the previous page.



And press '**Next'** to proceed to test;



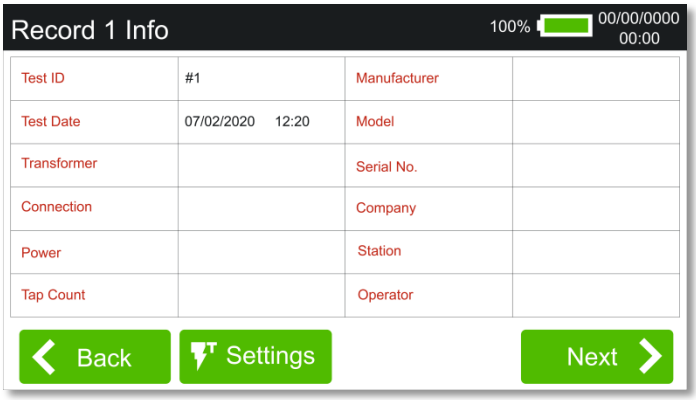
Press '**Ok**' when the heat source is switched off from the test object and then press '**Test**'. WINRES-20 will start to plot the graph.



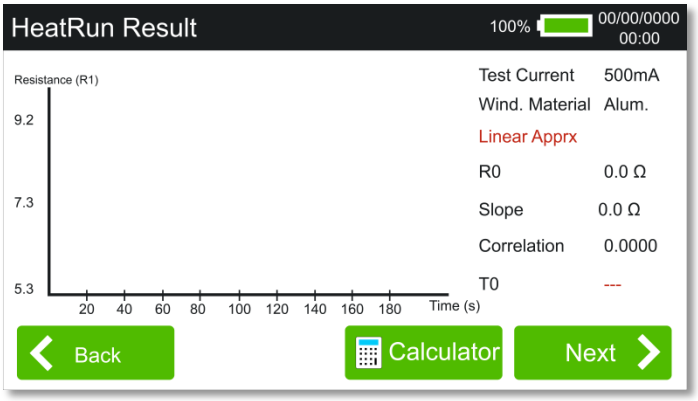
CAUTION!

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. The test will be cancelled immediately.

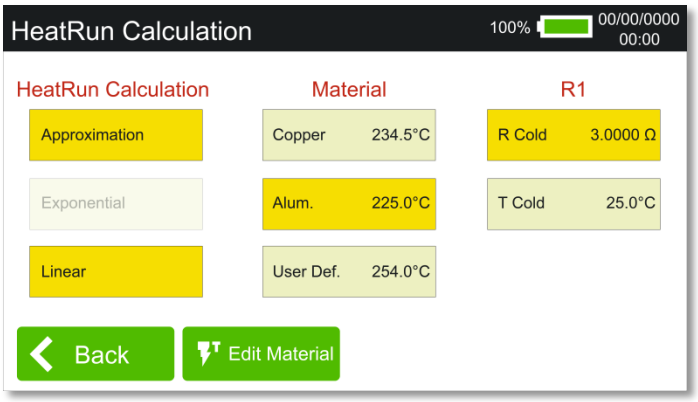
After completing the test, you will not be able to see the test results unless you save it first and then you go to "**Test Records**" and select the desired heat run test records.



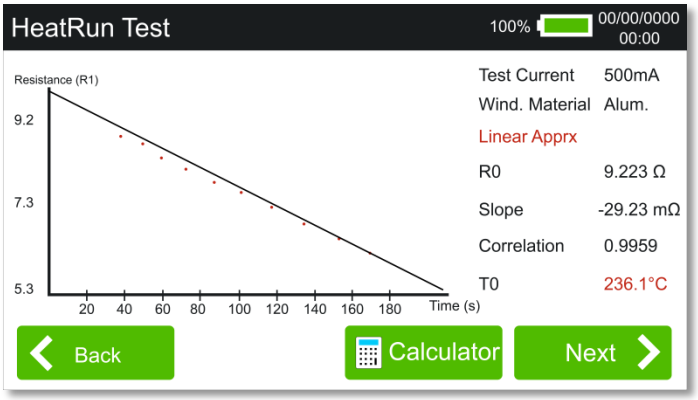
Clicking '**Next**' tab in screen above directed you to the following screen. Then press '**Calculator**' tab to enter the test parameters.



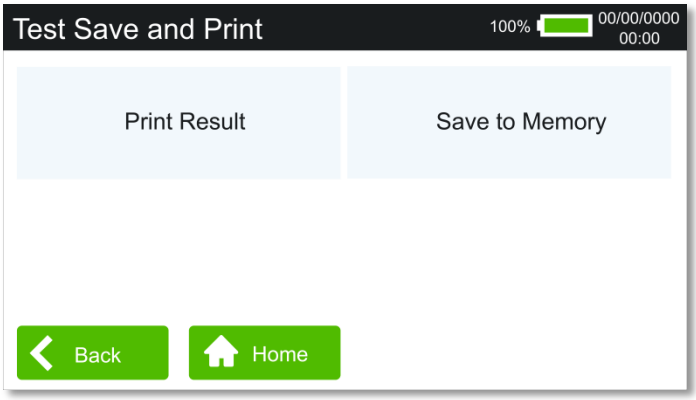
By pressing the '**Calculator**' tab you can set; the heat run calculation approach, Material, R cold and T cold parameters separately by clicking on the respective tab.



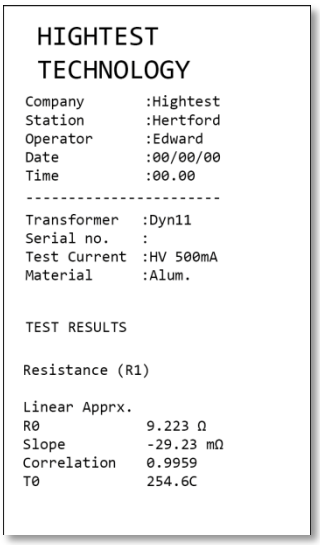
Once you enter all test parameters, you can see the test results on screen as follow.



Then press '**Next**' to proceed to print or save the result.



You can instantly print the result with WINRES-20 built-in printer or save to internal memory for further reference. Or else if a USB flash disc is connected you can save the test result on it as well. A sample of printed result for Heat-Run Test is given below;

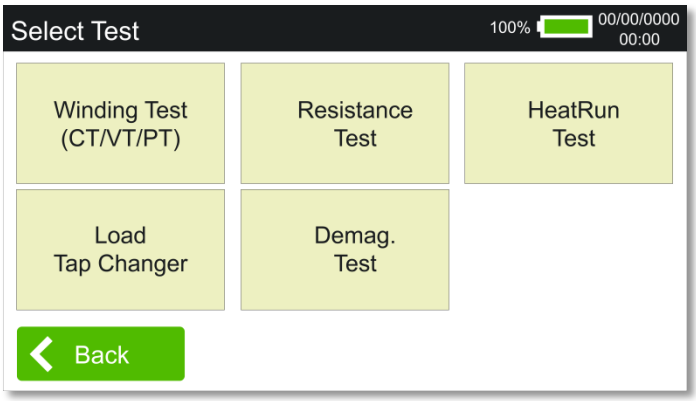


HIGHTEST
TECHNOLOGY

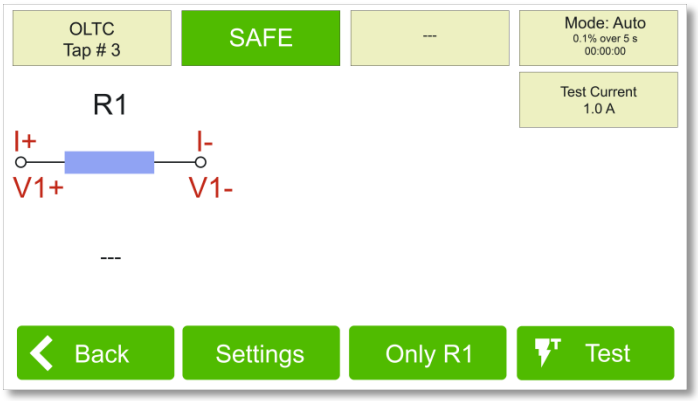
```
Company        :Hightest
Station        :Hertford
Operator       :Edward
Date           :00/00/00
Time           :00.00
-----------------------
Transformer    :Dyn11
Serial no.     :
Test Current   :HV 500mA
Material       :Alum.


TEST RESULTS

Resistance (R1)

Linear Apprx.
R0             9.223 Ω
Slope          -29.23 mΩ
Correlation    0.9959
T0             254.6C
```

3.4 Load Tap Changer

To conduct OLTC test press on Load Tap changer tab in the Select test menu as shown in the picture bellow.

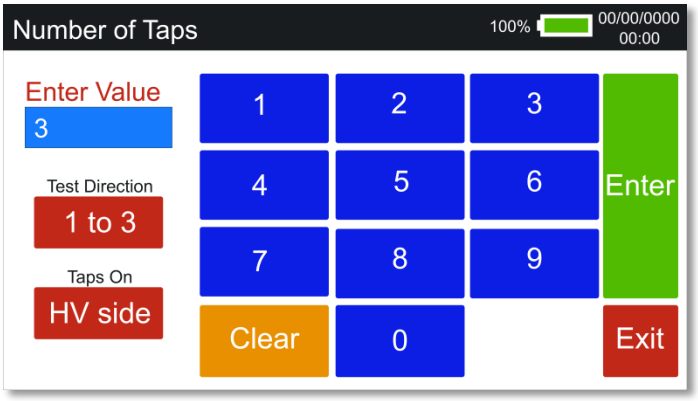


Using the quick options tabs at the top in the screen bellow allow to users to set the load tap changer test settings (OLTC taps, Stop mode and Test Current).



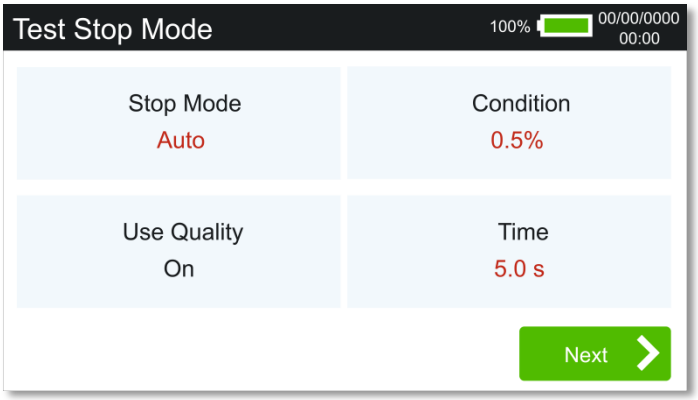
1- OLTC taps

From here you can change the number of taps you have using WINRES onscreen keyboard, test direction by pressing on '**Test Direction**' tab and you can test the primary side or the secondary side using '**Taps On**' tab.



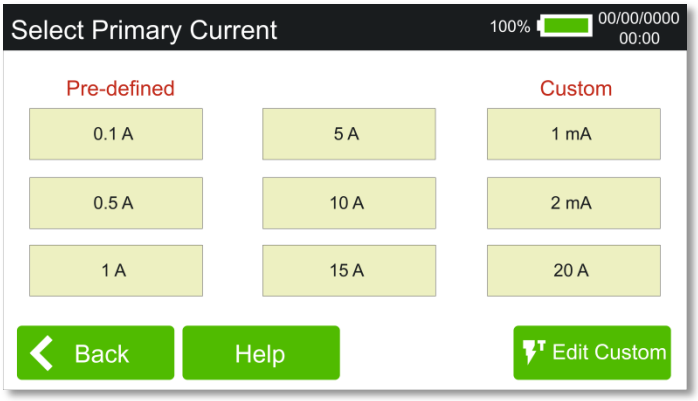
2- Stop Mode

In Stop mode you can change the condition based on the time to stop the test automatically using the respective tabs in the following screen.

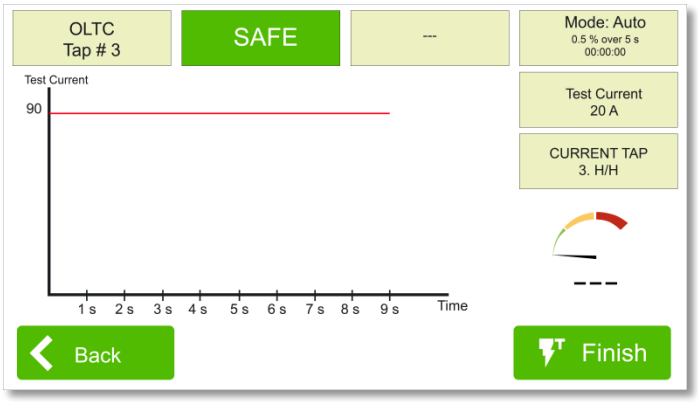


3- Test Current

From here users can select the test current; you can easily choose the test current from predefined values. Or you can enter custom values by pressing the tab '**Edit Custom**' and you can enter the values using on-screen keyboard.



After setting all test details and pressing on the '**Test**' tab, the test will start as follow. After completing the test, you can press '**Finish**' tab to save the obtained test results.



3.5 Demagnetisation Test

Demagnetisation on transformers is performed in order to remove remnant magnetism. It is caused due to several ways;

- DC winding resistance measurement,
- Taking the transformer out of service,
- Clearing high fault current

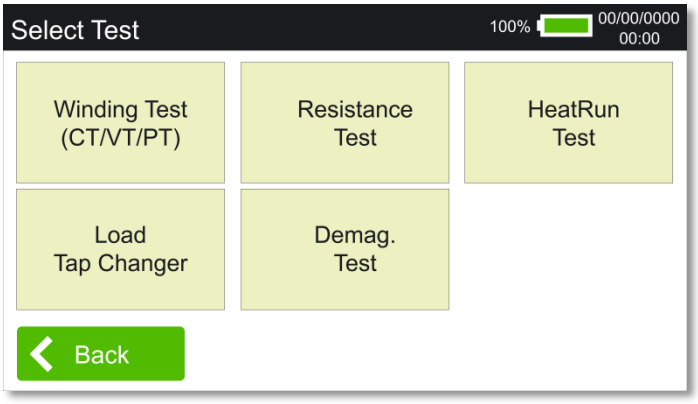
It can cause several problems in the energy sector such as;

- Incorrect operation of relays,
- Mechanical damage to transformer active parts
- Disturbance and power quality problems

- Incorrect diagnostic test results etc.

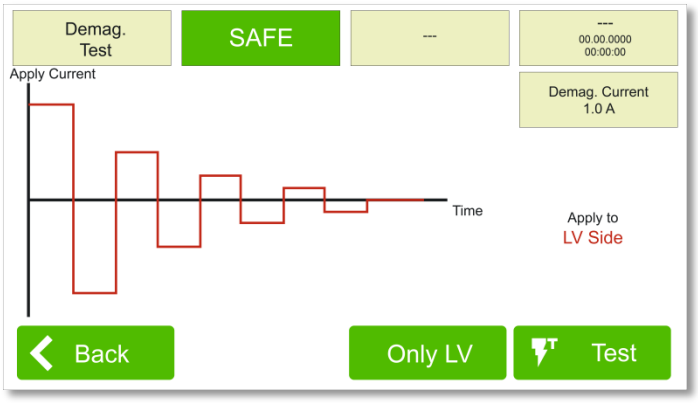
So '**Demagnetisation**' is highly recommended after every winding test.

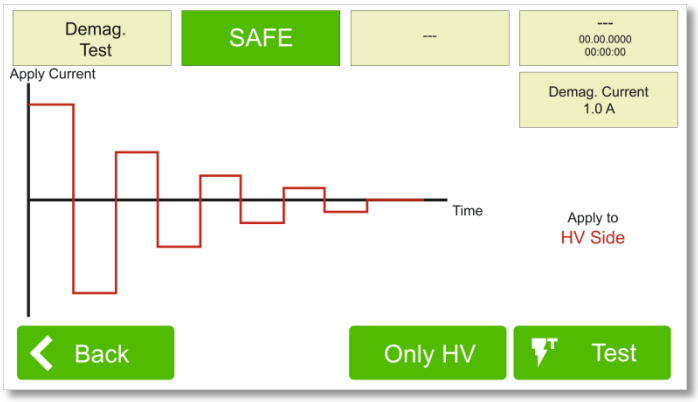
Press the '**Demag. Test**' from the menu.



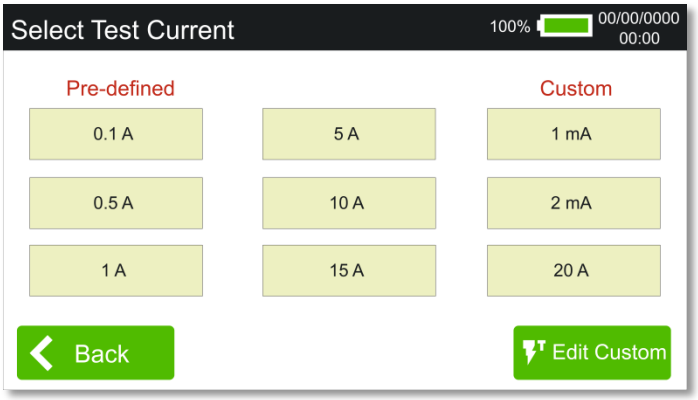
You can test LV and HV sides separately and can make the selection by pressing the tab '**Switch to LV**' or '**Switch to HV**' accordingly.

The ideal demagnetisation graph is shown as below.

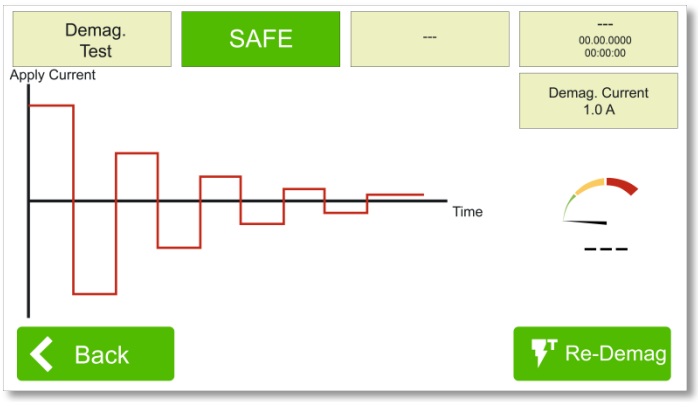




Press the tab '**Demag.Current**' to select the test current. You can either choose a test current from predefined values or you can add custom value by pressing 'Edit Custom' and can enter test current values manually using the onscreen keyboard of WINRES-20.



After choosing a test current value, press '**Test**'.

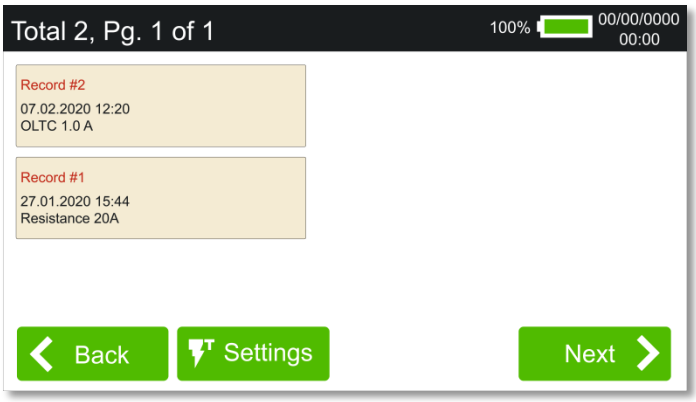


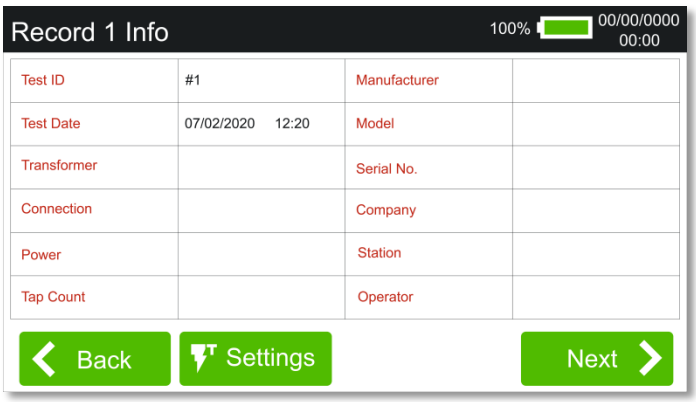
You can repeat the test by pressing '**Re-demag**'.

4. Test Records

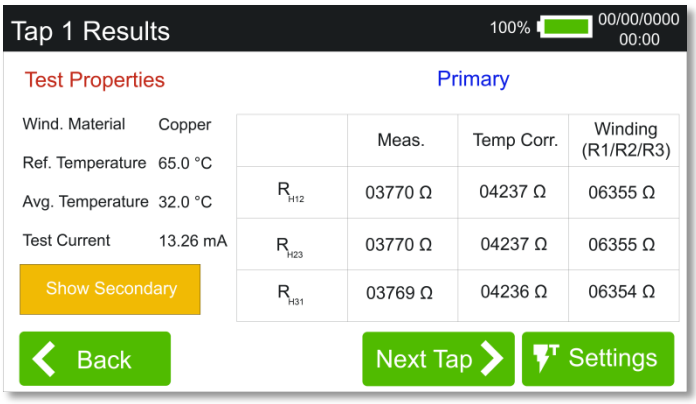
You can access the test results that you have already saved from the '**Test Records**' menu. You can also quit the tests at some point, and later continue from where you left the test.

WINRES-20 can store 100 test results in its internal memory. Each test can hold up to 75 measurements. WINRES-20 can hold up to 7500 measurements in total. In addition to the internal memory, WINRES-20 has unlimited extended memory by using an external USB. When a USB is connected, the test records will be saved to USB.

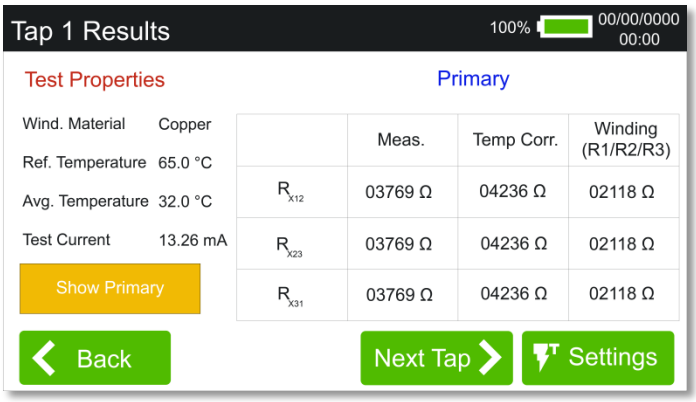




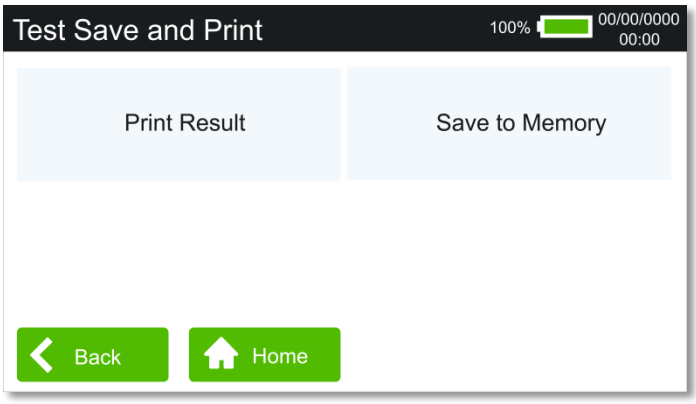
The details of the test records will be displayed as shown in the picture given above. You can delete or print the test using the '**Settings**' tab.



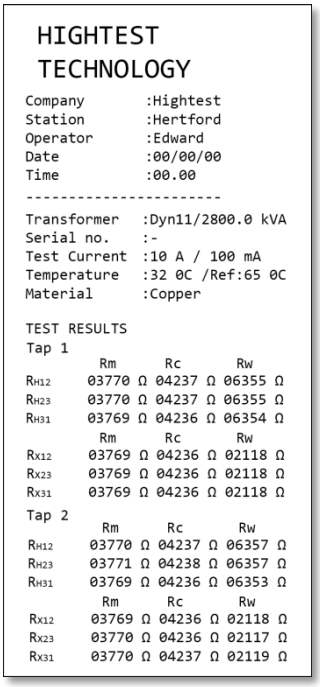
Press the tab '**Show Secondary**' to see the secondary values.



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



The printed result will be as follows;



HIGHTEST
TECHNOLOGY

```
Company       :Hightest
Station       :Hertford
Operator      :Edward
Date          :00/00/00
Time          :00.00
----------------------
Transformer   :Dyn11/2800.0 kVA
Serial no.    :-
Test Current  :10 A / 100 mA
Temperature   :32 0C /Ref:65 0C
Material      :Copper

TEST RESULTS
Tap 1
          Rm       Rc       Rw
RH12    03770 Ω 04237 Ω 06355 Ω
RH23    03770 Ω 04237 Ω 06355 Ω
RH31    03769 Ω 04236 Ω 06354 Ω
          Rm       Rc       Rw
RX12    03769 Ω 04236 Ω 02118 Ω
RX23    03769 Ω 04236 Ω 02118 Ω
RX31    03769 Ω 04236 Ω 02118 Ω
Tap 2
          Rm       Rc       Rw
RH12    03770 Ω 04237 Ω 06357 Ω
RH23    03771 Ω 04238 Ω 06357 Ω
RH31    03769 Ω 04236 Ω 06353 Ω
          Rm       Rc       Rw
RX12    03769 Ω 04236 Ω 02118 Ω
RX23    03770 Ω 04236 Ω 02117 Ω
RX31    03770 Ω 04237 Ω 02119 Ω
```

HighTest Technology Ltd. is a leading manufacturing company based in the UK which produces highly precise substation testing equipment such as Turns Ratio Testers, Winding Resistance Meters, Circuit Breaker Analysers, Contact Resistance Meters, Vacuum Bottle Testers etc.

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 are designed and produced according to the most widely adopted international standards. As we value our customers the most, our well-experienced team always provide 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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